2nd World Small-Scale Fisheries Congress

Options & Opportunities for Small-Scale Fisheries

Mérida, México
21-26 September 2014

Economic Viability

Livelihoods & Wellbeing

Ecosystem Stewardship

Rights & Access

Food Security & Food Sovereignty

Governance & Governability

Assessment & Monitoring
2nd World Small-Scale Fisheries Congress
Proceedings

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Merida, Mexico
Proceedings of the 2nd World Small-Scale Fisheries Congress


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## Program-at-a-Glance

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<tr>
<th>Time</th>
<th>Sunday Sept 21</th>
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<td>Plenary session (3) Food, rights &amp; governance</td>
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<td>Plenary session (2) Assessment, sustainability &amp; stewardship</td>
<td>Plenary session (4) Fishers’ perspectives</td>
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Live-Bait fishing: An alternative to artisanal fishermen in the middle Tietê river basin, Brazil

Paula Maria Gênova de Castro – Instituto de Pesca/Secretaria de Agricultura e Abastecimento do Estado de São Paulo–SP–Brasil, E-mail: paulagc08@gmail.com
Maria Helena Carvalho da Silva – Centro Universitário da Serra dos Órgãos, Teresópolis, RJ–Brazil - E-mail: mhc06.silva@gmail.com
Lílian Paula Faria-Pereira - Instituto de Pesca, Secretaria de Agricultura e Abastecimento do Estado de São Paulo–SP–Brasil, E-mail: lilianpaula78@gmail.com
Luciana Carvalho Bezerra de Meneses - Instituto de Pesca/Secretaria de Agricultura e Abastecimento do Estado de São Paulo–SP–Brasil, E-mail: lcbn@usp.br
Lídia Sumile Maruyama - Instituto de Pesca/Secretaria de Agricultura e Abastecimento do Estado de São Paulo–SP–Brasil, E-mail: lidiamaruayma@gmail.com

Abstract

Over the past decades the artisanal fishery in the Tietê River Basin has undergone changes in fishing productivity and yield, causing alterations to the ichthyic fauna and the behavior of artisanal fisherman. It is observed that new actors have used the fishery resources and a new activity grows in the region as alternative income: the fishing of “tuviras” (a fish species of the Gymnotus genus) used as live-bait in sport fishing. Rectangular sieves, made with nylon net (a “mosquito” net type) mounted in an iron frame, are placed below banks of macrophytes, allowing the capture of fish. This art of fishing is not legalized in Sao Paulo State. In the period from March/2012 to October/2013 the activity was monitored with the participation of 48 fishermen from the San Giacomo Farm, in Ibitinga, a town in São Paulo State. Fishing for tuvira has a family character. The product sales are destined for sport fishermen. The principal problem faced is connected to the absence of regulation (48.4%). The socio-economic improvement of the fishermen community and the decrease of the environmental impacts of live-bait fishing are the main factors for the sustainability of this practice.

Introduction

Over the past decades the artisanal fishery practiced in the basin of Middle and Lower Tietê River, SP, has undergone changes that undermine the productivity and fisheries yield (Maruyama et al. 2009). These changes are due to several factors such as the damming of the river, through the construction of dams that transform lotic to lentic waters, preventing the reproductive migration of migratory fish; agro-industrial and domestic pollution; deforestation in riparian areas, with consequent siltation on the banks of rivers, interfering with feeding species frugivorous habits; the introduction of exotic species to replace the native migratory; overfishing; among others (Petrere and Agostinho, 1993; Agostinho et al. 2007). Such changes result in changes in ichthyofauna of the region and the behavior of the fisherman in their extractive practices, directly affecting their lives and their community who use this resource as food, employment and income.
It is observed that new actors have been using fish stocks and a new activity grows in the region as an alternative income: fishing tuviras used as live-bait in recreational fishing.

In middle Tietê along the flooded areas of Ibitinga dam, concentrations of bait fishermen were identified, whose target is the tuvira (*Gymnotus* genus). The tuvira when captured by professional fishing, with the use of gillnet (method of waiting), has no market value. Thus, this resource has been used by fishermen, as live bait for recreational fishing, constituting an alternative form of income and employment for professional artisanal fishermen (Gomez and Castro 2011; Castro et al. 2014).

However, such activity practiced with sieves in flooded areas, shallow and covered by macrophytes, does not yet have legal instrument to practice on rivers in the state of São Paulo, contrary to what has been occurring in Mato Grosso do Sul (Banducci et al. 2000; Catella et al. 2008).

Thus, the main focus of this research is to describe the changes over the years in the fishing activity practiced in Tietê Basin/SP-Brazil. Also, knowing the structure and dynamics of live-bait fishing as new activity that presents the fishermen community from Jacaré-Guaçu River in Ibitinga Dam. The existing problems and conflicts between groups with different interests are presented and solutions are discussed, aiming to generate subsidies for possible regulation of fishing in the region concerned.

**Methodology**

From March/2012 to October/2013, workshops were performed and the live-bait fishing accompanied along San Giacomo Farm community, where 48 fishermen were interviewed according to the methodology described in Castro et al. (2014).

Fishermen were applied a socioeconomic questionnaire and structure of fishing, with which it was possible to obtain data regarding the standard and quality of life, species caught, fishing gear practiced, possession and use of equipment, fishing income, and the strategies used to capture and major fishing grounds. In the field, employed record to statistical capture, and information about the surrounding environment at the time of the fishery.

Information concerning the structural data of live-bait fishing were analyzed qualitatively and quantitatively (Levin and Fox, 2008). Monitoring of fishing was introduced in the form of scatter plot, where the axis of the ordinate (y) refers to the sum of the number of captured tuviras and the axis of abscissa (x) the effort undertaken in hours of fishing.

**Results and Discussion**

**History**

Due to changes observed along the middle and lower Tietê River (Table 1), we observe the entry of new actors and activities in the use of continental fishery resources and a strong pressure from the public and private sectors in the transformation of the artisanal fisherman, an extractive in nature, in a fish farmer, or as pilot boatcraft in recreational fishing, gradually discouraging the practice of fisheries in the region.
Table 1 – Historical summary of activities engaged in fishing, middle and lower Tietê River Basin, SP.

<table>
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<tr>
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<tbody>
<tr>
<td>Environment/Habitat</td>
<td>river/lotic</td>
<td>rivers and reservoirs/lotic-lentic</td>
<td>lentic</td>
<td>lentic</td>
</tr>
<tr>
<td>No reservoir environment</td>
<td>construction of dams/hydroelectric</td>
<td>dams, artificial lakes</td>
<td>dams, artificial lakes</td>
<td></td>
</tr>
<tr>
<td>Low anthropogenic interference</td>
<td>medium/high anthropogenic interference</td>
<td>high interference (domestic/industrial pollution)</td>
<td>(domestic/industrial pollution)</td>
<td></td>
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<tr>
<td>Activity</td>
<td>artisanal/small scale fishing (+++)</td>
<td>artisanal/small scale fishing (+++)</td>
<td>artisanal/small scale fishing (+)</td>
<td>artisanal/small scale fishing (+)</td>
</tr>
<tr>
<td>Subsistence fishing (+++)</td>
<td>subsistence fishing (+++)</td>
<td>subsistence fishing (+++)</td>
<td>and subsistence fishing (++)</td>
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<tr>
<td>Recreational fishing (+)</td>
<td>recreational fishing (++)</td>
<td>recreational fishing (++)</td>
<td>recreational fishing/sport fishing (+++)</td>
<td></td>
</tr>
<tr>
<td>Fishing gear</td>
<td>hook and line; cast net</td>
<td>hook and line; cast net and boat</td>
<td>hook and line; windlass</td>
<td>hook and line; windlass and harpoon</td>
</tr>
<tr>
<td>Artisanal gill nets</td>
<td>artisanal and industrial gill nets</td>
<td>artisanal and industrial gill nets</td>
<td>artificial and industrial gill nets</td>
<td></td>
</tr>
<tr>
<td>Cast net</td>
<td>cast net and boat</td>
<td>cast net, beat and trawls</td>
<td>cast net, beat and trawls</td>
<td></td>
</tr>
<tr>
<td>Target species</td>
<td>large fishes, native species</td>
<td>replaced with exotic species/allochthonous</td>
<td>replaced with native species</td>
<td>replaced with native species by hydroelectric companies</td>
</tr>
<tr>
<td>Migratory species</td>
<td>entry of exotic species</td>
<td>incentive for tilapia culture</td>
<td>encouraging aquaculture in cages</td>
<td></td>
</tr>
<tr>
<td>Native species</td>
<td>decreased migratory species and increased sedentary species</td>
<td>CPUE best fishing for sedentary species</td>
<td>CPUE best fishing for sedentary species and midle migrations</td>
<td></td>
</tr>
</tbody>
</table>

+ low activity; ++ middle activity; > ++ high activity

Currently the main activity linked to artisanal fisheries conducted in the Ibitinga region is catching live-bait directed to meet the demands of fisheries or recreational activities, increasingly growing in the region (Gomez and Castro, 2011).

The live-bait fishing, practiced since 1990 in the Alto Paraná basin (Castro et al. 2014), is gradually taking the place of other fisheries activities aimed at catching fish mid-sized in rivers of state and other watersheds, both for better incomes that fishing with live-bait provides, as well as by declining stocks traditionally interest in professional fishing with the use of gillnet.

Fishing activity

To capture the tuvira for purposes of live-bait, is used a "sieve" (Figure 1), which normally consists of a rectangular frame PVC or metal 1.80m by 1.50 m size, with nylon net that, at one end are used three PET bottles with the function of floats and a rope on the other side in order to pick up the fishing gear (Castro et al. 2014).

The live-bait fisherman acts in tuvira fishing by 5.3 ± 1.2 days, range 3-7 days/week, during the night (80%), using sieves of different sizes, with the use of termite to attract tuviras in shallow and covered by macrophytes (Gomez and Castro, 2011).
The activity is basically family nature, and practiced in pairs (56.25%) or alone (43.75%) (Figure 2). When family (43.75%), wives and/or children actively participate in fishing installing and removing the sieve under the macrophytes. After the capture of baits, these are packed in buckets with water inside the boat and at the end of fishing, are transported alive to water tank and sold to recreational fishermen (Castro et al. 2014).

Most fishing is focused on the genus *Gymnotus*, however bait fishermen interviewed indicated that capture approximately 17 types of baits, each type usually includes more than one species, with a predominance of tuvira, followed by snails and shrimp as more targeted (Table 2). This fishing is done with the use of aluminum boat motor (15 HP), or paddle. Many of these species, before no economic value, have become very sought and valued because of its qualities as bait.

Table 2 - List of types of live-bait by fishermen cited.
Asked about the time (month) practicing bait-fishing in the region, 60% of respondents stated that fishing during the period that the fishery is open (March-October), while 31% fishing less than eight months in year, and 9% of fishermen reported fishing throughout the year (Figure 3).

Fishermen Farm San Giacomo indicated that there are two periods of bait fishing, where good phase occurs during the months of March-April and September-October, which corresponds to periods of flood and drought, respectively. The bad fishing stage occurs in June and July, during the winter in the southern hemisphere.

<table>
<thead>
<tr>
<th>Live-bait Taxa</th>
<th>Taxa</th>
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</thead>
<tbody>
<tr>
<td>tuvira, morenita</td>
<td>Gymnotus spp.</td>
</tr>
<tr>
<td>tuvira matrix</td>
<td>Gymnotus spp.</td>
</tr>
<tr>
<td>camarão (shrimp)</td>
<td>Decapoda</td>
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<tr>
<td>caramuje (conch; snail)</td>
<td>Pomacea sp.</td>
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<tr>
<td>lambari (small Characidae)</td>
<td>Astyanax</td>
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<tr>
<td>jucundá</td>
<td>Crenicichla sp.</td>
</tr>
<tr>
<td>cascudo</td>
<td>Callichthyidae; Hypostomus spp</td>
</tr>
<tr>
<td>traira</td>
<td>Hoplias malabaricus</td>
</tr>
<tr>
<td>piramboia</td>
<td>Synbranchus marmoratus</td>
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<tr>
<td>canivetinho</td>
<td>Apareiodon sp.</td>
</tr>
<tr>
<td>curimba; curimbatá (Prochilodontidae family)</td>
<td>Phochilodus lineatus</td>
</tr>
<tr>
<td>espadilha branca</td>
<td>Apareiodon genus</td>
</tr>
<tr>
<td>bagre (catfish)</td>
<td>Rhambdia</td>
</tr>
<tr>
<td>piranha</td>
<td>Serrasalmus</td>
</tr>
<tr>
<td>piava (Anostomidae family)</td>
<td>Leporinus</td>
</tr>
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</table>

According to research conducted with live bait fishermen of Pantanal/MS (Banducci et al 2000), the data relating to working time and income acquired, observed that there is no increase in income in accordance with the time of entry into the activity, demonstrating the instability of remuneration that is inherent in collecting bait and that has direct relation to the productive chains of fisheries and fishing tourism, similar to that occurred in the Jacaré-Guaçu River/SP.

Monitoring of Live-Bait Fishing

When analyzing the number of tuviras per hour fishing, it is observed that the trend or the peak catches (1,000 tuviras) occurred between 4 and 5 hours of fishing (Table 3).
Table 3 - Data monitoring of live-bait fishing - S. Giacomo Farm, March-October/2012 (N=07 fishermen).

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Standard Deviation</th>
<th>Minimum - Maximum</th>
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<tbody>
<tr>
<td>Nº tuviras/night</td>
<td>199</td>
<td>175</td>
<td>9 - 1053</td>
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<tr>
<td>Nº sieved/night</td>
<td>26</td>
<td>8</td>
<td>9 a 48</td>
</tr>
<tr>
<td>Nº hours/night</td>
<td>04:47</td>
<td>00:07</td>
<td>01:00 - 10:00</td>
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</table>

From there, there is a decrease of tuviras captured even increase their fishing effort (h) (Figure 4). We emphasize that there are many variables that can influence the success of tuviras fishing by practicing catch with sieves, like season, fishing area, moon phase, time of fishing, the use or not of bait, the fisherman's experience, among others.

![Figure 4](image)

Figure 4 - Numerical frequency tuviras captured with sieves per hour of fishing/night, March-October/2012, Jacaré-Guacu River, SP.

Problems and Conflicts

In the workshops performed during the development of the research was diagnosed a strong conflict between the traditional live-bait fishermen and those fishermen who not directly depend on this activity for their survival.

The main problems reported by live bait fishermen were grouped subsequently into 4 main categories: 1) no regulation of the activity (48.6%); 2) decline of professional artisanal fishermen using gillnets due to the decline of traditional fisheries (29.7%); 3) factors relating to the environment (13.5%) as pollution, rain, wind (14.0%) and 4) increase of illegal fishing in the activity (8.0%) (Figure 5).

![Figure 5](image)

Figure 5 - Problems related by live-bait fishermen, Jacaré-Guacu River, SP.
Conclusion

The live-bait fishing in Jacaré Guaçu River region proved viable in spring/summer, with good return to fisherman due to low investment applied. Furthermore, the activity has an essential role to families living exclusively from fishing, however, with the entry of new members in the activity, possibly the "tuvira" resource is not sustainable for many years. Thus there is need for periodic monitoring aiming at appropriate management measures, with the active participation of local fishermen.

This fishing activity in the Jacaré-Guaçu River (Middle Tietê Basin/SP-Brazil) besides representing another option for income and employment to the artisan fishermen and coastal communities, diverts part of the effort applied to the noble species for catching bait. This contributed to disperse stress over a larger number of species, improving the use and conservation of fishery resources in the region.

The socio-economic betterment of the community and the reduction of environmental impacts from fishing tuvira with use of sieves are factors that must be achieved with good use of this practice.

The results of this research will support measures to legalize the activity of live-bait fishing (tuvira) in the region.

References


A biosociological management unit for the conservation of reef fisheries with hook and line on the north coast of Bahia, Brazil

Iramaia De Santana, LABMARH - University of Bahia State (UNEB), Brasil, irasanta@uneb.br
Eliane Maria de Souza Nogueira, NECTAS – University of Bahia State (UNEB), Brasil, emsnogueira@gmail.com
The contribution of small-scale fisheries to food security in reef environments is critical. However, fishing pressure causes changes in species composition and structure of habitats, exceeding the regenerative capacity of these systems. This study aimed to establish a management unit for small-scale fisheries developed on the North Coast of Bahia. We used the diversity, abundance and trophic levels of landings, as well as the traditional knowledge of fishers and the reproductive strategy of spawning aggregation of *Lutjanus synagris*, one the main species exploited in the area. Our analyses revealed that exploitation in the reefs is divided into five distinct and interdependent units, which express three different models of fishing. The Model Reefs Offshore with Active Fisheries represents the hook and line fisheries and is the management unit present in this work. We used the lane snapper as a flagship species, thus any restrictions on the lane snapper potentially will protect the underlying trophic relationships and the reproductive potential of ecologically associated species.

We recommend the following actions for the conservation and management of hook and line fisheries: 1) Period of closure of spawning aggregation of lane snapper, that occurring in the most favorable periods for the settlement of eggs and larvae, 2) Participation of fishermen as a key stakeholder since the preparation until the evaluation of management plans and their impacts; 3) Redirect subsidies for fleet renewal, safety and safety at work and, 4) Fisheries statistics and research programs oriented to the inclusion of fishermen children in order to a) avoid the exodus, b) ensure the quality of data collection and c) community participation in the management process.

These programs should be implemented allowing adjustment of the plans in real time following the identified environmental and biological variations.

**A Brief Review**

Reef environments are, perhaps, the most important of tropical coastal ecosystems. They are described as one of the biggest projects of durable bioconstruction Earth (Knowlton and Jackson, 2001). They are highly diversified, directly providing goods and services to approximately 500 million people (Wilkinson, 2000).

Then artisanal fishing is recognized for providing a significant part of the resources of animal protein to the diet of human populations (Brewer et al., 2012; Mensah and Antwi, 2002; Ardiwijaya et al., 2008; Costa et al., 2003). Moreover, this type fish holding in long standing, tropical coastal communities constitute itself as one of the most important sources of income and livelihood for these communities.

The global goal of reefs fisheries management is to maintain their capability to provide goods and services as well the protection of social environmental integrity, this paper proposes a biosociological management unit for hook and line fisheries on the north coast of Bahia (LN / Ba).

**Analyzed data for the definition of fishing models**

We analyzed technological and spatially fishing developed in LN/Ba, calculated the diversity indices (S, H' and D), the importance value index (IVI), the CPUE and the trophic structure of the fish assemblage in determining the landed fisheries model developed here. We consider the trophic role and the predominant reproductive strategy of the main family landed. Also, we describe the reproductive strategy (*sensu* Brown-Peterson et al. (2011) and Lowerre-Barbieri et al. (2011)), the main and most important species landed. And for the definition of
management strategies, we review the historical governmental measures thrust for artisanal fishing in Brazil.

**Models of exploitation of reef environments in LN/Ba**

Characteristics interpolation of fishing technology and geographic distribution of fleet with ecological indices and trophic structure formed three models of natural exploitation on the reefs in LN/Ba: 1) Model Reefs Offshore with Active Fisheries: characterized by Non-motorized vessel, active fishing gear, low trophic level and feeding aggregations; 2) Model Reefs Inshore with Active-Passive Fisheries: characterized by boat with passive or active fishing gear, low to intermediate trophic levels, and aggregations residents, and 3) Model Reefs Offshore with Passive Fisheries, where the hook and line fisheries is sustained: characterized by passive fishing gear art, trophic level species and reproductive based on transient spawning aggregations strategy.

In the study area, the Lutjanidae complex drives the fleet dynamics. This group has the most abundant species according to the calculated indices. The Carangidae, Serranidae and Balistidae families follow the snapper group. Lane snapper, the flagship specie in this work, showed spawning aggregation in a long reproductive season. This population has synchronous reproduction with well marked spawning peaks in a period governed by the dry season, when water are more eutrophic.

Understanding which species of Lutjanidae family takes an active role in the dynamics of energy flow (Arreguin-Sanchez and Manickchand-Heileman, 1998), decreases the resistance, persistence and resilience in platform environments ((Pérez-España, 2003). Prohibitions made impact in other species not subject to restrictions such as: the congeneres, the species of the Serranidae family and four of the main species used as bait: White grunt, Queen triggerfish, Sand tilefish and Bigeye scad.

**Action for the Conservation and Management of Fisheries in Reefs Offshore in the North Coast of Bahia**

The management approach can be based on the definition of the maximum weight yield of a fishery on fishing effort employed (Sparre and Venema, 1998), or through the relationship between parental populations and their offspring (Marshall et al., 2006). The management strategy can still be directed by evaluating cascading effects of a stock (Pennino et al., 2011), or by seeking viable fishing communities (Jentoft, 2000), or in a combination of these different approaches. From this set of information, a framework of integrative parsimonious actions involving bioecological, socioeconomic and political aspects was defined.

The first action proposed a closed season based on sunset spawning peak of Lane snapper, February and November. Only traditional management measure protects matured fish using minimum sizes, which cannot be applied to hook and line fishery. It is not selective and does not allow the return of live fish to the sea. The spawning peaks are associated with the time of the richest streams in the region and thus create better conditions for the settlement of larvae. Lutjanidae family is recognized by form transients spawning aggregations with large migrations to spawning grounds (García-Cagide et al., 2001), thus a closed fishing season should implemented across the all North Coast of Bahia.

The second step will be the inclusion of fishermen in the management process. They are needed from the development of the plan, its implementation, monitoring and evaluation of its
impact. There is a high degree of ecological knowledge by the fishermen who know where, when, how and which gear to explore the environment.

We identify a historical trend of government measures in Brazil to increase productivity based on the increase of the fleet, notably in the last five years, just as the major stocks in the area are considered overexploited or being overexploited. Subsides should not be directed to this end.

On the other hand, subsidies should be directed to the:

- Renovation and modernization of the fleet in order to work safety and food security,
- Implementation of mandatory facilities for hygiene and personal care; equipment for security and communication;
- Sleeping facilities for fishermen; and
- Set-ups for processing fish, to reduce handling time and ensure their health suitable.

In the North Coast of Bahia, working conditions are very inhuman and unhealthy. In this new context, fiscal incentives should be scheduled to address the increased demand of closure salary. There existence for fishermen and of other resources such as shrimp legitimizes this social group as poor and vulnerable.

The participants’ qualification in the production chain would be a complementary alternative to the use of incentives, often aimed at women who are mostly responsible for the marketing of production. This could ensure that part of the production would go to surrounding regions with continuous demand during the months with low local demand for fish. This would allow the reduction of the force that has the middleman who control the production price.

If we consider that one of the characteristics of this type of fishing are family and close social relationships ties, then strengthening cooperation would be a recognized way for reducing poverty and vulnerability and avoiding social ecological traps of fishing. To master the production chain of small-scale fisheries is needed to work cooperatively.

A good collection of continuous data over time is part of any program of investment, to strengthen and expand a sector. In Brazil, the discontinuity and lack of standardization of fisheries data could be mitigated by a partnership among research institutions in the State for training and directing young researchers in the areas of fisheries to take advantage of existing programs in the state and national level for high school students and children of fishermen. This could ensure data quality sampling, allowing management plans, which will be adapted in real time according to the identified environmental and biological variations. The role of the community in the process of managing their own resources and avoidance of social-ecological traps would be strengthened, contributing to the re-appropriation of a misconfigured social and environmental space.

We understand that the most appropriate management for a multispecies fishery depends on both social-economic and biologic factors. Closed seasons applied a spawning aggregations, its underlying trophic relationships and their reproductive potential, could be effective. Moreover, they protect a part of the coastal population that depends solely on fishing, through a real possibility of a recovery should fish in the area decline. The inclusion of the community in its management can lead to share responsibility of fishermen in the fisheries that drive their own lives.
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Socio-ecological changes in artisanal fishery of two communities adjacent to a Brazilian marine reserve
In this paper, we investigate the socio-ecological change in artisanal fishery of two communities affected by a marine reserve, in face of conservation and development drivers of change in the region. We analyze institutional change in the property-rights regime of local fisheries along the development trajectory of the territory.

**Institutional change and development trajectory**

The study of institutions is important to comprehend the dynamics of fisheries management systems (Jentoft 2004), and may provide clues about changes in property regimes (Berkes 1996). Investigations about institutional change are outcomes of research on the dynamics of socio-ecological systems and common property resources (Ostrom 1990, 2009). Studies about institutional change are interested in the behavioral variables involved in cooperative systems able to generate collective action (Bromley 1989; Ostrom 2005; Poteete, Janssen, Ostrom 2010). Brazil has few case studies about institutional change in coastal artisanal fishery (Cordell and McKeen 1992; Kalikoski, Vasconcellos, Lavkulich 2002; Seixas and Berkes 2003). Such studies offer subsidies for the division of responsibilities between State and civil society in processes of fisheries co-management (Pinkerton 2003).

The term “socio-ecological change” (Bahia 2012; Prado 2013) will be used to refer to the study of institutional change in the perspective of the development trajectory of territories (Sabourin, Caron, Silva 1996). Studies on the territorial development phenomenon require a historical analysis of institutions around which the localized social interaction is organized (Abramovay 2010). In this sense, we are using the institutional change as a complementary approach to the development trajectory of territories in the context of research on the dynamics of common property resources (Berdengué et al. 2012). Socio-ecological change in artisanal fisheries are analyzed in four periods of development trajectory, with consequences for fisheries resources property regimes.

Along 154 days distributed in two years and eight months (February 2011 to September 2013) the fieldwork was carried out using the following research methods: (i) archival research and document analysis; (ii) direct observation of decision-making arenas; (iii) participant observation in 20 artisanal fishing; (iv) semi-structured and non-structured interviews with 24 artisanal fishermen (12 elderlies), 04 owners of fish markets, 06 leaders of fishermen's associations and 05 public managers and; (v) open interviews with 110 participants belonging to 14 categories of social actors.

**Socio-ecological changes in two communities of Ilha Grande Bay, Southeastern Brazil: Mambucaba and Tarituba**

The Ilha Grande Bay is located in the south of Rio de Janeiro State (22°50´- 23°20´S, 44°00´ - 44°45´W), comprising Angra dos Reis and Paraty municipalities. According to the Brazilian Institute of Geography and Statistics (IBGE) census, in 2012 the Paraty population was around 37,500 inhabitants (only 9,800 in rural areas) and Angra dos Reis had 169,500 inhabitants (only 6,200 in rural areas). For purposes of artisanal fisheries analysis, we are calling Mambucaba an area situated in the extreme southwest of Angra dos Reis municipality, which encompasses the communities of Vila Histórica (900 dwellers), Perequê (36,000
dwellers) and Praia Vermelha (350 dwellers). Tarituba is a community (430 dwellers) located in the extreme northwest of Paraty municipality and 9 km south of Mambucaba.

Tarituba and Mambucaba are located around a Marine Reserve called ‘Ecological Station of Tamoios, being also affected by others protected areas. The Ecological Station of Tamoios is a federal conservation unit, managed by the Chico Mendes Institute for Biodiversity Conservation (ICMBio).

The development trajectory analyses considered four periods, which are related to changes in the rules-in-use of fisheries resources regulation and access control.

First Period (Until the end of 1960s) – The world of tradition

Founded in the eighteenth century, the Mambucaba Historical Village had its period of wealth during the coffee economic cycle. Tarituba was founded in the early nineteenth century, working until the 1940s as a salting and shark liver oil industry. During the 1940s and 1950s the communities acquired the first engines for the fishing boats. Until the beginning of Rio-Santos Highway construction (1973), Tarituba and the Historical Village of Mambucaba, even with a few houses, were commercial centers for the neighborhood dwellers. The production focused on the consumption and sale of fishing surplus, and telegraphs were used to verify the buyers’ interest in fish. The trade, conservation and fish catching technologies were limited to artisanal process from the existing raw material. While in Tarituba the commercial fishing focused on the sharks, in Mambucaba predominated the fishing of anadromous species, in special, the mullet (Mugil spp.) in winter and the snook in summer.

Second Period (Early 1970s to mid-1980s) – The professionalization of fishing and the great enterprises

In the early 1970s three beaches were designated for condos of guideposts employees of the Nuclear Plants that were beginning to be built 6 km north of Mambucaba. The workers who built the Nuclear Plants started a migration to the site, forming two neighborhood-cities (Perequê and Frade). Most part of the sand used in the construction was withdrawn from Mambucaba River, leading to suppression of riparian vegetation and starting a process of siltation. Upon completion of the Rio-Santos Highway, the agriculture was abandoned and the dwellers were living exclusively from fishing. The fleet of artisanal vessels was expanded and important innovations occurred with the spread of multifilament nylon, engine, equipment for diving fishery, gillnet and ‘squid-diggings’. These innovations allowed modifications in traditional fishing gears during the 1970s, when the first sign of exhaustion of fish resources was evidenced by the reduced availability of large fishes near the shore occurred. In the early 1980s electricity reached communities, floating trap-nets for pelagic fish (cercos flutuantes) were installed along the rocky shore and the tourism and recreational fishing increased.

Third Period (Mid-1980s to mid-2000) – The development of tourism and the crisis in fishery system

In all Ilha Grande Bay this was a period characterized by changes in landscape and land property. Devoid of riparian vegetation, after two floods (1984 and 1986) there was a severe erosion process in Mambucaba River, limiting the entrance of fishes and the passage of vessels during low tide. The Nuclear Plants Angra I (concluded in 1987) and Angra II (concluded in 2000) were inaugurated, increasing the disorderly occupation of Perequê and the consequent pollution of the Mambucaba River. With lower occurrence of coastal large fishes in the late 1980s, the main collective fishing gears (rede de gancho and beach seines – ‘arrastão de praia’) were being modified or replaced by individual fishing gears, like setting gillnet. The increase of outsiders trawling activities generated reactions in Tarituba, through
the creation of an exclusion area of trawling (1999) and Mambucaba, by the installation of trawl net grippers (2004) in front of Praia Vermelha. From the mid-1990s until the end of this period, the local economy has become strongly dependent on tourism and, with the crisis in fisheries, the artisanal fishermen began to pursue other activities.

Fourth Period (Mid-2000 to present) – The expansion of the energy sector and the implementation of conservation units

The discovery of oil and gas reserves in the Pre-salt in 2007 and the construction of Angra 3 Nuclear Plant in 2008, opened a new cycle of industrial activities in Angra dos Reis. The Protected Areas became beneficiaries of the environmental licensing conditions that allowed their effective implementation. In the case of Tamoios Ecological Station, compliance with its rules generated an abandonment of fishing or their practice with fear of surveillance. The reactions of fishermen to inspection included cases of depression by the loss of equipment and inability to work and health problems in the elderly. In Mambucaba the fishermen reacted changing the fishing schedule and creating the Association of Professional and Recreational Fishermen of Angra dos Reis 4ª District (APEPAD) in 2008. The surveillance consequences in Tarituba were related to the enforcement of shrimp closed season policy and the lower use of wharf and Ilha Comprida as a clandestine harbor for unloading sardines by fishing boats. Furthermore, Tarituba fishermen had an informal agreement banning the encircling gillnets (‘cerco do robalo’) technique at the mouth of the Mambucaba River.

Socio-ecological change and property regimes

Data on socio-ecological change in artisanal fisheries at the community level (Tarituba and Mambucaba) and the related to formal institutions, allow us to make some inferences about property-rights regimes (Berkes 1996) on fisheries over the past decades (Table 01). Access to market since the 1970s increased competition for fish resources. This new context was not followed by institutional changes with the same adaptive character present in traditional institutions (Johannes 2002). Environmental change had not affected formal institutions that regulate fishery resources. This fact is related to the so called scale misfit between natural resources management institutions and ecosystems (Folke et al. 2007).

Fisher’s claims for institutional changes brought perspective to promote a process of adaptive co-management (Olsson et al. 2004) in Ecological Station of Tamoios. The legal instrument (Term of reference) proposed by ICMBio, enabled the openness to negotiation of new rules for use and access to fishery resources, which shall be periodically revised based on results of social and ecological monitoring. If integrated with other management strategies, Marine Protected Areas can offer many opportunities for fishing, tourism and environmental conservation (Ban et al. 2012). Fisheries monitoring could increase the Ecological Station ability to respond to emerging issues in an agile way to engage in adaptive management and direct long term questions in a suitable time.

<table>
<thead>
<tr>
<th>Period</th>
<th>Description</th>
<th>Prevalent regime</th>
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<tbody>
<tr>
<td>Until the end of 1960s</td>
<td>Local fishing rules with production directed for consumption and surplus sale.</td>
<td>Communal property</td>
</tr>
<tr>
<td>Early 1970s to Present</td>
<td>Access to markets, professionalization</td>
<td></td>
</tr>
</tbody>
</table>

Table 01 – Change in property regimes of fisheries resources in Tarituba and Mambucaba from the 1960s to 2012.
<table>
<thead>
<tr>
<th>Mid-1980s to mid-2000</th>
<th>Fishery system crisis, increase in the number of users, fish demand and dependence on the fishing grounds. Creation of Marine Reserve.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-2000 to 2012</td>
<td>Recovery of fish production, restrictions on use and access to resources and conflicts between fisheries and environmental agencies.</td>
</tr>
</tbody>
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**Bibliographic References**


**Governance conflicts in the small-scale fisheries of a tropical estuary**

Luana Prestrelo (Universidade Federal do Rio de Janeiro)
Marcelo Vianna (Universidade Federal do Rio de Janeiro)

In developing countries, poverty and government neglect towards small-scale fisheries increases the conflicts between fishermen and government. Guanabara Bay, Rio de Janeiro State, Brazil, is an important estuary but its eutrophication process is high and increasing due economic growth, enhancing important enterprises and population growth in surrounding counties. It increases prohibit fishing grounds and fisheries conflicts. We spatialized the small-scale fisheries along Guanabara Bay, identifying the conflicts with current fishing laws. Semi-structured interviews were performed to access fishermen mental maps combined with a geo-referenced grid-map of fishing legal zones. It will allow main fishing grounds identification and its overlap with legal zones, enabling the recognition of fishing activity and law conflicts. Guanabara Bay has a total area of 348.9 km² with fishing activity allowed in little more than half of it, dropping to a quarter considering trawling specific laws and purse seine technological limitation ranges due to nets’ weight and length. According to environmental and navigations laws and 60 mental maps, the results indicated that more than a half of the main fishing grounds are within prohibited fishing zones. When considering trawling it increases to nearly 100.0%. Different sources of fisheries limitations present dubious rules and magnify conflicts with fisheries community, leading to the bypass of
fishing to prohibited zones. These conflicts promote discontent and mistrust among fishermen, leading to the discredit of importance fishing restrictions. This behavior increases fishing pressure in ecologically important areas including nursery ground and river mouths, management inefficiency, fishermen marginalization and government neglect towards them.

**Collective resistance to environmental injustice of the organized artisanal fishers of Brazil**

Naína Pierri Estades (Federal University of Paraná)

The objective of the research is to study the collective forms of resistance of the organized artisanal fishermen of Brazil aiming to understand its capabilities and limitations to face / overcome situations of environmental injustice of which they are victims. It is understood by environmental injustice the situation of imposition of disproportionate environmental impacts and risks as well as territorial exclusion and lack of access to natural resources for the poorest and fragile sectors of the population. This is the case of the Brazilian artisanal fishers and their communities, who are victims of environmental problems which they are not responsible or are not primarily responsible and suffer territorial exclusion and lack of access to the resources that they depend. The methodology focused on analysis of secondary data, qualified informant interviews and participant observation. Consensus in the literature is the idea that this sector presents major difficulties of collective organization and representation that limit their collective struggles. These factors question their ability to accumulate the necessary forces to restore environmental justice in a more generally and permanently way. The results of the research show that the present model of development of the country and the national fisheries policies implemented in recent years have increased the situations of environmental injustice suffered by artisanal fishermen, but that they are living a reorganization process at local, state and national levels with unprecedented mobilizations in favor of broader and deeper claims, with positive local results and significant national advances.

**Characterization and analysis of fishing dynamics and productive chain of communities of traditional fishermen in the municipality of São Mateus, Espírito Santo state, Brazil**

Rodrigo Randow de Freitas (Bolsista de Desenvolvimento Científico e Tecnológico Regional (CNPq/FAPES) Universidade Federal do Espírito Santo, Centro Universitário Norte do ES. Departamento de Engenharias e Tecnologia - DETEC)

It can be said that the fishery in the state of Espírito Santo, Brazil, assumes an important role local socioeconomically. In this context, the community of Pedra D'Agua, municipality of Sao Mateus, presents itself with high degree of dependence (income and supply) regarding production and marketing from artisanal fishing. With this, aiming to analyze the current stage of development of the activity, we sought to analyze the fishing dynamics and local productive chain. For both, it was necessary to identify the characteristics of the fishing activities, stakeholders, draw up maps of fishing areas and a SWOT matrix, in addition to identifying the areas of influence of fishing. With the obtained results, it was evident that the groups of the productive chain of Pedra D'Agua await improvements in structure to support fishing and the extension of niches that are not yet explored, such as the cultivation of sea
bass. In the analysis of scenarios, it was found that the practices of planning and control are ineffective in ensuring the full local development, mainly, by weaknesses and threats you will come across in the SWOT matrix, such as the misuse of natural resources, absence of aggressive marketing and predatory fishing, for example. By means of the analysis of fishing areas and zones of influence it was found that, the productive chain of fishing Pedra D'Agua has great potential and strength, such as fishermen knowledge and possible value of fish. Therefore, if these positive factors are potentiated, weaknesses minimized and threats transformed into opportunities, management of the supply chain can become more efficient and competitive in local in the state the context.

**Portuguese/Spanish Session 1.2: Brazilian and Mexican studies**

**Monitoring small-scale fleet dynamics around tropical islands: squids and fishers behaviour in São Sebastião, SE Brazil**

Felippe Aldert Postuma, felippepostuma@usp.br  
Maria de los Angeles Gasalla, mgasalla@usp.br  
Fisheries Ecosystems Laboratory (LabPesq), Oceanographic Institute, University of São Paulo, Praça do Oceanografico 191, Cidade Universitária, 055080-900 São Paulo, SP, Brazil

**Abstract**

Monitoring small-scale fleet dynamics is important to understand both fisher’s and resources behaviour which may contribute to a more locally-focused management of the fisheries. Some resources such as the squid aggregate around islands in a seasonal basis while fishing communities take advantage of those grounds in different ways. This particularity seems to repeat in several insular ecosystems of the ocean’s world. The aim of the present study was to identify the particular patterns of the small-scale fisheries dynamics targeting the squid *Doryteuthis plei* around the São Sebastião Island, in SE Brazil. The study was based on a 10-years collaborative monitoring of the ‘fishers-fisheries-market’ tripod in the region. Spatio-temporal differences in the dynamics were observed. In the beginning of the study period (2002-2003) largest catches occurred in the deeper areas of the North and Northeast region of the island, while in later years the fleet tended to get highest catches in the shallower areas of the Southeast region. Fishers from the continent (Pontal da Cruz fishing village) showed the highest catches on the island’s North and Northeasters areas, destined to the local market, by using the largest boats with up to 6 people onboard and longer lasting jigging time (10h). Those fishers are often affiliated into a local fishing cooperative and to the fishers’ association (called *colônias*). In contrast, isolated communities of the island, mostly of islander’s using paddled or motor canoes concentrated their squid’s catches in the South and Southeastern areas, applying a jigging time of less than 4h, while squid catches were mostly for communities’ self-consumption (subsistence). Fishers decisions showed changes throughout time and space and this information seems useful for a potential management plan proposal integrating environmental, population patterns, and the dynamics of fisher’s behaviour presented here.

**Introduction**

Monitoring fleet dynamics is important to understand fisher’s and resources behaviour which may contribute to the management of the fisheries, e.g. spatial and temporal right’s
allocations. Many species inhabit the same fishing grounds and are exploited by using different fishing selectivity in a multispecies context, where stocks of low and high productivity are mixed making them difficult to manage (Flower, 1999; Branch et al. 2006). However, some fisheries with single targets, such as the squids, have shown that their management benefits if strongly supported by the monitoring of the spatial and temporal abundance of the resources (Arkhipkin and Middleton 2002; Maxwell et al. 2005; Roberts 2005; Smith et al. 2005; Young 2006).

In the South Brazil Bight, the loliginid squid *Doryteuthis plei* (Blainville, 1823) is more abundant during the summer and aggregate around small islands in a seasonal basis while fishing communities take advantage of those fishing grounds in different ways (Perez et al. 2002; Rodrigues and Gasalla 2008; Postuma and Gasalla 2010; 2014). In the São Sebastião Island (SSI), *D. plei* have been caught by a small-scale fishery during both daylight hours and at night and seems to operate under a wide range of environmental conditions (Postuma and Gasalla 2010). The squid fishery in SSI is a traditional activity where fishers, including women and children, use homemade jigs with hand-lines to capture the squid. The squid fishery around SSI does not have a management plan yet, but are presently threatened by forthcoming infrastructure projects such as port, oil and gas industries, even in areas potentially protected by MPAs.

The understanding of the spatial and temporal distribution of catch and fishing effort, and also the main fishing variables that better translate the fisher’s decision rules seems crucial to a more locally-focused fisheries management. Thus, the aim of this study is to identify particular patterns of the small-scale fisheries dynamics targeting the squid *Doryteuthis plei* around the São Sebastião Island, based on a 10-year collaborative fisheries monitoring involving an academic institution, the fishers, and the local fishing cooperative.

**Materials and methods**

**Study area**
The SSI is located between 23°70 and 24°00’S and 45°50 and 45°00’W in the South Brazil Bight marine coast ecosystem. In this region, the small-scale fishery operates at a depth of between 5 and 30 m depth, mainly close to the shore and in the island’s sheltered bays, but also close to smaller islands such as Búzios and Vitória (Figure 1).

![Figure 1 – Study area. Geographic distribution of the tropical arrow squid *Doryteuthis plei* (1) in the Western Atlantic Ocean (shadowed area) and (2) in detail, showing the four fishing areas in rectangles: A) North, B) Northeast, C) Southeast and D) South where the small-scale squid hand-jigging fishery around the São Sebastião Island operates.](image)

**Data sources**
Research and monitoring of the squid fishery around SSI began in 2002 with visits to fishing communities and landing points for biological sampling. Fishing information were collected weekly, across six fishing seasons ranging from 2002 to 2012 between November and April. The information collected with the fishers included: total catch per trip ($T_{ct}$) and the spatial factors: fishing area ($Fa$) and fishing depth ($Fd$), the temporal factors: both fishing month ($Fm$) and fishing season ($Fs$) and the fishing effort per trip: number of jigs per fisherman ($N_j$), number of fisherman onboard ($N_f$) and time spent fishing ($Ts$). Vessel type was also recorded. Catch-per-unit-effort per fishing trip ($cpue^t$) were calculated based on total catch (in kg) in function of the number of onboard fishers, number of jigs per fisherman per time spent fishing, as follows: $cpue^t = T_{ct}/N_f/N_j/Ts$

Secondly, spatial distributions of the total catch and $cpue^t$ were mapped with Surfer 9.0 software, selecting kriging as the geostatistical gridding method. The maps were generated by the statistical method of linear interpolation and the coordinates are in UTM, so it was possible to observe the variation around the SSI during the study period. Results were visualized with post plot overlays on bathymetric contour plots.

Data analysis
Besides the maps, both catch and $cpue^t$ were tested for normality using a Shapiro–Wilk test. Because data were found to violate the criteria for normality, the non-parametric Kruskal-Wallis test was applied to test the influence of fisheries-related factors (area and season) on catches and $cpue^t$. A post-hoc pairwise comparison test was applied to determine which factor was significantly different from the average. All statistical tests were considered at a 0.05 level of significance.

Results
The fishery monitoring of the squid fishery around São Sebastião Island showed the use of four vessel’s types: (i) motorized boats, (ii) wooden paddling canoes, (iii) motorized wooden canoe and (iv) fiber boats. The catch of $D. plei$ occurs on average by two fishers on board and with 4 jigs each. The mean total catch ($T_{ct}$) was 36.89 kg (+49.03 s.d.; range 1–270 kg) per fishing trip.

Spatial distribution
No significant relationship was found between mean catches and fishing areas. On the other hand, mean $cpue^t$ was significantly different ($P < 0.05$) where the highest values observed in the North (A) and South (D) area (Figure 2). The test also showed that the differences were significant in fishing effort (time spent fishing and number of jigs), the highest values were observed in the North (A) and Northeast (B) areas (Figure 2).

Temporal distribution
Average catches showed significant differences over time. The pairwise comparison test showed that the mean $T_{ct}$ was significantly higher in the 2003-04 with 51.46 kg and 2011-12 with 50.43 kg. The $cpue^t$ show the same pattern, with the high values 0.70 and 1.14 kg/fisherman/jig/hours per trip in 2003-04 and 2011-12 respectively. The number of jigs used per fishing trips around SSI ranged from 1 to 10 per fisherman. The number of jigs in 2003-04 was 10, but decreased to 7 in the 2011-12. The average time spent of the squid fishery increased between 2002-03 and 2011-12 (Figure 3).
Figure 2 – Means and quartiles (maximum and minimum) of A) total catch per trip $Tc^t$ (in kg), B) $cpue^t$ = Kg/ number of fisher/jigs/ time spent in hours; C) number of jigs per fisher ($Nj^t$) and D) time spent fishing in hours ($Ts^t$), for four fishing area caught by the small-scale squid hand-jigging fishery around São Sebastião Island during the period November 2002 to April 2012.

Spatial-temporal differences in the catch of $D. plei$ were observed. In the beginning of the study (2002-03 season) largest catches occurred in the North and Northeast deeper areas (A and B), while in later years the fleet tended to get highest catches in the Southeast (C) and shallower areas (Figure 4). Also, significant differences in the $cpue^t$ values were observed. In 2002-03 season largest values occurred in the Northeast (B) deeper areas very close to the Búzios and Vitória Island (B), while in later years the fleet tended to get highest catches in the North (A) and South (D) and shallower areas (Figure 5).
Figure 4 – Spatial distribution of the total catch ($Tc'$) of the squid *Doryteuthis plei* (in kg) per fishing trip by the small-scale fisheries around the São Sebastião Island across six fishing seasons (2002-03, 2003-04, 2004-05, 2006-07, 2008-09, 2011-2012).

Figure 5 - Spatial distribution of cpue' of the squid *Doryteuthis plei* (in kg) per trip, caught by small-scale fishery around São Sebastião Island during monitoring across six fishing seasons (2002-03, 2003-04, 2004-05, 2006-07, 2008-09, 2011-2012).
Fishers' behaviour
Fishers from the continent (Pontal da Cruz fishing village) showed the highest catches on the island’s North and Northeast areas (A and B), destined for the local market, by using the largest boats with up to 6 people and longer lasting jigging time (10h). Those fishers are affiliated into a local fishing cooperative and fishers’ association (called colônias). In contrast, isolated communities of the island, mostly of islander’s using paddled or motor canoes concentrated their squid’s catches in the South and Southeastern areas (C and D), applying a jigging time of less than 4h, while squid catches were for communities’ self-consumption.

Discussion and conclusion
The small-scale fisheries dynamics catching the squid D. plei around a tropical island in SE Brazil, exhibited strong temporal and spatial variations in terms of catches, cpue and fishing effort during the period from November 2002 to April 2012. We suggest that the high catches and cpue at the beginning of the study period (Figures 3A and 3B) may be linked to the increased fishing effort in terms of the number of jigs per fisherman in 2003-04 (Figure 3C), with short fishing time (Figure 3D). Fisher’s decisions also showed changes throughout time and space, for example, the largest catch by fleet was observed in 2002 in the North (A) and Northeastern (B) deeper areas, while in later years the fleet tended to migrate to get highest catches in the Southeast especially in sheltered bays ∼20 m deep, this information seems useful to the development of a management plan proposal integrating environmental, population patterns, fishermen knowledge and socio-economic aspects. Postuma and Gasalla, (2014) suggested that North (A) and Southern (D) areas are used as breeding and spawning grounds for this species. Therefore we recommend that additional attention should be placed to protect squid spawning grounds.

The management of small-scale fisheries is particularly challenging due to the difficulties in assessing both catches and fishing effort where we found that just monitoring institutions is not enough. Thus, the technical information about fishing effort and fisher’s behaviour, such as the one monitored by this study for the squid fishing, suggest that the management of the number of jigs and time spent fishing per trip could eventually be of help for protecting the spawning stock biomass that aggregates in the area.

References


**Development of a computerized system for integrated management of fisheries and participatory, in Tocantins State, Brazil**

Setubal, S.S (PQ), Núcleo de Pesquisa Aplicada a Pesca e Aquicultura Norte 5, Campus Palmas – Instituto Federal Tocantinense (IFTO). E-mail: sylviasetubal@ifto.edu.br

Rodrigues, B A(TC) Analista de Sistemas, Campus Palmas – Instituto Federal Tocantinense (IFTO). E-mail: alessandro.rodrigues@ifto.edu.br

Cruz, I.A.N (PQ), Núcleo de Pesquisa Aplicada a Pesca e Aquicultura Norte 5, Campus Palmas – Instituto Federal Tocantinense (IFTO)

Doeler, F. (PQ); Doeler Agronegócios. E-mail: fdoeler@hotmail.com

Patrício, A.Y(IC) Aluna do Curso Superior Tecnológico em Agronegócio, Campus Palmas-Instituto Federal Tocantinense (IFTO)- E-mail: vonaria-andre@hotmail.com

Feitosa. P.C. M.(IC) ⁴ Aluna do Curso Superior Tecnológico em Agronegócio, Campus Palmas- Instituto Federal Tocantinense (IFTO)- E-mail: dufeit@hotmail.com

**Abstract**

The State of Tocantins is located in the northern region of Brazil and belongs to the Brazilian Amazon. There are 35 professional artisanal fishing colonies distributed along the watershed basin of the Araguaia river –Tocantins. It has 35 professional fishermen colonies distributed among the rivers belonging to the Araguaia River Basin in the State of Tocantins. Nowadays the state productive artisanal fishing chain profile is unknown. The fishing colonies have a very simplified administrative and management system, partly due to the low fishermen educational level. In this context, the project aims to build a Computerized System for the Management of Fishing (“FISHING GIS”) to be used by fishermen colonies and managed by the Ministry of Fishing and Aquaculture (“MPA”). The SIG Fishing was generated in a web based system with the PHP
Potential exploration of fisheries resources in extractive reserve Cururupu-MA, Brazil

Polliana Farias Veras, Master's student in Fisheries and Aquatic Resources - UEMA. Brazil. E-mail: polliana_veras@hotmail.com
Eduardo Castro Menezes de Borba, Environmental Analyst - Chico Mendes Institute for Biodiversity Conservation - ICMBio. Brazil. E-mail: eduardo.borba@icmbio.gov.br
Zafira da Silva de Almeida, Professor, Department of Chemistry and Biology - UEMA. Brazil. E-mail: zafiraalmeida@hotmail.com.

Abstract

The coast of Maranhão contributes significantly to fish production in Northeastern Brazil and is the second largest producer in the region. The majority of the state's marine fisheries, about 95%, come from small-scale fisheries. In this context, this study aims to identify fishery resources produced by artisanal fisheries on the island of Peru located in Marine Extractive Reserve (MER) Cururupu, Maranhão, and suggests the potential for regional exploitation. To this end, semi-structured interviews with islanders were carried out, as well as, observation of their routine activities. Shrimp and fish are the main products from artisanal fisheries, representing the main source of food and income for the local population. These shrimp belong to the family Penaeidae (Litopenaeus schimitti, Farfantepenaeus subtilis and Xiphopenaeus kroyeri). Main fish include Go (Macrodon ancyldon), Mullet (Mugilidae), Bandeirado (Bagre spp), and Bagre (Ariidae), among others. It was observed that RESEX Cururupu does not currently have a management plan, however, there are some institutional management actions involving the prohibition of zangaria fishing during the months of June, July and August. It was noticed that the island of Peru offers other resources that could be commercially exploited and contribute to improving the income of local people, for example, some species of fish and seafood like oysters, crab, siri and sarnambi. Investment in the region is necessary that aims for the sustainable use of existing resources to improve the livelihoods of local populations.

Keywords: artisanal fishing, island of Peru, management, RESEX Cururupu.

1. Introduction

The Maranhão Coast, with an extension of 640 km, comprises a stretch that runs from the mouth of the Parnaíba River, in the east, to the mouth of the Gurupi River, in the west (Coutinho, 1996). Twenty-six municipalities are found along this vast coastal area,

programming language, using the PostgreSQL database from forms already used by MPA in the general register of fishermen, environmental assessment protocols and morphometric data that are already used by experts from each area. The system will do, among others, records of administrative data from the associated Fishermen Colony, from production and marketing of the captured fish to the bioecology data of species and the environmental conditions in the fishing region. Artisanal fishers receive qualification in scientific methodology to conduct this monitoring. This tool will provide agility, efficiency and effectiveness in assessment and monitoring of fishery resources since it allows establish correlations of information entered into a database, contributing to the development of the sector in the State of Tocantins.
comprising 273 fishing communities. This is reflected in the fishing statistics. According to the Ministry of Fisheries and Aquaculture, Maranhão was responsible for producing 44,599 tons of fish in 2011, constituting the second largest producer in the Northeast, second only to Bahia (Brazil, 2011).

The majority of marine fisheries in the state, approximately 95%, are provisioned from a large and dispersed artisanal sector. This primitive fishing has many implications in the state, exhibiting a complex and disorganized structure, and with a fishing population completely deserted by public powers (Almeida et al., 2006a).

In order to develop fishing activities in Maranhão, in a sustainable fashion that preserves the cultural values of traditional communities, Marine Extractive Reserve (MER) Cururupu was created in the municipalities of Cururupu and Serrano in Maranhão State. The reserve was federally formalized by decree on June 2, 2004 and is managed by the Chico Mendes Institute for Biodiversity Conservation (ICMBio).

The majority of people living in RESEX Cururupu live exclusively from fishing, hence the importance of studies to assess the fishing potential of the region in order to generate more income for this population.

Consequently, this study aims to identify the main fishing resources produced by artisanal fisheries from the island of Peru, Marine Extractive Reserve (MER) Cururupu - Maranhão, and to suggest the potential for exploitation.

2. Materials and methods

2.1 Area of Study

RESEX Cururupu has an area of approximately 186,053.87 ha and a population of about 1350 families registered in 2012 (Figure 1). Located in the state of Maranhão, in the western portion of the coast called Reentrâncias Maranhão, the reserve encompasses three bays: Lençóis Bay, Capim Bay and Mangunça Bay (ICMBIO, unpublished data).

Separated by these three bays are four archipelagos, comprising a total of 13 populated islands (Peru, São Lucas, Mangunça, Caçacueira, Valha-me-Deus, Guajerutua, Lençóis, Porto Alegre, Retiro, Bate-Vento, Porto do Meio, Mirinzal, Iguará) as well as other islands that act as fishing camps (Beiradão and Urumarú). Peru is located at 01° 29'52.6" S latitude 44° 5 S and 46° 49" W longitude.
2.2 Collecting and analyzing data

Field research was conducted in May of 2013 and in June and July of 2014, on the island of Peru (Cururupu - Maranhão). Interviews were conducted with island residents, most of whom were fishermen. In addition, informal dialogues and direct observation of residents’ routine activities were carried out, including the accompanying of fishing trips, in order to understand the fishing system in the region and evaluate the economic potential of the place.

Subsequently, the information was organized by working groups, consisting of a maximum of five components and socialized in meetings with the participation of local community members. This methodology allowed for the exchange of information between groups, so that in the end, we had an overview of fishing on the island of Peru.

3. Results and discussion

3.1 Social Aspects

Of the families surveyed, 78% are headed by men and 22% women. Of the respondents, 56% were active fishermen, 33% retired, 5% retired fishermen and 6% did not state their profession.

In relation to living conditions and local infrastructure, it was observed that among interview respondents, 53% had wooden houses, 29% brick and 18% straw; 65% of those homes had no bathroom inside the residence. There is no electricity or running water supplied by a public power. Eighty-five percent of the homes had a power generator, however, it only worked for 4 hours a day from 18:00 to 22:00. It was found that the water used in homes was coming from artesian wells and only received in-home treatment.

The education level of the residents of the region is low due to the difficulties in accessing basic education. The only community school has two classes with multiple series from 1st to
5th grade of elementary school. In search of better living conditions, including the education of children, entire families have moved to the county seat of Cururupu Municipality. Consequently, a low number of young people in the region has been observed, as reported by Almeida et al. (2007).

### 3.2 Fishing gear and fishing resources

The Extractive Reserve Cururupu has a Management Tool, termed the Management Agreement, which is a document that regulates the use of natural resources, extractive practices and the coexistence of users in the RESEX. According to this agreement, some of the types of fishing allowed in the reserve are: puçá de arrasto nets, with not less than 20mm (twenty millimeters) mesh; puçá de muruada nets (Figure 2), with not less than 24mm (twenty four millimeters) mesh; and zangaria or fuzarca nets (Figure 3), with not less than 50mm (fifty millimeters) mesh, a fixed minimum distance of 100m (one hundred meters) from one to another, a maximum height of 2.5m (two and a half meters), and maximum length of 1500m (1,500 meters).

**Figure 2: muruada**

**Figure 3: zangaria**

Peru Island is heavily involved in fisheries production, principally shrimp, with main species pertaining to the family Penaeidae: *Litopenaeus schimitti* (camarão branco), *Farfantepenaeus subtilis* (camarão vermelho or cascudo) and *Xiphopenaeus kroyeri* (piré or sete-barbas). These species are important fishery resources of the western coast of Maranhão, developing in abundance due to favorable abiotic conditions, such as the dynamics of tides, which favor the life cycle of marine shrimp and consequently their production. According to Almeida et al. (2007) shrimp from the family Penaeidae represent an excellent and important resource for food and income generation in coastal Maranhão (Figure 4).
Puçá de arrasto, is a type of fishing that primarily captures the smallest shrimp, or Piré (*Xiphopenaeus kroyeri*). Fishing with nets of this type is prohibited during the months of April, May and June, in the reserve area to protect the recruitment of shrimp, in accordance with the RESEX Management Agreement. Muruada fishing mainly captures cascudo shrimp (*Farfantepenaeus subtilis*). In relation to this fishery, we highlight the fact that muruada is regarded by fishermen as a non-predatory form of fishing as it selects shrimp sizes ideal for capturing. The accompanying fauna consists of fish, such as sardines (*Sardinella brasiliensis*) and some crustaceans such as siri (*Portunidae*), which was observed being harvested by some fishermen from Peru. However, the by-catch of this fishery is not a commercialized fishery resource and in general, serves more for consumption by the fishermen and their families.

Zangaria fishing, on the other hand, targets, camarão branco (*Litopenaeus schimitti*). Another important difference is the huge amount of zangaria by-catch, which consists of fish such as Gó (*Macrodon ancylodon*), Tainha (*Mugilidae*), Bandeirado (*Bagre spp*) and Bagre (*Ariidae*), crustaceans, cnidarians and elasmobranchs. According to Adams et al. (2010), this type of fishing captures large quantities of juvenile species that have coastal habits of different sizes, and are mostly discarded, causing a serious ecological problem (Figure 5).

The use of zangaria fishing in this regions is prohibited during the months of June, July and August, according to the Brazilian Institute of Environment and Renewable Natural Resources' Normative Instruction 39 from July 2, 2004 (IBAMA, 2004).

According to the fishermen, this prohibition is due to the migration of sardines which also pass through this region. Zangaria fishing acts as a trap for this fish, which gets stuck in nets without being harvested by local fishermen. According to Cergole and Dias Neto (2011), the sardine that migrates in Brazil and that also occurs in coastal Maranhão is known as sardinha verdadeira (*Sardinella brasiliensis*).
However, the fishermen say the months of the zangaria ban should be March, April and May and not those stipulated by the normative instruction mentioned, as these months are when the schools of sardines are said to be closer to shore. For fishers from Peru, the current prohibition period has generated conflicts in the region, mainly related to the period when the amount of shrimp increases exponentially, which hurts them greatly.

3.3 Economy and Potential

Artisanal fishing is the economic base for the community of Peru and shrimp (*Litopenaeus schimitti*, *Farfantepenaeus subtilis* and *Xiphopenaeus kroyeri*) is the main resource commercialized by local fishermen. According to the Ministry of Fisheries and Aquaculture, the sete-barbas and rosa shrimp continue to be the most commonly caught species in the country in 2011 with 15,417.8 and 10,331.2 tons, respectively, together representing 45% of total production of marine crustaceans in Brazil. The catch of camarão-branco, another species with high commercial value, was 4,115.7 tons in 2011 (Brazil, 2011).

In the region of Peru, it was observed that zangaria fishing stands out for obtaining the most commercially valuable fish, considering that the mesh size of this type of fishing captures large shrimp. The fish obtained from zangaria which average 200 kg per fishing effort, is carried to the beach on Peru, where the separation of the best shrimp and fish occurs. The catch to be sold is posteriorly weighed and sometimes the workers take the fish of lower value, which costs between 4 or 5 reais per kilo.

The product is sold fresh or salted and sold to main buyers in São Luís, Cururupu, and other states like Pará. A kilo of camarão graúdo (*Litopenaeus schimitti*) can cost between 20 and 23 reais during the period of scarcity. At the peak of production it is sold between 10 and 14 reais per kilogram.

Besides the indisputable potential for economic exploitation of shrimp, it was found that the region has other resources that are rarely used for commercial purposes, such as oysters, crabs, siris, sarnambis and even some fish, especially juveniles. These potential resources could replace shrimp during the zangaria prohibition or function as a complement to family income, since they have good commercial value, boosting the local economy and improving the living conditions of the local population.

Offering training courses on the utilization of these underutilized natural resources could help reverse this situation and reduce waste. Smaller fish caught could be used in the manufacture of anchovado fish fillet, a sub-product with higher added value, which would generate more income for the local population.

4 Final Remarks

Through this research it was possible to perform an analysis of fishing activity on the island of Peru. It was observed that greater investment in the region is needed that aims for the sustainable use of existing resources and improving social indicators and local infrastructure. Development of scientific research, environmental education, and increased enforcement for conservation are also needed.
However, it is important to emphasize that due to the fact that Peru is located within a RESEX area, ensures that differentiated protection is given to its natural resources and the maintenance of the traditional populations’ ways of life, in relation to other coastal areas.

References


Environmental perception of fishermen small scale community of Cajueiro as a result of implementing the pipeline track for integration with a refinery premium i

Karla Bittencourt Nunes, Master's student in Fisheries and Aquatic Resources - UEMA-Brazil. karlinhabio@hotmail.com
Leonardo Silva Soares, Professor of Institut Federal of Education, Science and Tecnology of Maranhão- IFMA- Brazil: leonardoufma@yahoo.com.br
Zafira da Silva de Almeida, Professor, Department of Chemistry and Biology - UEMA-Brazil: zafiraalmeida@hotmail.com.
Abstract

Cajueiro is a rural village with traditional life mode, located in the industrial district of São Luís Island area, owning around 50 families living directly or indirectly from small-scale fishing. Located in the area of direct influence deployment of Itaqui Waterway Terminal and pipeline that will pump oil and derived directly from the ships to the tanking of the Premium I Refinery refinery installation will result in the depletion of aquatic biota and biodiversity loss, suppression of mangrove that influence productivity that underpins stocks shrimp and fish in coastal waters, increased emission of pollutants into the atmosphere, noise, interference in the local landscape, change of water resources, affecting the quality of life of the community at all stages (planning, implementation and operation). semi-structured questionnaires were applied involving ecological, social, technological, economic aspects, management and future prospects of the fishing front deployment pipelines in community activities and other industrial activity. There is a strong bond with their community of fishermen; the fear of a possible relocation; feature simple way of life and degree of traditionalism, and consider that the enterprise will favor natural resource depletion and release of toxic substances and vapors that compromise their health. It is recommended to promote courses in Environmental Education to report on the risks and mitigation measures proposed, emphasizing the importance of the traditional activities they work, enabling the empowerment of community governance with the full participation of all social actors in order to build sustainability into their different dimensions.

Keywords: Small-scale fishing. Environmental perception. Risk.

Introduction

Maranhão, with its 640 km of coastline, is touted as the largest producer of fish in the Northeast of Brazil, 95% of this production from artisanal sector, which employs thousands of people who remain just that activity (STRIDE, 1992).

Along this coastal extension are distributed around 273 fishing communities, concentrated in estuaries, bays and shallow coastal waters that characterize the coast and perform artisanal fishing equipment well suited to local conditions (ALMEIDA, 2006), among these, highlight the community Cajueiro, located near the port of Itaqui, where it will be deployed Waterway Terminal Itaqui and a range of pipeline that will pump oil and derived directly from the ships to the tanking of the Premium I Refinery (RIMA, 2013).

The implementation of the project will cause a depletion of aquatic biota reducing biological diversity, mainly due to the suppression of mangrove that influence productivity that sustains fish stocks which will cause damage to fisheries. Besides these factors, are also present increased emission of pollutants into the atmosphere, noise, interference in the local landscape, change of water resources, which affect the quality of community life in the phases of planning, implementation and operation of the project (RIMA, 2013).

Thus the main objective of this work is to present the current landscape of the Cajueiro tree, immediately before the establishment of the range of pipelines, checking the perception of the community about the potential impacts that the project will result in environmental aspect, in order to give community grants for future research and to propose alternatives that are viable to the community.

1. Materials and methods
2.1 Area of Study

Cajueiro, as observed in the figure below is a community located to the northwest of the island of Maranhão, on the banks of Maranhense Gulf, inserted in the area of Porto do Itaqui, considered the direct influence of the project area, thus defined to establish the limits of action for mitigation and control measures can be taken, to prevent, reduce to acceptable limits or elimination of significant environmental impacts.

![Map of Cajueiro](image.png)

**Figure.1** Fonte: EIA/RIMA Terminal e dutos, 2013

In the community there are about 50 families whose source of income and subsistence, artisanal fishing and extractive activities. The natural resources of this area are quite preserved, presenting predominantly rural characteristics with traditional ways of life. It allotted sites, residences and dams, formed by secondary vegetation, sparse capoeira with Babassus, bacuri fruit, Tucun, Anajás, ariris and areas of marine influence, directly from São Marcos Bay, or via the creeks that enter the earth firm is formed by mangrove ecosystem (RIMA 2013).

Is isolated between the ocean and the BR 135, the main access is via dirt roads in disrepair, what degree of isolation and influences the dependence of the region's resources. Which is observed by the manner and conditions of life, forms of use of natural resources, isolation, time of occupation in the territory, among other aspects which determine the strong bond that people have with the territory. The housing is standard with brick houses and covered in ceramic tile and some residences mud that reach the shores of the bay of San Marcos.

2.2 Collecting and analyzing data

Methodology "case study" with the application of semi-structured questionnaire was used, using a quantitative-qualitative approach and exploratory nature to obtain information on general aspects of fishing, socioeconomic data (family composition, type of housing associations to which they belong fishermen, etc.), fishing time, fishing technology and strategies, marketing, exploited species and environmental perception, such as: major
problems currently faced by the fishermen, the fishing forecast for the future and possible solutions facing the implementation of pipelines community and other industrial activities.

Interviews were conducted with 15 fishermen over the months from September to November 2013, because it is a small community, consisting few residents.

According to Yin (2005), case study is suitable to investigate practical problems, empirical research and its method: planning or exploratory phase of data collection techniques, participant observation and analysis of such data. This methodology has enormous potential to contribute to provide valuable information that also allow policy decisions.

3. Results and discussion

The research results show that the fishing activity of the community is eminently Cashew handmade, with mode of production based on family labor (Figure 2). use traditional methods to catch fish, which occurs throughout the year, with greater intensity in the period between June to September, using the boat as a vessel. To Diegues (1988, 1996), a population is considered traditional by also being descendants and heirs of population and traditional culture.

Figure 2. Mão de obra familiar

The housing is standard with brick houses and covered in ceramic tile and some residences wattle and daub (Figure.3), we arrive at the shores of the bay of San Marcos.
Although the residents of Cajueiro perform other economic activities such as the community garden, where 9.4% of these cultivate cassava, corn 7.5%, 4.7% and 3.5% banana rice, beans and vegetable (EIA RIMA / DUTOS, 2013), fishing is the activity performed daily by fishermen and provides the main source of protein for household consumption and for sale.

The barter system where exchange the fish with flour, rice and / or beans, corn, fruits and vegetables is a widespread community dental practice, which leads to believe that their culture is closely dependent on the relations of production and survival. Showing that the fishing activity that has led to the continuation of this population and culture in the region, since other activities related to nature are scarce (PAIOLA AND TOMANIK, 2002).

Perform the task force system where fish together, their output varies on average between 05-15 kg of fish per fishing trip, and this divide among themselves, leaving most with the owner of petrecho. Both the partnership system, as the barter demonstrates that no significant conflicts between community members.

Many consider that fishing no longer guarantees the survival of their families and if they could, would change their activity. This fact may contribute to the decline of knowledge capture and attested for construction of fishing gear, if not transmitted to offspring.

Most respondents claims to have observed the decline of some fish and believe that this phenomenon occurs due to the pollution caused by companies in the industrial district, and reportedly is common to find fish with the presence of worms (helminths) in stomach inside. To Paiola and Tomanik (2002), these environmental changes, changes resulting from them belong to the traditional culture with little or almost no power to decide on the ways of economic and political development in the region, make it impossible to make projections for the future it self. Design a future for fishing only and the projection is that they do not have this future.

Most respondents, about 70%, not part of the colony of fishermen (Z-10), and those who are colonized, only 20% receive government benefits, though most have more than 50 years old and many act since childhood, when they began fishing activity to accompany older.

4 Final Remarks

Regarding venture is notorious existence a potential oil spill in the San Marcos Bay, if not followed the recommendations suggested by the study of environmental impacts, both in the area of mangrove ecosystem dominated, comprising the estuarine area of the community, consisting of more sensitive habitats with high species richness and biological value as within the Secondary Forest as create a risk of biodiversity loss. An oil spill on land cover in the intertidal zone can have disastrous consequences as smothering of benthic organisms and the local flora. And yet, because it is a soft substrate, exposure to oil and the difficulty of access, mobility difficulties due to the lack of highways and precariousness are aspects that can jeopardize the implementation of containment measures (SCHAEFFER-NOVELLI, 1986.1991).

The scenario of the artisanal fishing community in relation to environmental matters partner is characterized by low quality of life of the fisherman, who has little
schooling, and survives the planting of crops and small-scale fishing, which is the main source of income of the community.

The fishermen live in a natural way with a dependent relationship with the environment, which is your most precious asset, making it necessary to adopt management measures that are effective to maintain the action, which according to them, is increasingly scarce. All are categorical in relation to the decline in fish production, and fear that the situation will worsen with the implementation of the refinery.

It is perceived that lack of information, aggregate financial shortage makes no claim their rights and the public policies aimed at improving the quality of life of the community are incipient, generating important demands in social life. It is possible that preservation begins by decree, but it can only exist even through the actions of men, for not enough decrees, there have to be conditions for the preservation occur in practice (PAIOLA AND TOMANIK, 2002).

Despite the fishing fortunes did not move, such as oil, but sustains millions of poor communities, who need the activity to survive (KALIKOSKI et al, 2009). It is known that the fishery is fragile, the oil industry is well organized, politically and economically, it is necessary to invest in strategies for sustainable development and empowerment of community governance with the full participation of all stakeholders, especially the government, intermediate condition in order to make the oil companies take the damage they cause to the fishing activity, mainly artisanal, and intensify its programs of mitigation and compensation.

Referencias


Promoting sustainable fishing: A fishing cooperative´s perspective, from Quintana Roo, Mexico

Rodrigo Pantoja Cabrera, Sociedad Cooperativa de Producción Pesquera José María Azcorra, México, ffiggo@hotmail.com
Jacobo Caamal Madrigal, Comunidad y Biodiversidad A.C. México, jcaamal@cobi.org.mx
Stuart Fulton, Comunidad y Biodiversidad A.C. México, sfulton@cobi.org.mx

Abstract
Punta Herrero is a small community located in the Sian Ka’an Biosphere Reserve inhabited by fishers from the fishing cooperative José María Azcorra. The cooperative was founded in 1983 and currently has 21 members who fish lobster, fin fish and shark. The cooperative has exclusive fishing rights for lobster and has several internal regulations to promote the sustainability of the fishery. The lobster fishery recently received full certification from the Marine Stewardship Council (along with 5 neighbouring cooperatives) as recognition of its fishing practices.

The cooperative is currently involved in a variety of conservation efforts such as the restoration of Acropora palmata, biological monitoring of “fish refuges” (no-take zones voluntarily established by the cooperative), the search for grouper and snapper spawning sites and campaigns to promote sustainable fisheries. It is important to note that each of these projects has caused a change in the daily lives of the fishers, and more importantly, has caused a change in our way of fishing; now we do not only fish, we use our resources in a sustainable way and we hope that the next generation of fishers in our community can see what our fathers and grandfathers saw when they first began to fish the area.

Introduction

The fishing village of Punta Herrero, Quintana Roo, Mexico was established when the settlers who had arrived in the Bahía del Espíritu Santo in the 1950’s moved to the present site in the early 1980’s. The José María Azcorra Fishing Cooperative was established in 1983 when fishers based in Punta Herrero ceded from the Vigía Chico Cooperative in Punta Allen, further to the north. In 1986 the Sian Ka’an Biosphere Reserve (SKBR) was established (UNEP-WCMC 2011) in which Punta Herrero is currently the second largest settlement after Punta Allen, with a population of approximately 60, although this varies during the fishing season.
The SKBR is the largest protected area in the Mexican Caribbean and falls under the management of the National Park Commission (CONANP). The reserve covers 528,148 hectares, of which 153,136 ha are marine. The principal activities in the RBSK are fishing and low-impact tourism. The majority of the tourists enter the north of the reserve to visit Punta Allen, with few arriving in Punta Herrero in the south. Recent initiatives by CONANP, amongst others, are beginning to promote ecotourism in the south of the reserve as an alternative to fishing.

**Fishing Practices**

The José María Azcorra fishing cooperative currently has 21 members operating 18 boats, has exclusive access rights for Caribbean Spiny Lobster, *Panulirus argus* (covering approximately 300 km$^2$) and also has permits to catch fin fish and shark. The lobster concession was granted in 1994 for 20 years and the cooperative is currently undergoing its renewal. Live lobster is the principal target of the cooperative. In 2012 the cooperative caught 20,202 kg of lobster, 38,377 kg of fish and 3,536 kg of shark (SAGARPA 2012). The majority of the fish is caught during the closed lobster season from March 1$^{st}$ to June 30$^{th}$ each year.

The lobster concession is further subdivided amongst the fishers in to individual harvesting plots or “campos”. These plots are assigned to cooperative members who can fish them
however they please and can be transferred between fishers. The cooperative has the power to impose sanctions on those who violate the internal rules, such as fishing in the plot of another cooperative member. Punishments can be strict and can include expulsion from the cooperative.

The majority of the lobster caught by the cooperative is harvested from concrete lobster aggregating devices or “sombras” which the fishers construct and place in their plots in shallow water within the bay and lagoon. These devices mimic the natural habitat of the lobster and allow the fishers to hand select live lobsters using lassos or occasionally small hand nets. Undersized or berried lobsters are easily identified and returned to the water unharmed. The caught lobster are held in corrals in the shallows in front of the village until sufficient lobster have been caught and the buyer arrives to collect the catch.

In 2012 the hand-caught lobster fishery recently received full certification by the Marine Stewardship Council (along with five neighbouring cooperatives) as recognition of our fishing practices (MSC 2012). This is only the fourth fishery in Mexico to obtain the MSC certification and the first in the Caribbean.

**Conservation Projects**

The cooperative also participates in regional conservation initiatives that work towards protecting the marine environment and promoting sustainable use of our fisheries. In September 2013 the cooperative established four fish refuges inside its concession (Diario Oficial de la Federación 2013) covering 1,125.46 hectares. These fish refuges were established to protect sites of key ecological importance and include mangroves, sea grass, coral reef and two fish spawning aggregation sites. In March 2012 nine fishers undertook SCUBA and coral reef monitoring training with Comunidad y Biodiversidad A.C (COBI), and are now conducting biological surveys of the fish refuges to monitor the recuperation of the sites. To ensure the fishers collect reliable data they undergo regular training and evaluations by visiting scientists (Fulton et al. in press).
Two fish refuges were established to not only protect coral reef but also because they contained fish spawning aggregation sites. Initially documented in 2009, the community monitoring team verified the presence of Nassau and Yellowfin Grouper preparing to spawn in one of the refuges in January 2014. Nassau Grouper are listed as endangered by the IUCN (Cornish & Eklund 2003) and only 14 of 63 known spawning sites are protected from fishing in the Mexican Caribbean (COBI, unpublished data). The cooperative took the decision to create a fish refuge at this site to protect the fish during this vulnerable period and promote the recuperation of this previously important fishery.

The cooperative is currently working with Oceanus A.C in their coral restoration project. Nine Elkhorn coral (Acropora palmata) nurseries have been installed in the shallow reefs of Punta Herrero (Gabriela Nava, personal communication, 28 July 2014). In addition to helping collect coral fragments and install the nurseries, fishers from the cooperative regularly head out to the nurseries to remove algae and clean the fragments.

As residents of a Biosphere Reserve we participate in conservation programmes with the park managers, CONANP. In 2012 CONANP, in collaboration with RARE started the PRIDE campaign “Los Meros Meros de la Pesca Responsable” to promote sustainable fishing and reduce the use of nets by providing alternatives. Working with the training organisation CENLATUR and CONANP six fishers have also been certified as Nature Guides, with another five still undergoing training, able to conduct low-impact tourism such as bird watching, kayaking, fly fishing and snorkel tours. We hope these activities can provide...
alternative income and reduce the need to fish finfish during the closed lobster season when previously there were few economic alternatives.

Conclusion

As fishers we are custodians of the marine environment and want to continue our way of life, making a living from the sea. However at the same time we understand that the sea is not inexhaustible; the delicate ecosystem can be overfished, and this can impact us not only economically, but can also affect the biological balance in the area. It is important to note that each of the projects that the cooperative has supported has caused a change in our daily lives, and more importantly, has caused a change in our way of fishing; now we not only fish, we use our resources in a sustainable way and we hope that the next generation of fishers in our community can see what our fathers and grandfathers saw.

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**Small-scale fishery vulnerability to land-use change on the influence zone of the Veracruz Reef-System**

Ondrei Bazant-Fabre (Universidad Veracruzana)
Patricia Arceo (Universidad Veracruzana)
Javier Bello (Universidad Veracruzana)
Gabriela Galindo (Universidad Veracruzana)

In the past, the Veracruz Reef-System allowed the coastal settlement of a commercial port and fishing communities due to the protection and biodiversity it provides; the communities adjacent to the port became the city of Veracruz to the north, while others became the towns of Boca del Río and Antón Lizardo southward. However, in the past 50 years an accelerated urban growth, promoted by political development plans, has joined Boca del Río and Veracruz in a single metropolitan area and it seems it will reach Antón Lizardo in the near future. Furthermore, the reef-system was decreed a marine park in 1992 and the expansion of the port was recently authorized, which will destroy a couple of single reefs in its northernmost portion. The objective of this study is to evaluate the vulnerability of the small-scale fisheries of these three communities under land-use pressure; our hypothesis is that the property regimes or tenure of land and sea associated with these changes primordially affect the fishers’ rights and access, but also their livelihoods and wellbeing, economic opportunities, food security and governance. A two-way methodology will be developed: i) vulnerability index, composed of sensitivity and adaptive capacity criteria collected via weighted surveys; and ii) exposure index, composed of the changes between four categories of land-use impact and generated via geographical information system analyses for the last five decades. By the time of the congress, some preliminary results and discussion will be presented, as this is an ongoing postgraduate thesis.

Spanish Session 1.3: Mexican studies

Sustainable fishing practices made by crab fishermen of the Mexican blue crab Callinectes bellicosus (Stimpson 1859) in the lagoon complex Bahía Magdalena-Almejas, Baja California Sur, México.

Verónica Castañeda Fernández de Lara (CRIP-La Paz, INAPESCA)
Juan Carlos Castro Salgado (CRIP-La Paz, INAPESCA)
Juan Antonio García Borbón (CRIP-La Paz, INAPESCA)
Carlos Gómez Rojo (CRIP-La Paz, INAPESCA)

The Mexican blue crab in Baja California Sur is caught using a modified Chesapeake type trap. Fishing is conducted throughout the year and is principal species is Callinectes bellicosus. The activity is mostly done in three lagoon systems with different social and cultural complexity (Bahía Magdalena-Almejas, Laguna San Ignacio, and Laguna Ojo de liebre). A major part of the catch is exported to the United States and processed as pulp meat. This research was conducted in the lagoon Bahía Magdalena-Almejas because this system contributes about 70% of the total catch of the state. The size composition of the catch per trap of 20% of the traps used by a fisherman per day was recorded and their method of fishing was registered. The fisherman returns to the sea organisms considered small because they are below minimum legal size (i.e. 11.5 cm carapace width (Cw). The range of Cw of the organisms returned was 8.34 – 12.95 cm with an average 10.8 ± 0.8 cm considered as discard; also they were mainly females or juvenile males. The general catch is on organisms which range goes from 8.34 – 17.78 cm Cw (χ²=12.08 ± 1.8). We observed significant differences between the size of the blue crab of the total catch and the discard (F = 48.01, d.f. = 1,346, p
<0.05). The practice of discarding organisms below the minimum size is an activity that promotes sustainability on the fishing which needs to be promoted in other places.

Monitoring the fishing process and effort in the octopus (*Octopus hubbsorum*) diving fishery of Jalisco, México.

Antonio Corgos, César Lucano, Alejandro Rosende, Enrique Godínez-Domínguez, Juan Ramón Flores-Ortega, Jorge A. Rojo-Vázquez.
Departamento de Estudios para el Desarrollo Sustentable de Zonas Costeras. Universidad de Guadalajara. V. Gómez Farías #82, 48980, San Patricio-Melaque, Jalisco; acorgos@gmail.com.

Summary:
The octopus fishery in the coast of Jalisco is completely artisanal and could be classified as an S-fishery owing to its characteristics. There is a huge lack of data of this fishery although is one of the most important for the fishers’ community. The aim of this work is to cartography the fishing areas, fishing effort and to obtain data about the fishing process. Thirty GPS loggers were given weekly to the fishermen from December 2011 to August 2013. A total of 152 fishing trips were obtained, 993 dives were identified and used to map the fishing areas and estimating the fishing effort. Seven main fishing zones were identified, but only four received the 81.6% of the fishing effort. “El estrecho”, with 390 dives (39.3% of total) and a total dive time of 247.9 hours (39.6% of total) was the fishing zone that bore the highest effort. Each fisherman performed a mean of 6.5 dives/fishing trip, with a mean duration of 46.6 minutes, and a mean total dive time/fishing trip of 4.15 hours. The fishing effort showed high seasonality. Most of the fishing trips (85%) and total dive time/month (86%) took place from May to July, both for 2012 and 2013. These data are useful for the fishery management optimization.

Introduction
The commercial fishery in the coast of Jalisco, México, is completely artisanal, with a scarce infrastructure development and a strong social lag (CONAPESCA, 2011). The last official report showed a total of 2939 fishing vessels, and only one of which is a large size boat (CONAPESCA, 2011). The commercial fleet of Jalisco is composed by small fiberglass boats, less than 10 m length, with an outboard engine. There are one to four fishermen by boat, who perform daily fishing trips near the coastline. As well as other artisanal fisheries, Jalisco fishery is a multi-gear and multi-specific fishery (Corgos et al. unpublished data). In Jalisco the octopus is targeted by commercial hookah divers that work on 6-7.5 m long boats equipped with an air compressor. Crews consist of a skipper with one or two divers. Catch depends mainly on the dive time, but also on diver skills and environmental conditions like water turbidity and temperature, swell height or wind force. The official catch data for the Jalisco artisanal fishery in 2011 was 14,454 tons with a value of 195.25 million pesos (CONAPESCA 2011). The octopus fishery occupied the third place in catch magnitude in Jalisco, with 224 tons, that puts Jalisco in the fifth national place of octopus production. The octopus fishery in Jalisco could be classified as an S-fishery (Orensanz et al. 2005). Octopuses show small-scale movements and have specific habitat requirements, so, they show a structured spatial distribution, and the fishery is a small-scale fishery. Stocks targeted by S-fisheries are spatially structured as metapopulations of localized subpopulations typically interconnected through larval dispersal; population dynamics are dominated by spatial
heterogeneity and the effects of fishing events are localized (Orensanz et al. 2005). These characteristics as well as the lack of monitoring and control of the catches make especially difficult the management of these fisheries (Orensanz et al. 2005).

Information about the abundance, spatial structure of the stock, and the spatial allocation of the fishing effort is needed for a proper assessment and management of the fishery. This information helps the interpretation of catch data and is needed for the design of management strategies spatially explicit (Fernández-Boán et al. 2013). One way to solve this problem is the use of GPS devices to monitor boats, fishermen interviews and the register of biological data of catch at docks (Fernández-Boán et al. 2013). The fishing effort spatially located shows the spatial distribution and abundance of the targeted species. Fishing effort tends to concentrate in relatively small areas (Branch et al. 2005). The spatial location of fishing areas is determined primarily by resource abundance, but also depends on fishers’ knowledge and on a number of factors: depth, exposure to weather, distance from port (and fishing costs), resource quality (size, sex, weight, etc.). Therefore, the knowledge of the spatial distribution of fishing effort, the location of fishing areas and the fishing intensity within these areas is an essential tool for the design of proper management strategies. The aim of this work is to cartography the fishing areas, fishing effort and to obtain data about the fishing process of the octopus diving fishery of South Jalisco, México.

Methodology

For the present study we selected the fleet of Bahía de Navidad, where concentrates the 44% of the fishing cooperatives of South Jalisco. Thirty GPS devices (mini loggers iGotU GT-60) were used to monitor the activity of the octopus fishery fleet. GPS devices were given weekly to every two days (when fishermen gave back the device earlier) to a total of 25 fishermen. We visited the fishermen three to four times a week to collect GPS devices between December 2011 and August 2013. Each track consists of the positions of the boat (longitude and latitude in LAT/LON coordinates) during one daily fishing trip. Tracks were downloaded and processed to get fishing areas and discard “land” or “travel” registers. The accuracy of the GPS devices was 19 m root mean square (RMS). Participation in the study was voluntary, and the level of collaboration was variable among boats. Daily fishing operations always started and ended at Melaque beach or Barra de Navidad dock, from where boats moved directly to the fishing grounds; we refer to the duration of travel between dock and fishing zones, and among different fishing zones, as “travel time”. The time during which divers remained underwater is defined as “diving time”, equated with “effective fishing effort”. Given the proximity between boat and diver (that uses a 100 m hose) boat tracks corresponding to diving time were equated with diver tracks. The polling frequency was set to 60 s in order to get a clear differentiation between a “dive” and “travel” register and an easier identification of the fishing areas (Fernández-Boán et al., 2013). The battery life of the GPS with this setting was five days.

Fishing trip processing

Each fishing trip was inspected to classify into “complete” (when the trip starts and ends at the beach/dock) or “incomplete” (otherwise). Only complete fishing trips were taken into account for the estimation of the number of dives/fishing trip, total dive time/fishing trip and total diving area/fishing trip. Incomplete fishing trips were taken into account for the estimation of mean dive time/div and the cartography of fishing areas and fishing intensity. GPS records were classified as “diving” or “travel” on the basis of boat speed. A cut-off level was determined from a piecewise linear regression of the speed frequency distribution (see the results). Boat speed was calculated as the lineal distance separating two consecutive records,
divided by polling interval (60 s), and expressed in km h\(^{-1}\). Once all “diving” records were represented on a map, the complete area was divided in seven main fishing zones.

**Mapping fishing intensity**

Daily diving area and the area of each fishing zone identified were estimated by superimposing a 50 m × 50 m grid on the 152 mapped tracks using ArcGis 3.2 software, and counting the number of GPS recordings per grid cell. Grid size was selected considering the diver’s hose length and GPS accuracy. Daily diving area by boat was calculated as the sum of the number of 2500 m\(^2\) grid cells that contained at least one diving record. The total number of cells fished over all monitored trips was used to calculate the surface of each “dive”, the total area surveyed by fishing trip and the cumulative area explored by fishing zone during all the fishing season.

**Results**

A total of 152 fishing trips were obtained between December 2012 and August 2013; 108 were considered complete and 44 incomplete.

“Dive” identification in the fishing trips

Alternation of travel (high speed) and diving (low speed) activity was generally apparent in plots of boat speed vs. time along a track (Figure 1). Based on inspection of cumulative speed frequency distributions, a break-point of 6 km h\(^{-1}\) was set to perform the piecewise linear regression, and a \(R^2=0.96\) and the 96.6% of the variance explained was obtained (Figure 2). This was used to classify “diving” and “travel” speeds (Figure 2). Using this break-point for classification of GPS registers, 993 dives were identified to map the fishing zones and fishing intensity. Mean speed for “dive” records was 0.94 km h\(^{-1}\) (± 1.2 SD) and mean “travel” speed was 19.1 km h\(^{-1}\) (± 10.4 SD).

![Figure 1. Speed profile of a boat during a complete fishing trip. There were identified the points of low speed (<6 km·h\(^{-1}\)) as “dives”, and high speed as “travel” among fishing areas or the harbor/beach (start and finish of the fishing trip).](image-url)
Octopus fishing operation

Octopuses are caught during daytime, performing a single fishing trip/day that usually starts at 7:30-8:00 am and finishes at 1:00-2:00 pm (total time around 6 hours). The mean dive time/fishing trip obtained was 4.15 hours (Table 1), performing a mean of 6.5 dives of 46.6 minutes. Two types of dive were identified based on the dive time. The “exploratory dives” usually lasts less than 5 min (when the diver decide to change area due to scarceness of octopuses), and “catch dives” (where the abundance of octopuses is enough to spend more than 30 minutes in the area). Taking into account only “catch dives” each diver performed a mean of 5.6 dives/fishing trip of 44.7 minutes (Table 1). Fishermen performed a mean of 0.9 exploratory dives/fishing trip with a mean of 2.4 minutes. The mean area surveyed by a diver/fishing trip was 184851 m², with a mean area/dive of 34623 m² (5732 m² for exploratory dives). The cumulative fishing time of all fishing trips was 626 hours, and the cumulative area surveyed was 29.8 km² for both fishing seasons.

Table1. Fishing strategy of the octopus fishermen in South Jalisco. Mean number of dives/fishing trip, dive time and surveyed area by dive type and total (entire fishing trip) are shown, with their standard deviation.

| Dive type     | Mean#/
<table>
<thead>
<tr>
<th></th>
<th>fishing</th>
<th>Mean time (min.)/</th>
<th>Mean area (m²)/dive</th>
<th>SD</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>trip</td>
<td>SD</td>
<td>dive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch</td>
<td>5.6</td>
<td>2.06</td>
<td>44.7</td>
<td>39.93</td>
<td>34623.0</td>
</tr>
<tr>
<td>Exploratory</td>
<td>0.9</td>
<td>1.11</td>
<td>2.4</td>
<td>1.09</td>
<td>5732.3</td>
</tr>
<tr>
<td>Tot/Fishing trip</td>
<td>6.5</td>
<td>2.56</td>
<td>249.3</td>
<td>70.73</td>
<td>184851.3</td>
</tr>
</tbody>
</table>
Octopus fishery of South Jalisco showed high seasonality: 85% of the fishing trips and 86% of the fishing effort (dive time) took place between May and July, both for 2012 and 2013 (Figure 3). The rest of the year the effort was significantly lower.

Taking into account the map of the fishing effort, seven main fishing zones were identified, that were 4 to 36 km away from the beach/dock (Figure 4): El Estrecho (Figure 5), La Calechosa (Figure 5), Melaque Norte (Figure 6), El Tecuan (Figure 6), Tenacatita (Figure 7), Melaque Sur (Figure 7) and Peña Blanca (Figure 8). The first four zones received the 80% of the fishing effort. “El Estrecho” was the main fishing area, with 390 dives (39.3% of total dives), 247.9 hours (39.6% of total) and a cumulative surveyed area of 12.43 km² (41.7% of total) (Table 2). “La Calechosa” and “Melaque norte” received a similar fishing effort that sum the 30% of total. “El Tecuan”, that is 30 km away Melaque, received more fishing effort than Melaque Sur (4.1 km). There are high fishing intensity areas within each fishing zone, especially in “El Estrecho”, “La Calechosa” and “Melaque norte” (Figure 5 and 6).

Figure 3. Seasonality of the octopus fishing effort by means of percentage of fishing trips/month and fishing time/month.
Table 2. Information of the main octopus fishing zones visited by the Bahía de Navidad fleet during 2012 and 2013 seasons. Distance to dock/beach, area in km$^2$, number of dives, dive time (hours) and surveyed dive area are shown.

<table>
<thead>
<tr>
<th>Fishing zone</th>
<th>Distance (Km)</th>
<th>Area (Km$^2$)</th>
<th># dives</th>
<th>%</th>
<th>Dive time (h)</th>
<th>%</th>
<th>Dive area (Km$^2$)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Estrecho</td>
<td>12.3</td>
<td>0.945</td>
<td>390</td>
<td>39.3</td>
<td>247.9</td>
<td>39.6</td>
<td>12.425</td>
<td>41.7</td>
</tr>
<tr>
<td>La Calechosa</td>
<td>7.4</td>
<td>0.683</td>
<td>162</td>
<td>16.3</td>
<td>103.3</td>
<td>16.5</td>
<td>5.058</td>
<td>17.0</td>
</tr>
<tr>
<td>Melaque Norte</td>
<td>3.9</td>
<td>0.532</td>
<td>164</td>
<td>16.5</td>
<td>87.3</td>
<td>13.9</td>
<td>4.695</td>
<td>15.8</td>
</tr>
<tr>
<td>El Tecuan</td>
<td>29.9</td>
<td>0.229</td>
<td>94</td>
<td>9.5</td>
<td>56.5</td>
<td>9.0</td>
<td>2.500</td>
<td>8.4</td>
</tr>
<tr>
<td>Tenacatita</td>
<td>21.0</td>
<td>0.180</td>
<td>58</td>
<td>5.8</td>
<td>30.1</td>
<td>4.8</td>
<td>1.283</td>
<td>4.3</td>
</tr>
<tr>
<td>Melaque Sur</td>
<td>4.1</td>
<td>0.359</td>
<td>87</td>
<td>8.8</td>
<td>69.7</td>
<td>11.1</td>
<td>2.885</td>
<td>9.7</td>
</tr>
<tr>
<td>Peña Blanca</td>
<td>36.6</td>
<td>0.124</td>
<td>34</td>
<td>3.4</td>
<td>26.2</td>
<td>4.2</td>
<td>0.888</td>
<td>3.0</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
<td>0.4</td>
<td>4.8</td>
<td>0.8</td>
<td>0.070</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4. Octopus fishing zones visited by the Bahía de Nevado fleet in the South coast of Julisso during 2012 and 2013 seasons.
Discussion
Tracking boat trajectories with GPS-based data loggers, an inexpensive technology, allowed characterization of patterns of fishing intensity at a hierarchy of spatial scales. Profiles of boat speed were used to partition trajectories and fishing time into their travel and effective fishing components, as has been also done in previous studies employing GPS (Marrs et al. 2002). GPS and data loggers have been used before to investigate patterns of spatial fleet behavior in the artisanal sea urchin fisheries (Fernández-Boán et al. 2013), but no papers were found about octopus diving fisheries. This sort of research may be especially useful in Latin-American diving fisheries, where the control of the catches is very low and catch data are very inaccurate. Fishing intensity by zones may reflect resource abundance (fishers do not fish where there is nothing to be fished), their location and extension also depend on a fisher’s knowledge, location-specific factors (depth, exposure to weather, distance from port), and resource quality (e.g. size or weight). Fishing intensity maps could be used as resource density maps, and obtaining catch data from fishermen would be an interesting tool for assessment and management of the fishery.
Figure 5. Distribution of cumulative fishing intensity within “El Estrecho” and “La Calechosa” fishing zones. The number of GPS recordings per 2500 m² are shown.
Figure 6. Distribution of cumulative fishing intensity within the “Melaque Norte” and “El Tecuán” fishing zones. The number of GPS recordings per 2500 m² are shown.
Figure 7. Distribution of cumulative fishing intensity within the “Tenacatita” and “Melaque Sur” fishing zones. The number of GPS recordings per 2500 m² are shown.
Figure 8. Distribution of cumulative fishing intensity within the “Peña Blanca” fishing zone. The number of GPS recordings per 2500 m² are shown.

References

Coastal fishery activity in Jalisco and Colima, México, with emphasis on the red snapper Lutjanus peru

Elaine Espino-Barr (CRIP-Manzanillo, INAPESCA)
Arturo Garcia-Boa (CRIP-Manzanillo, INAPESCA)
Esther Guadalupe Cabral-Solís (CRIP-Manzanillo, INAPESCA)
Marcos Puente-Gómez (CRIP-Manzanillo, INAPESCA)

Coastal fishery in Colima and Jalisco is a social and economic important activity, which provides of excellent food quality and generates work for a great number of persons. The fish
community was analyzed through the presence and persistence of species richness in the catches of the period 2002-2013, and trends were analyzed of the catches of the objective species. Abundance data of the fishing trips determined that the specific richness (from $d = 10$ to $d = 103$) and the diversity (from $H' = 0.5$ to $H' = 1.4$) of the fish in the area have variations that can be explained by changes in the fishing effort, species vulnerability and environmental factors. Individually, the data series of the captures of the snapper Lutjanus peru show very marked variations (from 500 t to 1,350 t per year), but with a constant increase in the last few years. This information could suggest changes in the fishery administration, with an increase of fishing effort, without losing sight of the community as a unit.

Small scale finfish fishery of Magdalena-Almejas Bay, Baja California Sur, Mexico

Miguel Ángel Ojeda-Ruiz, Universidad Autónoma de Baja California Sur
Luis Burnes-Romo, Centro Interdisciplinario de Ciencias Marinas, IPN.
Mauricio Ramírez-Rodríguez, Centro Interdisciplinario de Ciencias Marinas, IPN.

The fishery of various species, known collectively as finfish “escama” has taken a significant role in the region of Bahía Magdalena- Almejas. His capture is done with nets, traps and hook lines of various types and includes more than 90 species, of 30 families, and which little is known about their biology, population dynamics and dynamics of fleets. This paper characterizes the operation of this fishery in an attempt to understand how the fleet operates based on local knowledge. Forty interviews were conducted with licensed fishermen in the main communities and ports in the region, San Carlos and Adolfo Lopez Mateos. Trip tickets of 1998-2010 by species and fishing locality provided by CONAPESCA were used to confirm and complete the study. The results showed how the fleet operation is highly oriented to target species in each port, since in Puerto San Carlos, the species "pierna" (Caulolatilus spp) and "verdillo" (Paralabrax nebulifer) dominate the catch reports (40%) both being captured mostly by hook and line, followed by trap; while in Puerto Adolfo Lopez Mateos "garropa" (Mycteroperca spp; Epinephelus spp) and "lenguado" (Paralichthys spp; Pleuronichthys spp) have a high prevalence (46%). In relation to fishing gear, the “garropa” is mostly caught by hook and line, while the “lenguado” is almost entirely fishing with gillnets. The patters between fleets by port are slightly different, and in both cases related to other livelihoods such as whale watching and sport fishing activities. The network shows dominance of few commercial agents, different on each port.

Cucapá fishery: potential factors of governance for a successful gulf corvina fishery in the Upper Gulf of California, Mexico

Silvia Yee, Environmental Defense Fund de México, A.C., México, s_vees@me.com
Rafael Ortiz-Rodríguez, Environmental Defense Fund de México, A.C., México, rortiz@edf.org

Introduction

The Cucapá or Chapey Kuapá, “people of the river”, is one of the four communities fishing gulf corvina (Cynoscion othonopterus) in the Upper Gulf of California. Gulf corvina is a large
marine fish endemic to the Upper Gulf of California whose migration to its only known spawning grounds in the Colorado River Delta supports one of the most productive artisanal fisheries in Mexico (Erisman et al., 2012). There are several aspects of this group’s fishery which turn it unique: first, the Cucapá are one of the few fishing related indigenous communities in Mexico since ancient times, which coupled with their ethnicity makes them subject to special rights under Mexican law and international agreements on indigenous rights. Second, gulf corvina is the most important fishery for the Cucapá, and the only one permitted for two of the three indigenous fishing cooperatives. Last, some gulf corvina is caught inside the no-take zone of a natural protected area (Upper Gulf and Colorado River Delta Biosphere Reserve), where law prohibits extractive activities.

Methods

In this presentation we characterize Cucapá’s gulf corvina governance system describing the second level variables for governance and user subsystems proposed in specialized literature (Ostrom 2007, 2009; Basurto and Ostrom, 2009). This second level variables description is based on our continuous ethnographic research of Cucapá fishery since 2011, and our knowledge of gulf corvina management as part of our work as a non-governmental organization in the region. Having characterized Cucapá’s gulf corvina governance system, we identify the variables or traits that could potentially lead them to a successful fishery. For this purpose, we take success elements from comparable cases around the world as examples, discussing their applicability in the specific context of gulf corvina governance for the Cucapá.

Results

Table 1 resumes the second level variables of governance system (GS) and users (U) subsystems, and qualitative marks we have assigned for each one.

<table>
<thead>
<tr>
<th>Governance System (GS)</th>
<th>Users (U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS1 Government organizations</td>
<td>Present</td>
</tr>
<tr>
<td>GS2 Nongovernment organizations</td>
<td>Present</td>
</tr>
<tr>
<td>GS3 Network structure</td>
<td>Present</td>
</tr>
<tr>
<td>GS4 Property-rights system</td>
<td>Present</td>
</tr>
<tr>
<td>GS5 Operational rules</td>
<td>Present</td>
</tr>
<tr>
<td>GS6 Collective-choice rules</td>
<td>Present</td>
</tr>
<tr>
<td>GS7 Constitutional rules</td>
<td>Present</td>
</tr>
<tr>
<td>GS8 Monitoring and sanctioning processes</td>
<td>Present</td>
</tr>
</tbody>
</table>
In this section we describe the second level variables identified as potential for a successful fishery. These positive variables are GS3, GS4, GS5, GS6, GS7, U5, U3 and U8. Beginning with GS3, Cucapá fishermen are organized in three legally constituted fishing cooperatives with recognized members and leaders, with standard communication and decision taking mechanisms. The communication and trade between cooperatives fluctuates, increasing or decreasing depending on the political context. Each cooperative has a recognized territoriality, directly linked with the leader’s place of residence: while “El Mayor Cucapá” cooperative are “from” Colonia Carranza, “Pueblo Indígena Cucapá” cooperative are formed by people from El Indiviso and “Juañak jah kajuath” cooperative by people from El Mayor (the two first are mestizo localities, while the last one is the traditional Cucapá locality in Baja California). Along this, many fishermen families don’t live in the cooperative’s “territory”, but in other localities of Mexicali Valley (e.g. members of “Pueblo Indígena Cucapá” live in El Mayor). These cooperatives comprise mainly entire families, but members of the same family can be part of different cooperatives. There are family (and locality) links and communication between cooperatives. Cooperative’s leaders have links with other agents, like fisheries authorities, NGO’s, researchers and other gulf corvina fishers from different communities.

About GS4, gulf corvina have been under catch shares implementation since 2012: every year, the National Commission of Aquaculture and Fisheries, based on a National Institute of Aquaculture and Fisheries recommendation, publishes an annual TAC for all gulf corvina users: Cucapá community, Bajo Río and San Felipe, in Baja California and Golfo de Santa Clara, Sonora. The TAC is allocated on a permit/boat individual basis. During the established season (from February to April) inside the reserve. In 2014, Cucapá community obtained additional permits, adding 109 gulf corvina permits in total. Gulf corvina permits (one of the few finfish specific fishing permits in Mexico) are obligatory since 2013.

GS5 is represented by the Official Norm 063 (NOM-063), as the main set of rules for gulf corvina fishing that dictates specific fishing gear, minimum length, a no-take zone and landing places. Still, some fishing takes place inside the no-take zone, because is near and easier to fish there due to the aggregation (Erisman et al., 2012). In the case of Cucapá fishermen, they usually declare feeling more comfortable navigating the no-take Zone, because of its river-like characteristics.

Gulf corvina fishery has two more sets of GS5: the annual closure (veda) and the TAC. The annual closure prohibits gulf corvina fishing from May 1st to August 31th, while the TAC is allocated between the total number of gulf corvina permits in the region. While some fishermen stop fishing corvina during its closure (because they have permits for more species or have other jobs), others continue fishing. Exposing themselves to sanctions (detention and penalties), and legal problems while trading the catch. The TAC drives the decisions and behavior of fishermen.

Continuing with GS6, for gulf corvina governance system the collective choice rules are mainly the Decree of Creation of the reserve, its Management Plan, and the General Law of Sustainable Fisheries and Aquaculture (LGPAS). The physical limits of the reserve’s no-take Zone (164,779.75 has. surface) are established in the Decree of Creation; and the Management Plan describes it as an area where any productive extraction and change in the soil’s use is prohibited.
Concerning Cucapá fishery, there are two more rules playing a role in the gulf corvina governance system, at the GS6 level: the Convention 169 from the International Work Organization and the LGPAS. The first one is the main legal reference for Cucapá fishermen when fighting for the indigenous right to fish, particularly the right to be consulted on any issue affecting them and the right to participate in policy and development process affecting them in a free, prior and informed way. Aside this, the LGPAS establishes the obligatory consultation to representatives of indigenous peoples in the case of any allowance affecting communities’ habitat, and states the preferential access and use of fisheries resources to indigenous peoples. Communities’ right to free determination and autonomy to access to preferential use of natural resources of places they occupy and inhabit is recognized in Mexican Constitution.

Justly, Mexican Constitution is a paradigmatic example of GS7, as it defines the self-consciousness of indigenous as the fundamental criterion for determining who must be considered indigenous (for who applies the dispositions about indigenous peoples in the same Constitution and, in extend, in all Mexican laws). At local level, Cucapá cooperative’s rules define whom and how anyone can be a cooperative member, granting access to the gulf corvina fishery even when more fishing permits are unavailable. At local level too, not only the self-consciousness but also peer’s recognition as Cucapá, limits the right to claim for the right to fish.

About U3, gulf corvina history of use is very similar to other non-indigenous communities. The difference lies in that the Cucapá used to fish corvina in the Colorado River, when it was carried by the upper tide, and not at sea. Gulf corvina is tied with ethnic identity as other river species. The ethnic identity linked to U3 leads us to U8, as Cucapá considers gulf corvina their actual principal fishery: mainly because is perceived as the most profitable in economic terms, but also because in the last twenty years gulf corvina fishery has been a kind of “lifesaver” for Cucapá, in the middle of Colorado River ecological degradation. But gulf corvina season is short, and earnings aren’t enough for the rest of the year. Some Cucapá fishermen migrate to the south of Baja California (San Felipe and other near fishing grounds) to be employed as free workers in other fisheries; or fish mojarra in the Hardy River (near El Mayor locality). Cucapá fishermen, when not fishing, have other jobs (temporal jobs provided by the reserve, for example).

Finally, U5 is nowadays feminine, and there is one leader for fishing cooperative. They are Cucapá women in the 40-60 years old range, mothers and grandmothers. Cooperative rules set fixed periods for presidency (3-4 years) and the leadership is shared between close relatives. The only exception is in one cooperative, where two families share the leadership; even when the formal power figures of the cooperative (president, secretary and treasurer) are occupied by one family. Leaders represent the interests of their cooperatives members, and are nearly the only contact between authorities and fishermen. They are in charge of administrative affairs, like the management of fishing permits (renovation and the acquisition of new ones), fishing office procedures, and the expenditure of invoices. Leaders also negotiate the price and the procedures of selling with fish buyers. They have a lot of responsibility and receive no salary, cooperative performance lies upon them, with little help of the members.

Discussion
This is the first attempt to systematically characterize the Cucapá’s gulf corvina governance system. We have identified seven second level variants as potential (positive) traits for successful fishery, yet some of them can present negative counterparts. The first positive trait is the current implementation of catch shares management (GS4), which guarantees the access of Cucapá fishermen to gulf corvina fishery. Similar implementations in other countries have provoked conflict by not recognizing indigenous rights since the beginning, such as the Norway Saami in 1990 (Davis and Jentoft, 2001). Negative traits such as the non-deliberative participation of Cucapá fishermen community in the overall process of designing the catch shares process and decision making, blocks the legitimation and adoption of the annual allocation by fishermen and leads to rejection and conflict. Despite international treaties and national laws’ recognition of the consultation right for indigenous community in any policy decision affecting them and the access to preferential use of natural resources, there is not an alignment of GS6 and GS7 rule levels with GS5 level. As consequence, operative rules don’t reflect in practice any of the indigenous rights granted in GS6 and GS7.

Another positive trait is the operation of the three Cucapá cooperatives as a network structure (GS3). Cucapá’s cooperatives (rural production societies and cooperative societies) are the legal associative figures for fishing. Present leadership (U5) can be seen as a positive trait too, as every cooperative has an identifiable and recognized leader representing their interests. But low social capital (U6) between leaders and cooperatives’ members is a negative aspect interfering negotiation and decision taking in gulf corvina management.

The ethnic identity linked to gulf corvina fishing as part of their history of use (U3), is tied with the high importance of resource (U8) for Cucapá fishermen. As a positive trait it makes negotiation and agreement on fishing management a priority for them. Along this, the lack of specific monitoring and sanctioning processes (GS8) for gulf corvina fishery are one of the challenges for a successful fishery. While there are operative sanctions for fishing gulf corvina in the no-take zone of the reserve, there are not for fishing in excess of the allocation or during the closure. When this happens, the only “sanction” is the rejection of the landing’s slip at the local fishing office. The landing’s slip’s rejection may promote more illegality, conflict and waste of fish. It can’t be considered a specific sanction for non-compliance of the gulf corvina allocation, and it doesn’t prevent illegal fishing before it happens.

References
Territory and property rights as factors of a successful fishery: a case study of Punta Allen in the Sian Ka'an Reserve, Mexico.

Crisol Méndez-Medina (El Colegio de la Frontera Sur, Chetumal)
Birgit Schmook (El Colegio de la Frontera Sur, Chetumal)

We conducted a case study of the success of the Vigía Chico lobster cooperative, in the community of Punta Allen located within the Sian Ka’an Biosphere Reserve. The fisheries concession, which is a right-of-use bounded by a protected area, has provided a series of tools to the cooperative that translates to proper management of fisheries resources in the area. Using an institutional analysis approach, we study the system of rights that allows the sustainable use of resources. We use the concept of territoriality, understood as strategies for territorial control over invested resources within a geographic area, thus implying a series of codes and regulations over the uses of resources within this territory. Territoriality revealed how relationships of power and control between the State and local stakeholders are built and contributed to the success of lobster fisheries for both the cooperative and the State.

Sunday September 21st, 15:30-16:30
Spanish Session 1.4: Mexican studies

Cooperation processes as fishing strategy in a fishing community of the Yucatan Coast, Mexico

Citlalli Guevara-Cruz,
Silvia Salas,
Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, Unidad Mérida.

Fishing is an important socio-economic activity; thousand of fishers and their families depend directly or indirectly on them. However, given the nature of the resources, the “prisoner’s dilemma”, that involves a trend of fishers to seek their own benefit not accounting for the impact on the resources and other users, been unable to exclude others from overuse of resources. One strategy that could reduce the negative effect of this “dilemma” could be through cooperation processes; this paper deals with these issues, having as a case study a fishing community in Mexico. The aim of the study was to learn if cooperation processes take place in this community, either at individual or by community level, and if so to identify the incentives that motivate this strategy. Log-books provided by a fishing cooperative were used; data includes daily catch by fisher and species of four fishing seasons. Results showed that fishers in the community cooperated at the individual level (between fishers) and also within the community (fishers helping other community members called locally seagulls, who gather fish products at the landing sites). A total of 9805 trips were recorded between 2007 and 2010; from those, only 107 trips included cooperation between fishers working in 15 teams. In 2009 more cooperation teams were observed (42 trips). In the case of cooperation with the seagulls, 817 trips were recorded; in 2008 fewer seagulls showed benefits. The incentives that
motivate fishers to cooperate are presented and changes in this cooperative strategy though time are discussed.

The abalone fishery, the benthic community associated, the habitat and climate variability of southern Baja California, Mexico

Alejandra Chavez-Hidalgo (Instituto Politecnico Nacional-CICIMAR)  
Ernesto Chavez (Instituto Politecnico Nacional-CICIMAR)  
Jose Manuel Borges-Souza (Instituto Politecnico Nacional-CICIMAR)

The mollusk known as abalone (Halioits fulgens and H. corrugata) inhabiting the intertidal and subtidal rocky coast of western Baja California, are exploited in one of the most important fisheries in Mexico due to their high commercial value. Despite the efforts to manage this fishery in a sustainable way, it has undergone drastic changes attributed mainly to overfishing, to climate variability and habitat deterioration. In consequence, some emerged benthic stocks lead to a multispecific fisheries (sea urchin, sea cucumber, algae, plus a conch and the spiny lobster fisheries already exploited), which are part of the same community. This situation has forced to manage the monospecific fisheries into a new integrated management approach to ecosystem, in order to understand the interspecific relationships and their dependance on the habitat. This paper analyzes the blue and pink abalone fishery through a simulation model considering population parameters like age structure, data on catch and effort and estimates of abundance. Variability of sea temperature is also analyzed on the west coast of the peninsula of Baja California and the decrease on kelp coverage (Macrocystis pyrifera, Eisenia arboreaa, Cystoseira osmundaceae), as a signal of habitat deterioration.

Optimum harvesting strategies of an octopus fishery

Ernesto A. Chávez, Centro Interdisciplinario de Ciencias Marinas del IPN, Av.- IPN s/n Col. Playa Palo de Sta. Rita, Conchalito, La Paz, BCS 2396, México

An artisanal fishery of octopus (Octopus hubbsorum Berry), from the state of Baja California Sur was evaluated. The most common gear to extract this resource on the west side of the peninsula is the trap; on the east coast of the state, the most common fishing method is the hook and free diving. Boats have three crew members. The habitat of octopus a benthic species, is on rocky and sandy substrates living from the intertidal zone to 30 m. The assessment of the stock was carried-on by using the FISMO simulation model with fifteen years of catch data and population parameter values. Results indicate that the stock biomass has been stable, although in recent years, a significant decrease was observed; however, production of octopus has been economically stable even in years of low catch, so the activity is profitable. The simulation model applied allowed to evaluate the maximum yield, the maximum economic yield, and the maximum economic yield per fisher, finding that with an increase of the age of first catch from three to eight months of age, it is possible to achieve much higher catches and profits than the current fishing strategy.
Plenary 1: Viability, livelihoods and well-being

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Community co-management of metapopulations with source-sink configuration: The small-scale spiny lobster (Panulirus argus) fishery of Punta Allen, México

Juan Carlos Seijo, Universidad Marista de Mérida, Mexico

Management and conservation of the spiny lobster fisheries of the West Central Atlantic involve the following complexities: (i) it is a transboundary resource, (ii) it is characterized by a metapopulation with source-sink configuration, (iii) gears and fishing methods are heterogeneous with differing effects on population structure, and (iv) the heterogeneity in management strategies, regulations (including differing legal sizes and trade restrictions), and enforcement. The metapopulation connectivity imposes management difficulties because not all of the countries involved in the Caribbean ecosystem implement the same regulatory strategies for responsible use of this resource over time. Within this complex context, the Punta Allen fishing community has co-managed the resource with a history of sound decision making. Currently there is a limited entry policy with no new licenses being issued to fishermen cooperatives, a closed season, minimum size restrictions, and prohibition on the harvest of egg bearing females. As a co-managed fishery, the community has implemented additional local rules, and community enforcement mechanisms. Punta Allen cooperative members (56) have granted among themselves exclusive individual fishing rights of 150 fishing lots ranging in size from 0.5 to 3.0 km2. Factors identified to explain the relative success of the Punta Allen spiny lobster fishery will be presented and discussed.

Social, institutional, and knowledge access mechanisms mediate diverse ecosystem service benefits in small scale fisheries
Christina Hicks, Stanford University’s Center for Ocean Solutions, USA, and James Cook University’s Centre of Excellence for Coral Reef Studies, Australia

Fisheries management often results in trade-offs that influence who benefits, or what they benefit from. Effective and equitable fisheries management can be informed by an understanding of when and why these trade-offs occur. Ecosystem services are the benefits people receive from nature and as a concept are gaining attention in natural resource and fisheries management. Using examples from coral reef fisheries in the western Indian Ocean, I ask: 1) what are the common trade-offs that emerge among people and among ecosystem services? And, 2) what enables or constrains different people from benefitting from these ecosystem services? I found that trade-offs often occur across scale (local vs national benefits), across category (cultural vs provisioning), and that resource users perceive more trade-offs than scientists; but managers can potentially mediate these differences. Further, using an entitlements approach, I found that access mechanisms influence who is able to benefit from ecosystem services and what benefits they perceive. In particular, social, institutional, and knowledge access mechanisms (rather than rights or economic mechanisms) have the greatest influence on the number and diversity of benefits that people perceive. However, local context strongly determines whether specific access mechanisms enable or constrain perceived benefits. For example, local ecological knowledge enables people to perceive a habitat benefit in Kenya, but constrains people from perceiving the same benefit in Madagascar. Ecosystem service assessments, and their resultant policies, need to take into consideration the broad suite of access mechanisms that enable different people to benefit from a supply of ecosystem services.

Understanding the importance of small-scale fisheries

Tim Acott, University of Greenwich, UK

The livelihoods of small-scale fishermen are under threat in many places across the world. This threat is set against a backdrop of a reported global fisheries ‘crisis’ with 73% of marine stocks reported as either fully exploited, overexploited, depleted or recovering. The focus of fisheries management has often been on the biological and economic dimensions and arguably not enough attention has been given to socio-cultural issues. Capturing the importance of small-scale fisheries from a socio-cultural perspective is not an easy task and requires a range of epistemological perspectives and methodological approaches. Using examples from the development of ‘21st Century Catch’ (a toolkit developed to help understand the importance of small-scale fisheries) Tim Acott will present insights into developing and using multi-dimensional and multi-disciplinary perspectives for capturing the value of fisheries for the well-being of coastal communities. For such initiatives to succeed, from grassroots to strategic policy planning, attention needs to be given to epistemological considerations of acceptable evidence that in turn means addressing issues of the relationship between nature and culture. Tim will address these issues with a focus on small-scale fisheries, cultural ecosystem services and sense of place.

Monday September 22nd, 11:00-12.30
Regular session 1.1: Viability and value chain
Economic viability of small-scale fisheries – a global study

Anna Schuhbauer, Fisheries Economic Research Unit, Fisheries Centre, The University of British Columbia, Vancouver, Canada. a.schuhbauer@fisheries.ubc.ca
Ratana Chuenpagdee, Too Big To Ignore, Department of Geography Memorial University of Newfoundland St. John's, Canada. ratanac@mun.ca
Dr. Rashid Sumaila, Fisheries Economic Research Unit, Fisheries Centre, The University of British Columbia, Vancouver, Canada. r.sumaila@fisheries.ubc.ca

Abstract
Small-scale fisheries, which employ about 90% of all fishers globally, are known to be tied to their local communities; are often marginalized, suffer from high levels of poverty, climate change and low economic performance. Our project aims to strengthen the knowledge base and investigate options to improve economic viability of small-scale fisheries. With a multi-entry perspective that includes economic, social, governance and ecological aspects, we developed a framework to assess economic viability on a global scale. While maintaining a comprehensive view, we identify a set of key attributes as essential for this assessment. We will measure these attributes and demonstrate how they contribute to economic viability at a global scale using a linear regression model. The assessment will improve our understanding of how, for example, fair access to resources by small scale fishers and positive net benefits for society influence the economic viability of small-scale fisheries. Results will help us find solutions to better prepare these fisheries to the threats they face and increase their resilience to large-scale processes of change such as industrialization, climate change and market shifts.

Introduction
Marine capture fisheries are estimated to contribute about 240 billion USD to the world economy, based on direct, indirect and induced impacts (Dyck and Sumaila, 2010). However, global fisheries are known to be underperforming, mainly due to overfishing, harmful subsidies and over capacity (Sumaila et al., 2012). Small-scale fisheries (SSF) constitute a substantial component of global fisheries as over 90% of all active fishing vessels are considered small-scale (FAO, 2014). SSF support up to 22 million fishers worldwide (Teh and Sumaila, 2013), involving an additional 100 million people in post-harvest activities (Béné et al., 2007). Despite these tremendous numbers and the obvious importance of this fishing sector, globally, SSF are understudied and marginalized (Chuenpagdee, 2012; Guyader et al., 2013; Pauly, 1997).

Furthermore, SSF are facing many problems and threats: low economic performance; unequal distribution of benefits; relatively high incidence of poverty and pressure from globalization and global change such as climate change (e.g., Chuenpagdee, 2012; Lam et al., 2012). In addition to these challenges, bad governance, ineffective management and the under-representation of local stakeholders in decision making processes have contributed to the marginalization of SSF (Allison and Ellis, 2001; Béné et al., 2010; Béné and Friend, 2011; Chuenpagdee, 2012; Pauly, 1997). These issues are the main motivation behind this study, which aims to assess economic viability of SSF globally. We argue that the assessment of economic viability of SSF is fundamental to understanding the current problems faced by these fisheries, and necessary for developing effective solutions.

Based on a literature review, we discovered that most studies that include an economic viability assessment equate economic viability with pure financial performance, meaning if a
profit is made over time the fishery is considered economically viable (Adeogun et al., 2009; Ehui and Spencer, 1993; Lery et al., 1999; Tietze et al., 2001; Ünal and Franquesa, 2010). We define economic viability as the use of scarce resources to produce valuable commodities and distribute them among people in an equitable manner, while these dynamics survive and maintain themselves in the long term. Fisheries are prone to uncertainty, meaning that changes, either environmental, institutional, economic or social, cannot easily be foreseen or determined. Therefore, to estimate a fishery’s economic viability, uncertainties need to be dealt with in the most realistic way possible. Based on many studies different criteria, variables and constraints need to be identified to assess economic viability in a comprehensive manner (Baumgärtner and Quaas, 2009; Béné and Doyen, 2000). We propose here that this can only be carried out successfully while considering social, ecological, governance and economic dimensions at the same time. Furthermore, this is especially of relevance when assessing small-scale fisheries, because as argued in many papers, the goal for the participants is not always just profit but includes traditional, cultural and social values as well (Berkes et al., 2001; Kronen, 2004; Pollnac and Poggie, 2008; Trimble and Johnson, 2013). Often, main parts of the catch are for home consumption (Hospital and Beavers, 2012), and fishing is considered a way of life rather than a profit orientated business (Kronen, 2004). Furthermore, the coastal community plays a central role in the SSF system and should be taken into account for its viability assessment (Jentoft, 2000). Small-scale fisheries are often found to be isolated and marginalized from policy and governance which must also be considered when assessing economic viability. With these considerations in mind we have developed a framework to assess economic viability of small-scale fisheries, globally, considering governance, economic, social and ecosystem components (Figure 1). While maintaining a comprehensive view, the current framework focuses mainly on assessing the main components affecting economic viability, i.e., economic and social attributes.

Figure 1) A framework describing economic viability for small-scale fisheries. All shown compartments (Ecosystem, social, economic and governance) need to be considered when assessing the economic viability of a small-scale fishery; they all influence each other and influence the economic viability of the fishery.

Methods
Using attributes to measure the state of a fishery is a common technique used for a variety of goals, including assessing the sustainability of a fishery. After a thorough literature review and several consultations with scientists with economic, social, governance and ecological
expertise in SSF, we selected a set of key attributes to assess economic viability at the global level. The selection criteria include relevance, availability, measurability, and objectivity, i.e., whether the same result is obtained when the attribute is measured by different scientists at different times (Boyd and Charles, 2006). The identified attributes are:

1. Landings (t)
2. Ex-vessel price ($)
3. Total Cost of Fishing ($)
4. Subsidies ($)
5. Proportion of SSF to LSF (%)
6. Cost structure (ratio)
7. Discount rate (rate)
8. Multiplier (factor)
9. Number of jobs per employment type (various)
10. Degree of economic dependence on fishing (%)
11. Distribution of benefits within the fishing community (coefficient)
12. Access to finance (various)
13. Fish consumption per capita (g/capita)

To test the attributes and their importance and contribution to economic viability, a generalized linear model (GLM) is being created. Each measured attribute is considered a variable in the model and the goal is to understand each variable’s relationship and how each specifically influences economic viability. It should be noted that both quantitative and qualitative data can be used in a GLM, the latter through the use of a dummy variable. Two approaches will be carried out to find out how economically viability can be assessed.

A) The first approach uses national data and economic viability will be calculated as net benefits to society based on pure monetary values using the following equation:

\[ \text{NB}_{\text{society}} = \text{TR}_{\text{society}} - (\text{TC}_{\text{society}} + \sum (S_{\text{units}})) \]

where Total Revenue to the society or fishing community (\( \text{TR}_{\text{society}} \)) is the product of ex-vessel price and landings; \( \text{TC} \) = total cost, i.e., the sum of variable costs and fixed costs; and \( S_{\text{units}} \) = the amount of subsidies received from the government by the sum of all fishing units in the fishing community.

As we argue that it is not enough to only base economic viability on net benefits i.e., pure monetary values, we will run a generalized linear model to determine how the attributes 5-13 influence economic viability.

B) The second approach is based on small-scale fisheries case studies. To find out whether a fishery is economically viable, we will introduce a binary system, where the fishery is either economically viable (=1) or it is not (=0). As economic viability will be the dependent variable and the attributes (1-13) are the independent variables, we will use expert opinions from the collected case studies to determine whether their fishery is considered economically viable or not. Once the opinions of the experts are noted (either as 0 or as 1), we will use data from each case-study to determine all 13 attributes. To avoid as much bias as possible during this selection process, we will aim to select case studies from various different geographical locations, considering tropical, temperate, more and less developed regions of the world. These measurements will be introduced and different statistical tests run to understand the data distribution and possible correlations. This might lead to a reduced number of variables which will facilitate running the GLM.

Preliminary results and conclusions
The results from the GLM will include a formula which can then be used to assess economic viability (EV) of small-scale fisheries globally.

$$\text{EV} = \beta_1 A_1 + \beta_2 A_2 + \beta_3 A_3 + \ldots + \beta_{13} A_{13}$$

where A is a vector of attribute and β denotes a vector of their coefficients, which is a measure of each attribute's importance, the higher β the more influential the attribute on economic viability.

Preliminary conclusions are that economic viability assessments of small-scale fisheries involve more than just monetary values and it is therefore important to use a method that allows for both quantitative and qualitative measurements. We realize the challenges we will face in collecting the needed data at both the case study and national levels, however, several sources of data for the latter have been identified and may only need to be verified by local experts and key informants. To discover what exactly causes a small-scale fishery to be economically viable or not, will help us identify where the main problems lie within that fishery. The results from this assessment can then directly be used for policy and management recommendations. Due to the complexity and variability of these fisheries there is not one panacea that solves all the problems, however, this can be seen as one of many contributions to improve the global state of small-scale fisheries and thereby help to counter their marginalization as well as reduce their vulnerability to large scale processes of change.

References


**Sustainable gross domestic product from small-scale marine fishery: A study from India**

Jyothis Sathyapalan (Centre for Economic and Social Studies, Hyderabad, India)

Economic Viability of small-scale fishery is assessed on the basis of many attributes ranging from socio-economic, ecological, climatic and governance aspects. An important attribute of measuring economic viability of fishery is the degree of economic dependence of a society on
fishing. In India, calculation of the degree of economic dependence on fishery in terms of gross domestic product is beset with problems which are both conceptual and data related in nature. The seriousness of the issue becomes more complex when we take into account the fact that fishery sector has underwent various changes in terms of technology, production, value addition, employment generation and input costs in the recent past. For instance, environmental cost in terms of by-catch which has been assumed to be negligibly low in income accounting methods is actually showing an increasing trend. Against this background, the paper provides an extensive review of methodological issues related to fishery income accounting, and makes a fresh assessment of the contribution of ‘small-scale fishery’ to the state gross domestic product, by correcting for the existing methodological flaws and using primary data from the marine fishery sector of Andhra Pradesh State, in India. On the basis of the estimates; the paper argues that the economic contribution of small scale fishery is highly significant and viable from a societal point of view. It remains positive even after incorporating environmental costs in terms of by-catch as compared to its larger counterparts.

**Economic assessment of multispecies finfish fisheries: a case study at the Santa Rosalía region, west coast of the Gulf of California, Mexico.**

Mauricio Ramírez-Rodríguez  
Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional  
Av. IPN s/n, Col. Playa Palo de Santa Rita, La Paz, Baja California Sur, México 23096.

Small-scale fisheries involves different processes of resource utilization, whose availability in space and time at a given geographical region, allows the firms to design strategies to operate their boats with objectives related to economic, social and ecological values. To assess the performance of these multispecies fisheries is difficult, because its economic viability depends on the availability of resources, type of catch technology, products and prices, and the data are usually scarce or inexistent. In this work, we used the method of typical production units to analyze cost-benefit ratios, of a firm that operates a boat using gillnets and another with hooks and lines, to catch several fish species in the west coast of the Gulf of California. The income depends on the quantity and price of at least 19 different products, whose availability change during the year, affecting operative strategies and annual income. Total costs included salaries to fishers and the owner, combustibles, food, gear and maintenance. Financial balance shows that the firm works at levels near the economic equilibrium, with scarce revenues, affecting the owner’s income at the catch level, but providing him the opportunity to gain in the commercialization process.

**Cooperation vs. Competition: Divergent harvest strategies (and profits) in a New Zealand and New England lobster fishery**

Michael De Alessi (School of Aquatic and Fishery Sciences, University of Washington)  
Over the last 20 years, lobster populations in both New Zealand and New England have increased significantly. The response of lobstermen, however, has been markedly different. In New Zealand, harvests have remained relatively constant and CPUE has risen dramatically. Port price has also increased. In Maine, the number of traps and the total harvest increased...
apace with the underlying population increase, enough to effectively hold CPUE constant. And with the increase in supply, prices for Maine lobster have fallen dramatically. This presentation explores the role of cooperation and profit maximization – as opposed to harvest maximization – in New Zealand and suggests cooperative strategies to improve the economic viability of other small-scale fisheries.

Value chains of small-scale fisheries: a comparative investigation in the coastal region of São Paulo, Brazil

Caroline Ykuta, Graduate student on Oceanography, Oceanographic Institute, University of São Paulo. Praça do Oceanográfico, 191. CEP: 05508-120. São Paulo, SP, Brazil. E-mail: caroline.ykuta@usp.br, Fisheries Ecosystems Laboratory (LabPesq), Oceanographic Institute, University of São Paulo, Brazil. E-mail: mgasalla@usp.br
Maria A. Gasalla, Fisheries Ecosystems Laboratory (LabPesq), Oceanographic Institute, University of São Paulo, Brazil. E-mail: mgasalla@usp.br

Abstract

The contribution of small-scale fisheries in Brazil represents about 60% of all national fisheries production, and one of the main knowledge gaps to promote sustainable practices are the identification of the supply and value chains involved in post-harvesting processes. There is an inherent complexity involving several informal elements, which make them difficult to map and understand, while data and in-depth research are missing. Here, we present the results from an investigation of the value chain’s structure, function, and performance of two fisheries systems of São Paulo State (Brazil) with high socioeconomic relevance: the whitemouth croaker (Micropogonias furnieri) fishery in Ubatuba by gillnetters, and the seabob-shrimp (Xiphopeneaus kroyeri) fishery in Guarujá by Rio do Meio’s trawlers. The data were collected during March-November 2013 through in-person surveys with questionnaires applied to all sectors involved in both fishery systems – catching, processing, distribution and sale. A mapping of both value chains will be presented and discussed. In the croaker’s fishery, the system comprises 21 vessels, 4 middlemen, 2 wholesalers and 6 retail categories, while in the seabob-shrimp, 55 vessels, 8 processing plants and 5 retail categories were identified. A stronger dependence of middlemen was found in the croaker fishery due to the facilitation required in the sale to the wholesaler, while in the shrimp fishery the only available option for marketing is through the often informal processing domestic plants. The lack of a direct marketing pathway between the fishers and the final consumers prevent the former of receiving two or three times more the price per unit weight.

Introduction

Artisanal fisheries are an increasingly important basis of livelihood in many developing countries, and it account for over 45% of the world fish catch (UNEP 2004). In Brazil, the artisanal fisheries are about 60% of the fish national production and more than two million people depend directly and indirectly on fishing and activities allied to it, including those engaged in processing and marketing fish and fish products (Diegues 2008). Currently, the artisanal fishery faces several difficulties, including the low incomes and the structural deficiencies to storage fish, to organize the distribution and the marketing. Besides, comparing to the industrial sector, fishers have few material resources to capture, transport
and trade (Vasconcellos et al. 2007). Studies conducted around the world focusing on the value chains of small-scale fisheries emphasize that one of the main problems is the difficulty to quantify and qualify all the actors involved (Roheim 2008, Hameri & Pálsson 2010, Connolly & Caffrey 2011), especially in post-harvest processes.

The value chain of small-scale fisheries can be described as the group of activities needed to bring a product through the intermediate stages of production until delivery to the consumer. It consists of the capture, processing, distribution, marketing and consumption, with each segment adds some value to the final product (Kaplisky 2000) and it would comprise of several stakeholders such as producer, wholesaler, dealers, middlemen, retailer, processor and consumer (Silva 2010). There are often other dimensions involved, such as cultural, traditional, and related to livelihoods. However, the main objectives often set to the management of a value chain are reduce the number of links and friction (between them), such as bottlenecks, costs, time to market, etc. Also, an important issue in the study of the fisheries value chains is the analysis of the benefits (Russell & Hanoomanjee 2012).

It seems crucial to obtain regular information on the value chains of small-scale fisheries systems, especially about input suppliers, producers (fishers and ship owners), intermediates (processors, middlemen, wholesalers and retailers) and consumers, to develop guidelines to gain added value of fish as well as to improve the link between the processes capture and marketing, promoting more sustainable practices in the various ecological, social and economic aspects (Gasalla et al. 2013, TBTI 2013).

The aim of this study is to understand the marketing’s dynamics of the two important fisheries systems of São Paulo State (Brazil), through of an investigation on their value chain’s structure, function and performance.

Methods

This study was conducted in two sites of the coast of São Paulo State (Brazil). The fisheries systems investigated were the whitemouth croaker (Micropogonias furnieri) fishery in Ubatuba by gillnetters, and the seabob-shrimp (Xiphopeneaus kroyeri) fishery in Guarujá by trawlers from “Rio do Meio”. The croaker, in terms of volume, is the main demersal species landed in SE/South Brazil, with socioeconomic relevance in the study region, while the seabob-shrimp is caught all year (excepting the closure period), and it is the most third specie landed in São Paulo. These fisheries have high economic and social relevance in the Southeast coast of Brazil, as well as elsewhere (IP 2013).

In-person surveys were conducted from March to November 2013 with the value chain segments: producers and traders. The analysis is based on the price transmission between fishing markets, located in different levels of the value chain. For actors in each segments of the chain, data of the purchase and sold price (R$/kg) were collected accordingly to several references (e.g. FAO 2011, Russell & Hanoomanjee 2012, Wamukota et al. 2014). A total of 70 interviews were conducted (30 fishers and 40 traders). The data collected were used to map the value chains with the average of sold prices and three segments to the value chains were considered: producer (fishers and ship owners), intermediate (middlemen, wholesalers and processors) and retailers.

RESULTS
**Whitemouth croaker fishery system in Ubatuba by gillnetters**

The segments of the value chain identified were: artisanal fisher (producer), intermediate (middleman and wholesale), retailer, and consumer (Figure 1).

**Producer:** 21 vessels from 3 to 20 T were identified with 2 - 7 crews. The landing occurred in three regions: Cais do Alemão, Saco do Ribeira e Picinguaba (Ubatuba, São Paulo).

**Intermediate I - Middleman:** Four middlemen were identified: two fish markets; one processing industry in Ubatuba and a person who assists in the commercial issues of invoice and tax. Those middlemen act mainly in support of the transportation (freight hiring or own freight) for the wholesaler, in the previous financial assistance for the supply of supplies for the fishing trips and also, in some cases, lending money to the crew.

**Intermediate II - Wholesale:** two wholesalers were identified: two enterprises employed on the CEASA – Grande Rio unit/Rio de Janeiro.

**Retail:** six groups of retail establishments that are responsible for selling the fish to the consumer were identified. They are: fishmongers (in Rio de Janeiro and São Paulo (coastal regions), restaurants and Municipal Fish Market in Ubatuba, supermarkets (Southeastern Brazil), and both São Pedro Market and farmer’s market in Rio de Janeiro. At this stage, between the retailer and the consumer, the fish is processed (cleaning, filleting and freezing).

For the marketing of the croaker, three situations can be seen in the marketing diagrams of the benefits distribution (Figure 1). The intermediate II - wholesaler holds 90% of the production of croaker, being largely responsible for the distribution to the retail sector. Comparing first sale values of the flow A, B and C, the highest value that the artisanal fishers can take is when the sell is direct to wholesale, i.e. there is not middleman who intermediates the marketing. Independently of the production flow, the final price that the consumer pays is almost twice the value of the first sale.

**Figure 1 - Whitemouth croaker value chain.** The production intensity flow is represented by the widths different. There are five segments: artisanal fisher, intermediate I (middleman), intermediate II (wholesaler), retail and consumer. Production flows: A) Artisanal fishers - Intermediate I – Middleman - Intermediate II – Wholesaler - Retail - Consumer (red line); B) Artisanal fishers - Intermediate II – Wholesaler - Retail - Consumer (brown line); C) Artisanal fishers - Retail - Consumer (blue line). Mean values sold price of the September/2013 of fresh fish.

The value of croaker (BrR$/Kg) is established only in the intermediate II - wholesaler and it is defined daily according to the following criteria: supply and demand and subsequently the quality of fish. After the sales, in this retail segment, the payment is done to the fishers, discounting the expenses, fees and commissions such as the freight costs (ice and transport),
landing fees and parking the truck, commissions the middleman and wholesaler, besides the rates of the invoice for interstate transportation.

**Seabob-shrimp fishery system in Guarujá by trawlers from Rio do Meio**

The segments of the value chain were: artisanal fisher (producer), intermediate (processing plant), retail, and consumer (Figure 2).

**Producer:** 55 vessels from 3 to 15 T were identified with 2 - 7 crew. The landing place was in the Rio do Meio’s pier (Guarujá, São Paulo), where there are the processing plants.

**Intermediate I - Processing plants:** eight processing plants were identified in which benefit the shrimp headless or cleaned. The difference between these two processing was the size of the shrimp. Therefore, there is a prior selection of the capture concomitantly with process of the headless. Even majority of processing plants are informal, they are the main intermediate selling their catch and many of them have a link with the fishers for financial assistance, for early purchase of the ranch, gear, ice and fuel or advance valley.

**Retail:** Five categories of retail establishments that are responsible for selling the fish to the consumer were identified. They are fishmongers, restaurants and farmer’s market of the Santos Metropolitan Region; restaurants and the Municipal Market of São Paulo.

![Figure 2 - Seabob-shrimp value chain](image)

**Discussion and conclusion**

All production of the seabob-shrimp fishery system in Guarujá by trawlers from Rio do Meio and the whitemouth croaker fishery system in Ubatuba by gillnetters were sold only for domestic market. All fishers used intermediaries to sell the fish caught, characterizing the strongly dependent between them. The croaker’s fishers are dependent of the middlemen and shrimp’s fishers are dependent of the processing plants. Both intermediaries play the role as credit or loan providers and once that happens, the process of selling the catch becomes exclusive to the intermediary, regardless if this sold is the best price of the market. The lack of a direct marketing pathway between the fishers and the final consumers prevent the former of receiving two or three times more the price per unit weight.
References


Value chain optimization within a small-scale fisheries “economic-welfare” hybrid model: An analysis of interventions in the indigenous small scale fisheries value chain in Bolivia’s Northern Amazon region

M. John Wojciechowski, Universidad Federal do ABC (UFABC) Santo André, SP, Brazil; World Fisheries Trust, Victoria, B.C. Canada. matias.john.w@gmail.com
Claudia Coca, FAUNAGUA Institute for Applied Research on Aquatic Resources, Cochabamba, Bolivia. claudinacoca@gmail.com
During the last two decades, fisheries development narratives have been bifurcated by either (re)enforcing long-standing rent-seeking and reductionist models of sustainable fisheries or arguing in favor of holistic welfare-based and/or livelihood models. Recently, the approximation of international development literature and critical education theory has constructively sustained the importance of creating linkages between value-chain improvement strategies and participatory market approaches as a means of increasing the legitimacy of development interventions amongst the main social agents. Within this highly contested body of literature, the contribution of this paper is two-fold. In the first place, we present a hybrid intervention and analytical model for small-scale fisheries value-chain development based on pre, harvest and post development criteria suggested by Chuenpagdee et al. (2006) and value-chain integration (vertical and horizontal) criteria developed by Riisgard et al. (2010). Particular attention is placed on its adaptive nature, moving away from cookie-cutter approaches that dominate both development narratives, as well as on elements of social learning and transformation. Secondly, we develop a quantitative evaluative framework for the model incorporating both content and process indicators. The analysis of this paper focuses on three specific value-chain improvement interventions that were carried out within the reach of the IDRC funded “Peces Para la Vida” Project, in the Northern Bolivian Amazon region.

Regular session 1.2: Assessment and monitoring

How far are territorial use rights in fisheries from an optimal size?

Erendira Aceves Bueno (Bren School of Environmental Science and Management)

Territorial use rights in fisheries (TURFs) have existed for centuries and most of them have been established within the boundaries of traditional fishing grounds (Panayotou, 1982). However, TURFs are gaining attention as a tool for fisheries’ management in new sites around the world, and their creation requires a better understanding of the features that lead to their success. TURF’s size is an important aspect of their design, affecting their efficiency both from an ecological and social standpoint. Previous efforts (White & Costello 2011) have looked at the effects of TURF size on yield, showing that TURFs should be designed tens of kilometers long to generate enough returns. Larger TURFs decrease the spillover of adults and larvae to surrounding areas and thereby create greater incentives for TURF owners to take actions that enhance yields in the future. We compared the optimal size dictated by the model created by White and Costello (2011), with empirical data from TURFs created based on the boundaries of traditional fishing grounds. The difference in size between the empirical TURFs and that predicted from the model is likely due to social constraints and it will have important consequences for the performance of these TURFs.

Co-management in Latin American small-scale shellfisheries: Assessment from long-term case studies
Abstract

Co-management (Co-M), defined as the sharing of management tasks and responsibilities between governments and local users, is emerging as a powerful institutional arrangement to redress fisheries paradigm failures, yet long-term assessments of its performance are lacking. A comparative analysis of five small-scale Latin American shellfisheries was conducted to identify factors suggesting success and failure. In Chile, Uruguay and Mexico Co-M produced positive effects, including stabilization of landings at low levels, increase in abundance, CPUE, unit prices and revenues per unit of effort, and reduced interannual variability in several fishery indicators, particularly in landings. Co-M was successful because it was mainly bottom-up implemented and accompanied by catch shares (spatial property rights and community quotas). By contrast, Co-M implementation was unable to prevent the collapse of the Galapagos sea cucumber fishery, as reflected by a decrease in abundance and CPUE. Negative effects were also observed in the Galapagos spiny lobster fishery during Co-M implementation. However, recovery was observed in recent years, reflected in a stabilization of fishing effort and the highest CPUE and economic revenues observed since the beginning of the Co-M implementation phase. The combined effects of market forces, climate variability and a moratorium on fishing effort were critical in fishery recovery. We conclude that Co-M is not a blueprint that can be applied to all shellfisheries to enhance their governability. These social-ecological systems need to be managed by jointly addressing problems related to the resources, their marine environment and the people targeting them, accounting for their socio-economic and cultural contexts.

Introduction

Co-management (Co-M), defined as the sharing of management tasks and responsibilities between governments and local users, is emerging as a powerful institutional arrangement to redress fisheries paradigm failures (Carlsson and Berkes 2005; Gutiérrez et al. 2011). This mode of governance has been widely applied in many small-scale shellfisheries to involve local communities in management schemes (Basurto 2005; Defeo and Castilla 2005; Begossi
et al. 2011). However, long-term assessments of its performance are lacking, especially in developing countries where very limited or no exertion has been allocated to monitoring and periodical assessment of this governance mode after being implemented (Gutiérrez et al. 2011). Such type of studies is critical to produce well-grounded evidence about the conditions that facilitate or preclude the successful implementation of Co-M approaches.

In this paper, we assess the long-term performance of Co-M in five Latin American shellfisheries using multiple fishery indicators, and identify the main factors associated to their success or failure. Finally, we discuss future needs, challenges and issues to improve shellfisheries Co-M.

Methods

The shellfisheries analyzed here involved the muricid gastropod Concholepas concholepas, “loco”, in Chile; the yellow clam Mesodesma mactroides at Barra del Chuy, Uruguay; the sea cucumber Isostichopus fuscus and spiny lobsters Panulirus penicillatus and P. gracilis in the Galapagos Islands, Ecuador; and the spiny lobster Panulirus argus in the Yucatan Peninsula, Mexico (17 years of daily information in the Vigía Chico Cooperative at Punta Allen, and five years for Chiquilá and San Felipe Cooperatives). Each of them is described in Table 1.

Changes in fishery indicators associated with Co-M implementation (abundance, individual size, landings, fishing effort, catch per unit effort (CPUE), unit price and economic revenues per unit of effort) were estimated as response ratios of the mean and the variance (Essington 2010). We tested whether shellfishery stocks were improved after Co-M implementation (before-after analysis) or when compared with open access sites (control-impact analysis). Different strategies were set in each case, according to the nature, amount and extent of the information gathered (Table 1). ANOVAs were employed to test the null hypothesis of absence of differences in indicators of Co-M success through time and/or space. ANCOVAs were used to test for differences in the unit price – catch relationship before and after Co-M implementation. The unit price was used as the dependent variable, landings as the covariate, and the fishing regime (before-after Co-M) as the fixed factor. When data were heteroscedastic, transformations were conducted.

Table 1 Summary information of the five small-scale Latin American shellfisheries analyzed in this paper
<table>
<thead>
<tr>
<th>Country</th>
<th>Loco</th>
<th>Yellow clam</th>
<th>Spiny lobster</th>
<th>Sea cucumber</th>
<th>Spiny lobster</th>
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<tr>
<td>Chile</td>
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<td>Uruguay</td>
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<td>Ecuador</td>
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<td>Mexico</td>
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<tr>
<td>Quintana Roo</td>
<td>Punta Allen</td>
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<tr>
<td>Subtidal, soft-bottom</td>
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</table>

<table>
<thead>
<tr>
<th>Region/locality</th>
<th>Subtidal, rocky</th>
<th>Intertidal, sandy beach</th>
<th>Subtidal, rocky</th>
<th>Subtidal, rocky</th>
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<tr>
<td>Central/El Quisco</td>
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<td>Rocha/Barra del Chuy</td>
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| Number of active fishers | ca. 22,000 | 40 | 410 | 536 | 76 |
| Economic value (million US$) | Up to 50 | 0.24 | 0.69 | 2.78 | 1.00 |
| Main market  (Domestic/Export) | Export | Domestic | Export | Export | Domestic |
| Individual revenues (US$) per unit of effort | 280 fisher$^{-1}$ h$^{-1}$ | 21 fisher$^{-1}$ h$^{-1}$ | 51 fisher$^{-1}$ h$^{-1}$ | 110 fisher$^{-1}$ h$^{-1}$ | 366 boat$^{-1}$ d$^{-1}$ |
| Fishing method | Hand-gathering by hookah and skin divers | Hand-gathering (shovels) | Hand-gathering by hookah - skin divers | Hand-gathering by hookah - skin divers | Hand-gathering by skin divers |
| Organization | Unions | Family groups | Cooperatives | Cooperatives | Cooperatives |
| Methodological approach | Comparison between open access (OA) and Co-M sites | Comparison between weakly managed and Co-M sites | (1998-2002) | 1986-2003 |


$^1$ Revenue per unit of effort are given for fishing seasons that varied from days to months
$^2$ Information extracted from previous papers and unpublished information (J. C. Castilla)
$^3$ Missing years of data between Before and After periods are due to fishery closures.

Results

The response ratios analysis showed that most after Co-M implementation: (1) abundance and CPUE of loco, yellow clam and Galapagos spiny lobster increased, whereas the sea cucumber decreased markedly; (2) all cases studies registered a consistent decrease in landings and fishing effort and a marked increase in unit price and revenues per unit of effort; and (3) mean individual sizes remained fairly constant. Before-After comparisons through ANOVA roughly followed these patterns. The response ratio of the variance showed large positive changes (variance > 25%) in 10 of the 28 fishery/indicator combinations (notably in individual size, unit price and revenues per unit of effort), whereas nine analyses showed a reduced variance in the co-managed phase. However, a consistent response in the reduction of the variance was found only for landings.

Concerning spiny lobster fishery in the Yucatan Peninsula (Mexico), CPUE estimates obtained from daily records during four consecutive fishing seasons (July – February) showed
that the Vigía Chico cooperative at Punta Allen (co-managed site) had significantly higher catch rates than other two cooperatives with weak centralized management.

Catch and unit price relationships (Fig. 1) showed similar decreasing trends, but with different interpretation among cases. In Chile and Uruguay, loco and yellow clam’s catches reached their lowest values after Co-M implementation, concurrently with high unit prices (Fig. 1a and 1b), abundance and CPUE. ANCOVAs discriminated by period showed a steeper slope of the relationship for the Co-M phase than in the pre Co-M period, denoting a willingness to pay higher prices after Co-M implementation in both cases. The Galapagos spiny lobster also showed a significant increase in unit price after Co-M implementation at low catch levels (Fig. 1c), as well as a significant decrease in fishing effort. Even though annual average CPUE did not show significant differences between fishery regimes, a substantial and systematic increase of this indicator has been observed between 2006 and 2012. This has occurred together with a stabilization of fishing effort and an increase in unit prices, resulting in the highest revenues per unit effort since 1997. The unit price-catch relationship for the sea cucumber Galapagos fishery had a same trend (Fig.1d). Unit prices also increased at low catches, but this was followed by decreasing abundance and CPUE levels, suggesting its overexploitation. Intra-annual patterns in the price-catch relationship for the Vigía Chico cooperative at Punta Allen (Mexico)\(^1\) also showed a same monotonic decreasing exponential function: the average price paid per t of spiny lobster increased from the beginning (July) to the end (February) of the fishing season, suggesting short-term changes in price according to the magnitude of landings (Fig. 1e) and resource availability (considering CPUE as an index of abundance).
Figure 1 Scatter diagrams and functions fitted for the relation between catch and unit price in five Latin American shellfisheries: a) loco, both at the country level (catch in t·10^3 and price in US$·10^3·t^{-1}) and for the Co-M area El Quisco in Central Chile (panel at the right hand side: # of locos·10^3 and US$-loco^{-1}); b) yellow clam (Uruguay), expressed in t and US$·kg^{-1}; c-d) Galapagos spiny lobster (t tails and US$·kg tail^{-1}) and sea cucumber (catch in millions of individuals and price in US$·ind^{-1}); and e) spiny lobster (Punta Allen, Mexico). In a-d, open access (red circles), Co-M transition phase (yellow circles) and Co-M (green circles) fishery phases are highlighted. In e) the exponential decreasing function for the spiny lobster in Mexico was fitted only for empty circles (O), which define the upper limit of the “envelope”
between catch \((t)\) and unit price \((\text{US\$ kg}^{-1})\), representing maximum unit prices for varying catch levels.

**Discussion**

The shellfisheries of Chile, Uruguay and Mexico showed that Co-M produced several positive effects, including: (a) stabilization of landings; (b) an increase in abundance, individual size, CPUE and economic revenues per unit of effort; and (c) a reduced interannual variability in several indicators (notably landings). These results are associated to the bottom-up implementation of Co-M with catch shares (territorial user rights for fisheries [TURFs], and community quotas) (Castilla and Defeo 2001; Gelcich et al. 2010). These measures promoted a strong sense of ownership and accountability by local fishing communities that led to the end of the race-to-fish in Co-M sites (Castilla 2010). Social attributes, including leadership and social cohesion, also contributed to success (Gelcich et al. 2010; Castilla and Defeo 2001).

In the yellow clam and loco shellfisheries, the measures described were taken as a result of institutional learning process occurred after the overexploitation of both fisheries. In both cases, fishers adopted management measures, in agreement with the government, to stop entry to the fishery being promulgated, and to ensure an efficient organization, coordination and collaboration with local actors to enforce regulations (Gelcich et al. 2010).

By contrast, Co-M implementation was unable to prevent the collapse of the Galapagos sea cucumber fishery. Several factors are responsible for this failure (Castrejón 2011, Castrejón and Charles 2013), including: (a) weak leadership, lack of social cohesion and poor organization of local fishing sector; (b) lack of long term strategic planning and mechanisms for precautionary and adaptive management; (c) incapacity of the rights-based management system (i.e., licenses and fishing permits) to mitigate over-exploitive fishing practices; and (d) poor implementation, enforcement and compliance with management regulations. The latter was encouraged by an anthropogenic Allee effect (sensu Couchamp et al. 2006); i.e., as resource abundance becomes scarcer the willingness of external agents, particularly Asian middlemen, to pay higher prices for sea cucumbers increased exponentially. This led to the intensification of illegal fishing and to the collapse of the fishery in 2006.

Most factors of failure described above for the sea cucumber also affected negatively the Galapagos spiny lobster fishery from the late 1990s to the middle 2000s (i.e., during and after Co-M implementation), leading to its overexploitation. Nevertheless, it has shown a marked and consistent yield and CPUE recovery between 2006 and 2012. This trend could be attributed to: (1) a marked reduction in fishing effort observed since 2006 as a result of the collapse of the sea cucumber fishery and the global financial crisis (Castrejón 2011; Ramírez et al. 2012); (2) a positive impact on yields produced two years after “El Niño” event occurred in 2009 (Defeo et al. 2013), and (3) a moratorium on new entrants applied since 2002. Therefore, the combined effects of market forces, climate variability and the moratorium were critical in fishery recovery.

In Punta Allen, the “Vigía Chico” cooperative constitutes a well-institutionalized and solid Co-M system that emerged from the local community some 50 years ago (Castilla and Defeo 2001). The lobster fishery has showed a high persistence and stability in landings, fishing effort and CPUE for the last 17 years. Self-organization has been a key driver for the success of this Co-M system, where coastal-parceled areas (TURFs) have been effectively allocated to
families as inherited owners for lobster extraction. The geographic isolation also promoted a high motivation on a self-help approach to community development (Defeo and Castilla 2005). The strong collective organization, with penalties imposed by well-defined operational rules enforced and controlled by local fishers on this well-defined and isolated territorial permit, explains the long-term success of the fishery.

**Conclusion**

Our long-term analysis suggests that Co-M could be an effective governance mode to sustain shellfisheries over time, leading to improved social-ecological fishery conditions and greater production capacity. Nevertheless, it is not a panacea, i.e., a blueprint for a single governance mode that is applied to all environmental problems (Ostrom et al. 2007).

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Towards management of small-scale fisheries not monitored by government agencies: Study cases in Colombia and Peru

John Gabriel Ramírez, Institute of Marine Science of Barcelona, Spain. j.gabriel@icm.csic.es
Alfonso Alonso, Center of Conservation, Education and Sustainability – Smithsonian Conservation Biology Institute, USA. alonsoa@si.edu

Abstract
Small-scale fisheries are sources of food security and food sovereignty for thousands of coastal communities around the world. Paradoxically, the fishing effort produced by fishers is increasing the risk of resources collapse that supports their livelihood and well-being. On the other hand, marine and freshwater fishing areas are rapidly being influenced by tourism, mining, hydrocarbon sector, among others, and governments, mainly in developing countries, are unable to monitor such resources. These conditions make necessary a new and complementary approach for monitoring and management of fishing resources. This work presents results obtained through strategies of monitoring with management ends, including participation of local communities, the government agencies and with the support of gas and oil companies in Colombia and Peru. Through these partnerships, it was possible to relate 291 fishing species with 775 common names in Spanish and the indigenous language in the small-scale fisheries in the north of Colombian Caribbean. Additionally, it was possible to association of physical coastal processes with the use of 26 different types of fishing gears for catching just few target species in coastal fisheries at central Peru. Both Peru and Colombian cases integrated multiple stakeholder interests for promoting specific management of small-scale fisheries in areas without previous fishing baseline.

Introduction
The Ecosystem Approach to Fisheries (EAF) is considered the best pathway to small-scale fisheries management because the traditional mono-species approach and the stock assessment do not satisfy entirely its biological, social or economic management challenges (Berkes et al., 2001). Fishery policies, especially in developing countries, have given relevance to the most important resources and main fishing areas, many times in detriment of small-scale fisheries management. The latter besides the economic and technical limited capacity, outdated policies and a sectorial high complexity have promoted a partial and insufficient coverage of fishing monitoring.

The most part of fishery management effort in Peru is focused in small pelagic resources (Aranda, 2009), while in Colombia many policies have focused in tuna and shrimp trawl fisheries (Wielgus et al, 2010). However, these countries hold high presence of artisanal fishers who are sharing similar conditions since their fishing activities are not widely covered by government monitoring while tourism, mining and oil companies have increased their influence in small-scale fishing areas. The fishing monitoring is one of main sources of information to manage both resources and fisheries, but in the north Colombian fisheries is occurring either overestimation of species and catches in some cases, or underestimation in other ones. The peruvian small-scale fisheries, especially those carried out from shoreline, show unknown or underestimated characteristics despite producing high catches of high commercial value fishes (e.g. fine flounder and peruvian grunt).

Differentiation of common names of fishes as well as understanding ecological relationship between fishing gears and the catches are outstanding aspects to consider into first steps toward artisanal fishery management. The richness of common names and folk information associated to artisanal fisheries could help to effectively characterize the diversity and total
catch values per species, they implying direct relationship with the assessment, the management and monitoring of fishery resources (Freire and Pauly, 2005). In general small-scale fisheries use coastal areas given the limited autonomy of the fishing units. However, fishers are able to overcome their spatial limitations using many different gears to cover all environmental variations identified by them. That would suppose variation of species, size and sex from catches (Hawkins and Roberts, 2004).

Colombian and Peruvian small-scale fisheries we studied are involved in high commercial value targets but conversely they receive low attention by government agencies but furthermore, oil companies have interests associated to these fishing areas. Under this context, research and academic institutions, NGOs, fishery local communities and oil companies have implemented participatory monitoring in order to gathering useful information in either management or co-management scheme. Therefore, the purpose of this work was to show underlying information to fish common names and fishing gears obtained by local stakeholders under collaboration scheme. The results and collaboration methods could lead to enhance fishing monitoring of small-scale fisheries both government monitoring areas and those still no covered by any monitoring program.

Methods
The Indigenous Wayuu fisheries (Colombia)
In the continental shelf of La Guajira (North of Colombian Caribbean) the gas extraction has been carried out during last thirty years. This region holds settlements of indigenous Wayuu people who develop small-scale fishery along all continental shelf. This is one of the most important artisanal fisheries from Colombian Caribbean according to landing values and it holds a fishery composed by at least 500 vessels operating on upwelling waters.

From June 2006 to May 2014 data was obtained by previously trained local members, of 37 communities along 170 km of shoreline (11° 33.300' N, 72° 54.240' W - 12° 15.348', 71° 58'), reaching over 90,000 fishing landings records. During 2013, seventy semi-structured interviews, mainly to old fishers, were carried out to identify all possible variation of common names. This approach allowed to find differences associated with language issues, given that Wayuunaiki is an oral traditional language. We identified The common names information according to language (Spanish, Wayuunaiki, Borrowed from Spanish), the kind of common name (monomial, binomial and binomial Wayuu), meaning (by Local Ecosystem Knowledge), the meaning category (behavior, body shape, color pattern, ecology/habitat and indeterminate) as well as the ethno-family and ethno-genus. Total catches recorded in the present study, and the official national statistics were compared and the homonyms and synonyms were identified.

The shoreline fisheries (Peru)
Natural gas is extracted from Los Andes Mountain and conducted to a marine harbor for going aboard of cistern vessels for its shipping (Lima, Peru central). Beach fishers have traditionally used the current port area for carrying out fishing activities (13°12.00'S, 76°17'.130W - 13°18.00', 76°14.800 W). The seashore holds sandy and rocky beaches as well as cliff areas, while shallow waters exhibit strong waves.

Fishers usually remain on a same beach during a fishing day but they are able to change of beach to new one according to previous results. Therefore, in the case of shoreline monitoring, since 2012 the main five fishing beaches, during 24 hours and six continuous days in each monitoring season (Fall and spring), were simultaneously monitored. Fishing landing data by haul was recorded considering species (weight, sizes, sex, maturity and stomach contents) and fishing gear. Considering as many details as possible, each fishing gear was illustrated involving fisher’s knowledge. Additionally, the local ecological knowledge
related to its operation (environmental variations, the fishers competition, the interaction with sea lions and fish behavior) were reconstructed.

Over 80 fishing gear illustrations and operation information given by fishers were individually analyzed until reaching clustering common characteristics that led to separate each fishing gear from other. Additionally, the information generated by catches was employed to support the differentiation among fishing gears.

**Results**

**Common names of fishes**

The fishing records showed 291 species grouped in 77 families. Families with major representation were *Carangidae* (27), *Sciaenidae* (16), *Serranidae* (16), *Haemulidae* (15) and *Lutjanidae* (12) that were the 30% of total reported species. However, the Wayuu fishers name these all species using 775 common names in the Spanish (39%) and Wayuunaiki (53%) languages as well as Wayuu common names borrowed from Spanish (9%). Some species as *Larimus breviceps* reached 17 different common names while some common names as *Curvinata* (Spanish) and *Tutturuyu* (Wayunaiki) were related to 13 different species. Nevertheless, given important presence of homonyms and synonyms, the mean of common names per species was 5.40 (SD: ± 3.28).

Regarding one of most important fishing resource, there were identified 20 species belong to “pargo” group (snappers), but just 11 species belonged to *Lutjanidae* (Fig. 1). Several species as *Lutjanus mahogani* or *L. analis* showed both synonyms into the Pargo group and until ten additional synonyms in Spanish and Wayuunaiki languages. Additionally, into Pargo species many homonyms covering different genus and families were identified. The above circumstances were exhibited in almost all families covering the highly caught/valuable species as well as those with low catches/value.

![Diagram](image.png)

**Figure 1.** Species belonging to Pargo group (Snappers). The diagram links common names to scientific names (only homonyms and synonyms group), while number into parenthesis shows other synonyms by each species, that implies several other homonyms could be associated to the synonyms from each species.
Fishing gears
Thirty-six species from shoreline catches were identified but seven species had the 90% of catches, predominating "Chita" Anisotremus scapularis (50%). Nevertheless, fishing gears used by fishers were differentiated in 26 types, being the gillnets more used on "V" system focused to "Chita" (20%) and the longline on "L" system (11%) and handlining (10%) which were focused to miscellaneous targets (Fig. 2). Catches were associated to the rocky beaches (43%), sandy ones (42%) as well as those with shingle (14%). On the other hand, all fishers, but overall those were using hooks, were continuously changing fishing beaches during monitoring periods.

Figure 2. Relationship between fishing gears identified and the main target of each one. The percentage number expresses total catch per species obtained by all gears during study periods.

Discussion
Fishery researchers and governments increasingly promote the Co-management of small-scale fisheries but it still is not entirely clear how to achieve it as an enduring fact, because the self-complexity of these fisheries seem to overcome capacity of both government agencies and users. One of first steps is gathering information reliable under two conditions: achieving better spatial approach and identifying the truly spectra of small-scale fishing action.

Colombian case
The national and official fishing statistic differentiated the small-scale landings from La Guajira in 64 taxa. Nevertheless, richness of the common names fishes of our research was related to 291 species. The above implies serious problems to use this information for the trending studies to species level, further considering that the fisheries management, according with laws in Colombia, is based in stock assessment. On the other hand insufficient considerations of common names is leading to hide true effect of fishing on coastal diversity and to ignore the possible common names associated to one or several species (Paz and Begossi, 1996), when the fishing landings records were obtained. This could promote the loss of the social and cultural values since their broadcasting is through oral tradition. The increase of common names borrowed from Spanish would suggest cultural losses due to the promotion
of Spanish common names by Spanish speakers instead of traditional ones by Wayuu communities.

In the national statistic *Archosargus rhomboidalis* is named like “Mojarra amarilla” while the common name of *Anisotremus virginicus* is “Cabo martin”. However, in the fishing statistic obtained by local community *A. rhomboidalis* is known like “Mojarra rayada” and *A. virginicus* is named like “Mojarra amarilla”. Thus, there could have problems for comparing time series and information between national and local statistics because a same common name is associated with two different species (homonyms). These two species are involved into distinct families, exhibit different trophic levels and their catches were not similar. In order to solve this problem the Wayuu common name could be used. Although both species have several common names in Wayuu language, there are no common names shared between these species. *A. virginicus* is involved in the ethno-family *Winsiu* (From the sea) while *A. rhomboidalis* was part of *Kashasü* ethno-family (It excretes a lot). The latter circumstances are happening into several ethno-families given no consideration of the local knowledge and decrease of the high commercial value species. In this way the “Pargos” group has included some genus and species outside of *Lutjanidae* for compensating low catches with “new” species under the gaze of other stakeholders as traders and restaurant among others.

Peruvian case
According to national artisanal fishing census (INEI, 2012) fishers not involved in fishing vessels (shoreline fishing) represented the 21.5% of total Peruvian fishers (44.161 fishers). The states of Ica and south provinces of Lima, regions where was carried out our research, hold 40% of shoreline fishers. However, the fishing census did not detail beyond of gross categories the fishing gears used by them, pointing out 10 categories into all artisanal Peruvian fisheries. Across our study we found 26 fishing gears that responded to strong daily variations of sea level, increase and decrease of sedimentation on beaches and subtidal areas both daily and seasonally. In the same way, relationship of the local knowledge with the scientific one has allowed identifying that rip currents are responsible of input, redistribution and output of sediments into the wave break area, same place where fishers carry out their hauls. Thus, fishers have to modify their gears or move to better places, either into or among beaches, for finding adequate conditions. This environmental changes lead to the continuous building and destruction of "pampas" valleys and "pozo" hollows as well as the accessibility to "peñas" rocks, what allowed variations in the food exposure required by the target of each fishing gear. Therefore, according to oceanographic conditions the fishing target could change both species and size class caught.

Management enforcement
The management of the small-scale fisheries implemented by government agencies considers the findings at main landing ports because they suppose the best and efficient way to represent catch volumes. However, this circumstance could lead to bias by underestimation of artisanal fishing conditions. The standardization of fishing’s attributes into the national database could happen without considering the local variations if just it is considered the main fishing landing ports. The latter will lead to both generation of partial knowledge about managed fisheries by government and losses of the local ecosystem knowledge by fishers. Therefore, the resources and fisheries management could be based in far facts to real ones. Finally, our findings support the need to create collaborations between all stakeholders for appropriately covering gathered data gaps, considering that depending of information quality it will achieve the small-scale fisheries goals in an EAF approach.
Acknowledgements
The Colombian study, in their several phases, had support by ECOPETROL-CHEVRON association, ECOPETROL, University of La Guajira and it was led by Ecosfera Fundation and University of La Guajira. The Peruvian study involved collaboration of Center for conservation education and sustainability (CCES) of Smithsonian Conservation Biology Institute (SCBI) and PERU LNG with collaboration of The Management Environmental (TEM) across the Biodiversity Monitoring Assessment Program (BMAP).


How to assess complex small-scale fisheries in a cost-effective way? The case of Yoff, a suburb of Dakar (Senegal)

Rosana Ouréns (Kartenn tecnologías para la gestión ambiental y territorial)
Noela Sánchez-Carnero (University of Vigo, Kartenn tecnologías para la gestión ambiental y territorial)
María Pan (University of A Coruña)
Inma Álvarez (University of A Coruña)
Lamine Dione (ONG Ecodesarrollo Gaia)
Ibrahima Samba (ONG Ecodesarrollo Gaia)
Juan Freire (Teamlabs, Kartenn tecnologías para la gestión ambiental y territorial)

Small-Scale Fisheries (SSFs) contribute to food security, livelihood, employment and economic activity in coastal communities around the world, mainly in developing countries. Standard fishery management based in well-established and costly monitoring and control system run by governments is not useful for SSFs because of the multitude of landing sites and the decentralized nature of the post-harvest and marketing activities that make data collection difficult. For these reasons available information about SSFs is often scarce and fragmentary. There is a clear need for designing new methods and indicators to assess SSFs. We present here a case study that is specially complex: the SSF of Yoff, a suburb of Dakar (Senegal). Complexity is related operative (multi-gear and multi-specific), spatial (spatial heterogeneity in the exploitation pattern), organizational (many entities involved in management), and economic (complex network of intermediary agents affecting product traceability) aspects.
Here we present a rapid, cost-effective methodology to characterize the SSF of Yoff. Starting from common methods, modifications were implemented and tested through an adaptive and learning process to find the most suitable methodology adapted to the characteristics of the socio-ecological system. This methodology combines direct and indirect methods with the aim of estimating fleet size, identifying fishing strategies, target species and fishing areas; quantifying the temporal distribution of catches and effort, and characterizing the community in economic and social terms. The developed methodology allowed us to characterize this SSF and could be useful for other socio-ecological systems in similar contexts.

Under-reported small-scale fisheries catches in the Pacific: Reconstructions provide data baselines

Dirk Zeller (Sea Around Us, University of British Columbia, Canada)

Abstract

I summarize fisheries catch reconstruction studies for 25 Pacific island entities, and compare estimates of total domestic catches with officially reported catch data. I exclude data for the large-scale tuna fleets, which have largely foreign beneficial ownership (although provide considerable financial benefits to host countries), even when flying Pacific flags. The reconstructions for the 25 entities from 1950 to 2010 suggested total domestic catches were 2.5 times the officially reported data. There was a significant difference in trend between reported and reconstructed catches since 2000, with reconstructed catches declining strongly since their peak in 2000. This decrease is driven by a declining artisanal (i.e., small-scale commercial) catch, which was not compensated for by increasing domestic industrial (i.e., large-scale commercial) catches. However, total catches were dominated by subsistence (i.e., small-scale non-commercial) fisheries, which accounted for 69% of total catches, with the majority missing from reported data. Artisanal catches accounted for 22%, while truly domestic industrial fisheries accounted for only 6% of total catches. The smallest component is the recreational (i.e., small-scale non-commercial) sector (2%), which although small in catch, is likely of economic importance in some areas due to its direct link to tourism income.

Co-management in the yellow clam fishery in Uruguay: an assessment using social-ecological indicators

Ignacio Gianelli (UNDECIMAR, Faculty of Sciences, Montevideo, Uruguay)
Gastón Martínez (DINARA, Montevideo, Uruguay)
Omar Defeo (UNDECIMAR, Faculty of Sciences, Montevideo, Uruguay)

Co-management (Co-M), defined as the sharing of management tasks and responsibilities between governments and local users, is emerging as a powerful institutional arrangement to redress fisheries paradigm failures, yet long-term assessments of its performance are lacking. An example of the usefulness of this governance mode is given by the yellow clam (Mesodesma mactroides) fishery in Rocha, Uruguay. The yellow clam is a high-value species targeted by approximately 40 fishers by mean of shovels and handpicking. In order to assess the performance of co-management we distinguished between a pre-implementation phase
(2008-2010) and an implementation phase (2011-2014). Co-management performance was assessed by before-after comparisons of social-ecological indicators. Changes in fishery indicators associated with Co-M implementation (abundance, individual size, landings, fishing effort, catch per unit effort (CPUE), unit price and economic revenues per unit of effort) were estimated using different statistical approaches, including analyses of variance and response ratios.

Our 7-year analysis suggests that Co-M could be an effective governance mode to sustain this fishery over time, leading to improved social-ecological fishery conditions and a greater production capacity. A common significant bioeconomic improvement of main response variables was quantified and can be summarized in increased population abundance, CPUE, unit prices, economic revenues at low landing and fishing effort levels and a major destination of the product for human consumption instead of being used as bait. While, mean individual clam sizes remained fairly constant.

We conclude that co-management could be an effective vehicle for sustaining harvest and ensuring fishers welfare in this particular fishery.

Regular session 1.3: Governance (I)

Bridging organizations and multilevel governance for marine conservation and coastal communities in Indonesia

Samantha Berdej (University of Waterloo, Canada)
Derek Armitage (University of Waterloo, Canada)

Options to sustain small-scale fisheries and conserve coastal-marine systems in Bali, Indonesia are limited. There is critical need for coordination to overcome the limited influence of the central government, and to help navigate the various social, economic, and institutional barriers to sustainability. Bridging organizations (BOs) – i.e. independent entities that span the gaps between organizations to facilitate multiparty collaboration – are a potentially powerful mechanism to help overcome the barriers and challenges of small-scale fisheries and coastal-marine conservation. The objectives of this research are: 1) to critically examine how BOs can better connect local- and regional-scale conservation actions, and how they may better integrate different systems of practices, knowledge and beliefs (by e.g., addressing trade-offs); and 2) to assess the ability of select BOs to contribute to more effective multi-level governance of Bali’s coastal-marine systems, including small-scale fisheries. Semi-structured interviews (n=130) were coupled with social network analysis to identify and characterize four BOs – and their social networks – operating at the district and provincial levels. Our research revealed patterns of collaboration and communication (i.e. knowledge-sharing) between BOs and local level associations (e.g., seaweed farmers, fishers, territorial authorities), government agencies, funding bodies, and others. We show that BOs are taking on a number of different roles – from facilitating horizontal/vertical linkages and catalyzing new associations to serving as conduits of ideas and brokers of resources – in order to ‘bridge’ different organizations (e.g., NGOs, community-based entities, government bodies) and functional groups (e.g., private sector, marine enforcement, research).
Keeping the small in small scale: the Torres Strait lobster fishery

Shane Fava (Australian Fisheries Management Authority)
Jim Prescott (Australian Fisheries Management Authority)
Eva Plaganyi (Commonwealth Scientific and Industrial Research Organisation)
Darren Dennis (Commonwealth Scientific and Industrial Research Organisation)
Ray Moore (Torres Strait fisher)
Kenny Bedford (Torres Strait fisher)

The Torres Strait lobster fishery harvests a single high value migratory species, Panulirus ornatus, in the waters between Australia and Papua New Guinea (PNG). The fishery is uniquely managed under provisions of the Torres Strait Treaty and complimentary fisheries acts, which have objectives of preserving the traditional ways of life and livelihoods of “traditional inhabitants” (TIs). The objectives have been given effect through a series of conscious management decisions in PNG and Australia focusing on building capacity and economic viability for TIs. Examples of actively managing the fishery scale include the prohibition on the very profitable trawl fishery for migrating lobsters, vessel size restrictions and gear controls. Furthermore all reefs surrounding communities are restricted from commercial fishing to protect subsistence fishing. The number of licences issued to fishers at the ‘bigger end of small scale’ have been gradually reduced in Australia to favour the smaller scale traditional inhabitants. Collectively, the decisions taken have not been popular with those who were directly impacted because they have led to economic inefficiencies. However, the decisions have resulted in a fishery of smaller scale today than would have otherwise existed.

Despite the small scale of the fishery it has been well supported by a strong research program which has been central to the management process. Most recently research has included social research to support future decision making about fishery scale and form. We discuss the 40 year process and the extent to which the Treaty created the conditions that kept the fishery small.

Searching a cross-learning between small-scale and industrial fisheries governance tools: Is there something to learn from each other?

Amanda R. Rodrigues, Fisheries Ecosystems Laboratory (LabPesq), Oceanographic Institute, University of São Paulo, Praça do Oceanográfico, 191, São Paulo, 05508-120, SP, Brazil; Graduate Program on Oceanography, Oceanographic Institute, University of São Paulo, Brazil. E-mails: aricci@usp.br
Caroline Ykuta, Fisheries Ecosystems Laboratory (LabPesq), Oceanographic Institute, University of São Paulo, Praça do Oceanográfico, 191, São Paulo, 05508-120, SP, Brazil; Graduate Program on Oceanography, Oceanographic Institute, University of São Paulo, Brazil. caroline.ykuta@usp.br
Cássia G. Goçalo, Graduate Program on Oceanography, Oceanographic Institute, University of São Paulo, Brazil. cggocalo@gmail.com
Luciana C. M. Santos, Graduate Program on Ecology, Biosciences Institute, University of São Paulo. Rua do Matão, 321, Travessa 14, Cidade Universitária, São Paulo, SP, Brazil. santosl@usp.br
Abstract
There is a clear dichotomy in fisheries management between small-scale and industrial sectors with divergent strategies, tools, policies, and even scientific literature. We propose that an exchange of successful/unsuccessful experiences between the two sectors may provide relevant issues for governance cross-learning. Thus, we focused on 5 Brazilian small-scale fisheries resources (the crab *Ucides cordatus*, the shrimp *Xiphopenaeus kroyeri*, the groupers *Epinephelus itajara* and *E. marginatus* and the croaker *Micropogonias furnieri*) whose governance systems were investigated jointly with an industrially-explored counterpart elsewhere. The analysis followed criteria of the Ostrom’s complex SES diagram but included the further investigation of more fisheries-oriented management tools. The industrially explored stocks counterparts were the crab *Callinectes sapidus* from Lousiana/USA, the shrimps *Fenneropenaeus merguiensis* and *F. indicus* from Australia, the groupers *E. morio*, from Mexico and Cuba, and the croaker *M. furnieri* from Uruguay and Argentina. Lessons from successful management tools found in the industrial sector appeared relevant to small-scale fisheries (SSF) governance, and vice-versa. For example, input and output controls applied to some industrial fisheries may contribute to SSF sustainability while effective stakeholder participation and consideration of human/social aspects in the management system are examples of the lessons learned from SSF governance. We conclude that interdisciplinary comparative approaches observing the whole socio-ecological fisheries systems, such as our present, should promote a more fruitful conceptual dialogue on successful governance tools independently of the sector.

Introduction
Fisheries are examples of natural resources used by human societies and may therefore be considered complex socio-ecological systems (SES) (Ostrom 2009), formed by the interaction of three main sub-systems: 1) the natural, the fishery resource, the ecosystem and the biophysical environment; 2) the human, fishermen, consumers, market sector/industry, fishing communities and economic social and cultural environment; and 3) the management, plans, policies, management, research and development of fisheries (Charles 2001). The last sub-system seems crucial since common property resources with open access can’t prevent stocks of collapsing, as proposed by Hardin (1968), and overfishing, and the production of lower yields than its biological and ecological potential (Beddington et al. 2007) have expanded. Such overexploitation not only causes negative ecological consequences, but also generates negative social and economic impacts (FAO 2012). Therefore, the governance of fisheries systems shows particularities in the aim of promoting sustainable practices.

However, there is a clear dichotomy between small-scale (artisanal) and large-scale (industrial) fisheries management. A sort of gap on governance tools exchange and conceptual thinking between both sectors leads to different management strategies and divergent policies, beyond their often treatment as different “disciplines” or “knowledge areas”.

In that context, the aim of this study was to compare the governance systems and management strategies of both small-scale and industrial fisheries, focusing on a selection of Brazilian small-scale fisheries resources and some biologically analogous, industrially explored counterparts elsewhere in order to obtain a cross-learning analysis.
Methods
The governance of a total of nine highly-exploited target fisheries resources was evaluated based on the literature. The emphasis was given on a selection of five Brazilian small-scale fisheries that are considered socio-economically relevant, for which four biologically analogous industrial fisheries with high market importance elsewhere were identified (Figure 1). Analytical criteria were defined accordingly to the SES complex diagram (Ostrom 2009), while management tools followed the classification proposed by Charles (2001). After the data organization and plot of information and management measures applied to those fisheries were set, the strategies that could be beneficial to the small-scale fisheries sector and vice versa were evaluated and discussed.

Results and Discussion
The comparative analysis of the selected small-scale and industrial fisheries (Table 2) showed some important differences in their sectorial approaches, mainly in relation to management measures. For example, the small-scale fisheries in place haven’t shown any catch-based management tool (output control). Additionally, some target stocks of the small-scale fisheries shown to be endangered by overfishing. In general, we observed that a higher diversity and number of management tools were found in the industrial sector, mainly as input and output controls, which can be applied to the small-scale fisheries in question in terms of rights-based approaches.

For example, some of the management measures showed by the industrial fishery of the shrimps *F. indicus* and *F. merguiensis* in Northern Australia showed to be positive for stocks protection and maintaining long-term fishing activities. Those could be eventually adopted in the management of the shrimp *X. kroyeri* in Southern Brazil where some control of the number of operative vessels and the amount of catch per boat may be managed. Similarly, important measures of input control shown in the industrial fishery of the crab *C. spapidus* in Louisiana, USA, such as fishers licensing and catch control rules seemed of interest to be applied in the small-scale fishery of the crab *U. cordatus* in the northeast of Brazil. The *U. cordatus* stocks are declining in Brazil, some of them considered over-exploited, thus the management measures found to that industrial counterpart could contribute to the stocks recovery and to the maintenance of long-term goals, such as the economic subsistence for local populations.
Figure 1. Diagram of the selected Brazilian small-scale fisheries resources (left) whose
governance systems were investigated jointly with an industrially-explored counterpart
elsewhere (right), allowing the cross-learning analysis.

Also, the small-scale fishery of the groupers *E. marginatus* and *E. itajara* in Brazil could
benefit from the management experience from the industrial fisheries on the red grouper *E.
marginatus* in the Gulf of Mexico, such as the closed seasons established in reproductive periods
when aggregations occur when vulnerability to overfishing increases.

Despite the current management measures adopted in both industrial and small-scale fisheries
of *M. furnieri* in Brazil some stocks continue to be threatened. Measures as output controls
(maximum allowable catch) implemented in the industrial fisheries counterpart could be used
in the small-scale fisheries sector as rights-based approaches, as well as the technical
measures (closed seasons).

The main learning that the industrial fishery may acquire from the small-scale fisheries
management seems to be the consideration of human and social aspects in governance, and
also participative approaches during management process. In this sense, the network used for
managing the Brazilian groupers stocks could be applied to the industrial fishing of *E.
marginatus* and *E. morio*, in which the participation of governmental and non-governmental
organizations is complemented by the participation and oversight of local fishermen.

Overall, we observed that the management measures of the artisanal sector were more
qualitative while in the industrial sector they were more quantitative. It seems that the use of
an ancient management style, more qualitative, used in artisanal fisheries is gaining increasing
support from social scientists, economists and fisheries biologists to be used in data-poor
industrial fisheries (Johannes 2003). On the other hand, the management measures
implemented with successful results in industrial fisheries could be taken into account in artisanal fisheries.

**Conclusion**

A cross-learning approach proved to be fruitful in the analysis of fisheries governance. In general, governance tools of the industrial fisheries analyzed here used a more diverse set of mechanisms and were based on the quantitative regulation of both removals and profitability, while the management of the small-scale fishery focused more on closed seasons and closed areas, showing that each sector has made use of different management tools in essence. However, several tools from industrial fisheries could benefit the Brazilian small-scale fisheries that we analyzed. The main learning that the industrial sector may acquire from the artisanal sector seems to be the consideration of human and social aspects, with a more effective stakeholder participation into the management process.

We conclude that interdisciplinary comparative approaches observing the whole socio-ecological fisheries systems, such as our present, should promote a more fruitful conceptual dialogue on successful governance tools independently of the sector, and thus contributing to achieve more sustainable fisheries.
Table 2. Management measures* identified for the selected fisheries of (A) crabs, (B) shrimps, (C)groupers and (D) croakers, explored by small-scale and industrial fisheries. * According to Charles 2001

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<th>Industrial fisheries</th>
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<td>Resources (target species):</td>
<td>Resources (target species):</td>
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<tr>
<td>A- <em>Ucides cordatus</em> (NE Brazil)</td>
<td>A- <em>Callinectes sapidus</em> (Louisiana, USA)</td>
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<td>B- <em>Xiphopenaeus kroyeri</em> (South Brazil)</td>
<td>B- <em>Fenneropenaeus merguiensi</em> and <em>F. indicus</em> (Australia)</td>
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<td>C- <em>Epinephelus itajara</em> (SC, Brazil)</td>
<td>C- <em>Epinephelus morio</em> (Gulf of Mexico)</td>
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<td>D- <em>Micropogonias furnieri</em> (SP, Brazil)</td>
<td>D- <em>Micropogonias furnieri</em> (Uruguay and Argentina)</td>
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**Input control**
- Limiting entry: Fishers licensing
- Limiting entry: number of vessels
- Limiting the capacity per vessel: motor boats (catch, feet length and speed)

**Output control**
- Escapement control: Annual fully-recruited biomass: 6 to 34 tons.
- Individual quotas: 500kg/per boat/per day
- Community quotas: 1,200 mt per year
- Total allowable catch: 40,000 t.
- Individual quotas: 56% for Uruguay and 44% for Argentina

**Technical measures**
- Gear restrictions: *redinha*
- Gear restrictions: gear control
- Gear restrictions: artisanal fisheries
- Gear restrictions: maximum length and
- Gear restrictions: ghost fishing gear
- Gear restrictions: gear control
- Minimum catch size: 300 mm
- Gear restrictions: maximum length of gill
<table>
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<tr>
<th>Ecologically based management</th>
<th>Marine Protected Areas</th>
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<td>Indirect economic instruments</td>
<td>Subsidies: fuel and secure in the closed season</td>
<td>Subsidies: fuel and secure in the closed season</td>
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- is forbidden; 
- Minimum catch size: 60 mm; 
- Closed seasons
- only permitted with line and hook
- Minimum catch size: 470 mm.
- height of gill nets Minimum catch size: 250 mm 
- Closed areas 
- Closed seasons
- and night fishery Minimum catch size: 127 mm 
- Closed areas 
- Closed seasons
- Minimum catch size: 320 mm 
- Closed areas
References

Bottom-up fisheries management in Ecuador, a lesson to share

Hans Ruperti, Universidad de Las Palmas de Gran Canaria, Faculty of Marine Sciences, Campus Tafira, 35017 - Las Palmas de Gran Canaria, Spain
Fundación Centro de Educación e Investigación Costero Marina - CEICOMAR, Avda. Guayas s/n, Puerto Cayo, Ecuador
Víctor Veliz, Universidad Laica Eloy Alfaro de Manabí, Faculty of Marine Sciences, Vía San Mateo s/n, Manta, Ecuador
Fundación Centro de Educación e Investigación Costero Marina - CEICOMAR, Avda. Guayas s/n, Puerto Cayo, Ecuador
Alexandra Apolinario, Fundación Centro de Educación e Investigación Costero Marina - CEICOMAR, Avda. Guayas s/n, Puerto Cayo, Ecuador
José J. Castro Hernández, Universidad de Las Palmas de Gran Canaria, Faculty of Marine Sciences, Campus Tafira, 35017 - Las Palmas de Gran Canaria, Spain
Thijs Christiaan van Son, Marine Geology group, Geological Survey of Norway (NGU), PB 6315 Sluppen, 7491 Trondheim, Norway

In Ecuador the artisanal fishing activity is a major source of economic livelihood and social safeguard for coastal dwellers. This fishery is characterized by a very heterogeneous fleet, the use of different fishing gear, uncertainty concerning the number of people taking part in this activity, and a lack of consistency in management policies. Understanding and assessing the contributions from both social and institutional agents is likely to lead to an improved management of the fisheries.

The aim of this work is to describe the management as well as evaluate the participatory processes involved in the small-scale fisheries in the fishing village of Puerto Cayo.
(Manabí province). The methodology uses secondary and primary sources of information. On-site tasks were performed using participation dynamics and workable linkages between authorities and fishermen. This information provides invaluable insight into how the decentralized model of the fisheries management works, especially in terms of its economic performance, cost structure, and level of fishing effort.

The formation of the Participatory Management Board of Puerto Cayo (Junta de Manejo Participativo Puerto Cayo), an active and continuous interaction between local and national stakeholders, and the application of mechanisms for interagency governance are the most important actions implemented in order to enhance the management and participatory processes in this small-scale fishery. These actions are all consistent with the national policy for management of this type of fisheries. These insights has made it possible to implement fishery management strategies that now incorporate agreed actions with regard to organization and local self-regulation.

Can Ostrom’s design principles be used to guide policies towards participatory management? Examples from two South American small-scale fisheries

Micaela Trimble. Center for Marine Studies, Postdoctoral Fellow at the Graduate Program in Coastal and Oceanic Systems, Federal University of Paraná, Brazil. E-mail: mica.trimble@gmail.com.

Fikret Berkes. Natural Resources Institute, University of Manitoba, Canada. E-mail: Fikret.Berkes@ad.umanitoba.ca

Abstract

The literature on commons has established the validity and significance of Elinor Ostrom’s design principles for collective action. Can these principles be used to guide policies towards adaptive co-management? We test this idea by using two case studies, Piriápolis (Uruguay) and Paraty (Brazil). Both cases are small-scale fisheries, and both have been experiencing a social-ecological crisis of declining catches and socio-economic conditions, in a context of top-down government management. However, there are signs in both countries that government policies are moving towards co-management. The objective of this article is to identify opportunities and barriers to adaptive co-management of small-scale fisheries in Uruguay and Brazil using Ostrom’s design principles (as amended by Cox and colleagues) for guidance. Both case studies partially meet eight of the eleven design principles, but do not fulfill three (clearly defined resource boundaries, nested enterprises and conflict-resolution mechanisms). The analysis of the fisheries using Ostrom’s principles shed light on the opportunities and barriers to adaptive co-management in three categories (resource system, resource users and governance system). Barriers include long-standing conflicts between small-scale fishers and government agencies, and between small and large-scale fisheries sectors. Nevertheless, recent initiatives involving participatory approaches to research and management show potential to improve compliance with several principles. The
application of Ostrom's principles posed some challenges regarding scale issues and lack of attention to learning.

**Introduction**

Since the late 1980s, co-management has been widely proposed as a partial solution to resource crises and conflicts. It was initially conceived as a power-sharing arrangement between the state and a community of resource users (e.g. Pinkerton 1989). However, co-management has been evolving over time; the concept has become more complex, recognizing the existence of multiple stakeholders with multiple relationships (Carlsson and Berkes 2005). Further, to make rapid progress, co-management needs to incorporate a learning-by-doing component, effectively becoming adaptive co-management over time (Armitage et al. 2009). Adaptive co-management combines the dynamic learning characteristic of adaptive management with the linking characteristic of co-management, vertically and horizontally (Plummer et al. 2012).

Our research is based on two coastal artisanal or small-scale fisheries, one in Piriápolis (Río de la Plata, Uruguay) and the other in Praia Grande/Iilha do Araújo (Paraty, Brazil) (see Trimble and Johnson 2013 for a description of these areas, and Trimble and Berkes Under review for details on the research methods). Small-scale fisheries in coastal Uruguay and Brazil have been experiencing a social-ecological crisis, which is alarming because of the numerous coastal communities they sustain. However, there are signs of progress. In both countries, government agencies in charge of fisheries management have shown willingness to devolve some power to user groups in order to increase compliance of rules through co-management, among other reasons (Trimble and Johnson 2013).

Considering that adaptive co-management should be the target of fisheries governance because of its positive outcomes, such as increased social-ecological resilience, enhanced efficiency and effectiveness of decision making, and community empowerment (Plummer et al. 2012), our objective is to identify opportunities and barriers to adaptive co-management of small-scale fisheries in coastal Uruguay and Brazil using Ostrom’s design principles for guidance. Ostrom’s (1990) eight design principles for commons sustainability and collective action have been used to evaluate and diagnose various resource systems, including fisheries (e.g. Pinkerton and Weinstein 1995). Cox et al. (2010) analyzed 91 of these studies and concluded that Ostrom’s principles were well supported empirically, but suggested splitting three of them in line with the evidence from the cases.

**Analyzing the fisheries with the aid of Ostrom’s design principles**

In this section we analyze if the two fisheries comply with Ostrom’s principles, indicating if conditions for collective action are met (Table 1).

<table>
<thead>
<tr>
<th>Design principles (Ostrom 1990, Cox et al. 2010)</th>
<th>Piriápolis</th>
<th>Paraty</th>
</tr>
</thead>
</table>

Table 1. Fulfillment of Ostrom’s design principles in the two small-scale fisheries
<table>
<thead>
<tr>
<th>1A. Clearly defined user boundaries</th>
<th>Partly yes</th>
<th>Partly yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1B. Clearly defined resource boundaries</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2A. Congruence between rules and local conditions</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>2B. Proportional equivalence between costs (provision rules) and benefits (appropriation rules)</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>3. Collective-choice arrangements</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>4A. Monitoring rule enforcement</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>4B. Monitoring the resources</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>5. Graduated sanctions</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>6. Conflict-resolution mechanisms</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>7. Minimal recognition of rights to organize</td>
<td>Partly yes</td>
<td>Partly yes</td>
</tr>
<tr>
<td>8. Nested enterprises</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Principles violated**

The main fishing resources in the two study areas are distributed widely and hence the conditions do not comply with Principle 1B (Clearly defined resource boundaries). For instance, the whitemouth croaker is widely distributed along the western coast of the Atlantic Ocean, from Mexico to Argentina. In Piriápolis and Paraty, there are numerous conflicts between fishers and government agencies, as well as within and between user groups; between small- and large-scale fishers, between small-scale fishers using different gear, and between small-scale and sport fishers. However, there are no arenas for addressing and resolving these conflicts (Principle 6 - Conflict-resolution mechanisms). Nested enterprises (Principle 9) is another principle not met. Given the multiple scales of fishing resources in Piriápolis and Paraty, nesting the smaller systems in the larger ones may be necessary as institutional nesting can help accomplish the match between the user and the resource boundaries.

**Principles partially satisfied**

Clear boundaries between legitimate users and nonusers are important for collective action (Principle 1A). Both in Uruguay and Brazil, the large-scale fishery exploits many of the same species as the small-scale fishery. "Legitimate users" are those who have a valid fishing license issued by DINARA (national fisheries agency of Uruguay) or the Ministry of Fisheries and Aquaculture (Brazil). In Brazil, small-scale fishing licenses do not determine boundaries for the fishing activity, except that the boats cannot operate inside no-take protected areas. Fishers in Paraty usually fish close to their community, and there is some informal division of fishing spots, although there is shared use of many other spots by fishers from different communities. In Uruguay, DINARA in 2002 established the boundaries of four marine-coastal Artisanal Fishing Zones in the Río de la Plata and Atlantic Ocean, to facilitate fisher mobility within their zone.
In Piriápolis and Paraty, there was some congruence between local rules and local conditions (Principle 2A). In both areas there was a local rule of first comer’s rights. Once someone sets his gillnets, other fishers are expected to give him enough space so as not to cut off his fish supply. Non-congruence between formal rules imposed by the government and local social-environmental conditions seemed to be common in both areas.

Principle 2B states that the benefits obtained by users from a commons, as determined by appropriation rules, should be proportional to inputs in the form of labour, material, or money, as determined by provision rules. In both areas, given the prevailing lack of restrictions on the fishing effort, boat owners with higher financial capital are free to increase the fishing effort and make more profit. In Piriápolis and Paraty, there were several local rules, as well as trust, solidarity and reciprocity norms among fishers. However, there were no collective-choice arrangements to limit fishing effort (Principle 3 - Collective-choice arrangements); this is partly explainable in terms of fishers' powerlessness in a context in which the large-scale fishery harvests much the same resources, with considerably higher catches. Principle 7 posits that government agencies respect the right of local users to create their own institutions. This principle is partially fulfilled in both study areas, but not to the full extent because externally imposed rules are incongruent with local conditions.

Monitoring compliance of rules and condition of resources (Principles 4A and 4B), as well as assessing graduated sanctions when rules are violated (Principle 5), are three other principles leading to collective action. In Piriápolis and Paraty, fishers conduct informal monitoring of resources, but their long-term observations about the resources rarely reach the government agencies. Fishers from the two areas also monitor compliance, but when it comes to formal rules, they expect the government to enforce. When local rules are violated, informal sanctions usually follow. However, these are neither graduated nor collectively established.

**Opportunities for improving compliance with Ostrom’s design principles**

Except for resource boundaries, which cannot be changed, the fulfillment of the remaining principles can potentially be improved. Here we argue using three lines of evidence that this could be done through participatory approaches. First, a multi-stakeholder participatory research initiative developed in Piriápolis since 2011 provided opportunities for improving compliance with some of the principles. Fifteen participants from four stakeholder groups (fishers, DINARA, researchers, NGO) were committed to this process and formed the group POPA. The analysis of the contributions of this initiative to future co-management in the area (Trimble and Berkes 2013), as well as its evaluation (Trimble and Lázaro 2014), suggest that POPA provided an arena for conflict resolution between fishers and DINARA (Principle 6). It also contributed to improved collective-choice arrangements by increasing fishers’ unity (Principle 3).

Second, the new fisheries law in Uruguay provides a “window of opportunity” for alternative management approaches. Regional and local advisory boards for artisanal
fisheries co-management ("zonal councils") were established in some areas in 2012. They are integrated by representatives of DINARA, local and departmental governments, Coast Guard, and artisanal fishers. These councils can potentially function for conflict resolution (Principle 6). They can also contribute to building nested enterprises if horizontal and vertical linkages influencing governance decisions are established (Principle 8). The implementation of zonal councils, which requires that fishers elect legitimate representatives, could contribute to collective-choice arrangements if fishers’ organizational capacity is improved (Principle 3), perhaps by the help of external stakeholders.

Third, government agencies responsible for fisheries and environmental management in Brazil have included participatory guidelines and frameworks in legislation. In our study region, an opportunity for fisher participation emerged in 2012, when the Consultative Council of the ESEC Tamoios (no-take protected area) started a process towards building the Commitment Terms between the protected area and fishers from Tarituba (Paraty) (Trimble et al. 2014). These Terms can potentially contribute to reducing conflicts between fishers and the government (Principle 6); they could help increase congruence between local and formal rules (Principle 2A); and they can favour the emergence of collective-choice arrangements among fishers (Principle 3). Nonetheless, Commitment Terms do not ensure fisher autonomy in decision making (Araujo et al. 2014), which may weaken Principle 6.

**Discussion**

Our analysis using the two examples indicates that the design principles do indeed help assess cases and provide guidance in the transition from top-down management to (adaptive) co-management (Table 2). Many of the barriers to (adaptive) co-management of small-scale fisheries in coastal Uruguay and Brazil are complex and concern resource users and the governance system, indicating the need for institutional arrangements involving stakeholders at multiple levels.

<table>
<thead>
<tr>
<th>Table 2. Opportunities and barriers to small-scale fisheries (adaptive) co-management in Piriápolis-Uruguay (UR) and Paraty-Brazil (BR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunities</strong></td>
</tr>
<tr>
<td><strong>Resource System</strong></td>
</tr>
<tr>
<td>- (UR/BR) Resource crisis may lead to management changes</td>
</tr>
<tr>
<td>- (UR/BR) Resource crisis may lead to management changes</td>
</tr>
<tr>
<td><strong>Resource Users</strong></td>
</tr>
<tr>
<td>- (UR/BR) Local rules and social norms</td>
</tr>
<tr>
<td>- (BR) Clear group boundaries</td>
</tr>
<tr>
<td>- (UR) Fishers’ capacity to act collectively when facing crises</td>
</tr>
<tr>
<td>- (UR/BR) Fishers’ interest in co-management</td>
</tr>
</tbody>
</table>
Governance System
- (UR) New fisheries law supporting the creation of fisheries co-management councils
- (UR) Potential of participatory research involving multiple stakeholders
- (BR) Growing initiatives for fisher participation in protected area management
- (UR/BR) Prevailing top-down management
- (UR/BR) Conflicts between fishers and management agencies
- (UR/BR) Weak coordination among government agencies
- (UR/BR) Weak government rule enforcement
- (UR/BR) Poor capacity of stakeholders regarding co-management

Barriers or challenges for transitioning towards (adaptive) co-management include fishers’ seasonal migration and several kinds of scale issues. In many cases fishers are mobile, a condition that has been poorly discussed. Fishers’ seasonal migration has implications for co-management (Crona and Rosendo 2011); migrants should be included in decision-making processes as a distinct user-group.

A main component of adaptive co-management, i.e. learning, did not arise when assessing Ostrom’s principles. Furthermore, challenges of using Ostrom’s design principles towards adaptive co-management include scale issues. Principles should be analyzed over time, and the principles should be made or treated as dynamic (e.g. Gelcich et al. 2006). Most principles can potentially be improved through policy interventions. Adaptive co-management becomes an attractive approach for this because there is evidence that it leads to improved access to resources, increased equity in distribution of costs and benefits, resolution of conflicts, development of networks, and enhanced efficiency and effectiveness of management (Plummer et al. 2012).

References


Trimble, M., & Berkes, F. (Under review). Can Ostrom's principles be used to guide policies and initiatives towards adaptive co-management? Examples from two South American small-scale fisheries. *Ecological Economics*.


The Round table of Mexican fisheries: Fisheries governance examples from Northwestern Mexico

José Alberto Zepeda Domínguez (CICIMAR-IPN)
Francisco Arreguín Sánchez (CICIMAR-IPN)
Miguel Ángel Cisneros-Mata (INAPAESCA)
Pablo del Monte Luna (CICIMAR-IPN)
Germán Ponce Díaz (CICIMAR-IPN)
Manuel Zetina Rejón (CICIMAR-IPN)
Daniel Lluch Belda (CICIMAR-IPN)

Fisheries management currently claims for fisheries governance (FG), a more balanced scheme, which proposes to share the power among government, civil society and economics; in Mexico and other developing countries, the lack of operational regulations has delayed their implementation. Several authors state that topological analysis is useful to identify key stakeholders and their relations, so it can be used to identify the generalized model of participation needed to achieve the FG. The aim of this study was to identify how the FG social structure is currently performing in a blue crab, abalone and red lobster small-scale fisheries in NW Mexico. With interviews we did a stakeholders map of ach fishery. With social networks analysis (SNA) tools we identified consistent
key players (centrality measures); SNA showed that all stakeholders recognized by law are present (government, civil society, fishermen and researchers), although they play different social roles in each fishery. Structural and regular equivalences were identified for each fishery; the three systems showed that federal management agency, its technical arm and producers associations can be grouped in a main cluster with different companions according the fishery. Federal Agencies and producer associations were the key players in all the three fisheries, state agencies, NGOs and research institutions are present with different importance in each system. The round table contains all the guests but some of them can play a more important role if a FG will become the generalized scheme, SNA is an efficient way to identify the key players and their interactions.

Regular session 1.4: Spatial management and MPAs

Putting spatial management into practise: a case study of sea cucumber fisheries in New Caledonia and Vanuatu (Southwest Pacific)

Marc Léopold (Institut de Recherche pour le Développement, IRD)
Jayven Ham (Fisheries Department of Vanuatu)
Rocky Kaku (Fisheries Department of Vanuatu)
Zacharie Moenteapo (Fisheries Division of the Northern Province, New Caledonia)

Many small-scale fisheries targeting commercial sedentary invertebrates have dramatically declined worldwide due to rapid overexploitation and ineffective management. Limited availability of relevant biological data has been a critical issue to implement precautionary management of these vulnerable fisheries. This study designed a spatial resource monitoring and management program for small-scale sea cucumber fisheries using case studies in New Caledonia and Vanuatu (Southwest Pacific). Marine habitats have been mapped by the Fisheries Departments to design fishery-independent surveys to assess multispecies stocks over several fishing grounds (10-20 km²) in both countries. Assessment costs ranged from ~US$ 140 km⁻² to ~US$ 500 km⁻². A database then computes statistical calculations to estimate the size structure, abundance, density, biomass, and spatial distribution of the total stock. We observed that sea cucumber populations are heterogeneously distributed across fishing grounds, which calls for spatially-explicit regulatory measures. A collective TAC (Total Allowable Catch) of each commercial species was therefore set in each fishing ground corresponding to the conservative statistical estimate of the legal-sized biomass. Very positive ecological and economic outcomes in the New Caledonia case study since 2008 suggest that such fine scale TAC-based systems may perform efficiently in other sites providing that they are supported by local fishers’ organizations. Management costs have also to be rationalized with expected returns from catches (eg, participative monitoring, rotational harvest). This study provides an important lesson about the use of direct stock biomass estimates in spatial TAC-based co-management systems for small-scale sea cucumber fisheries in countries with limited expertise and financial capacity.
A collaborative approach to understand interactions between fishing activities, ecosystem processes, and managed areas

Marcia Moreno-Báez, Scripps Institution of Oceanography, University of California San Diego, mmorenobaez@ucsd.edu
Catalina López-Sagastegui, University of California Riverside, catalina.lopez-sagastegui@ucr.edu
Ismael Mascareñas-Osorio, Centro para la Biodiversidad Marina y la Conservación, A.C., ismael.mascarenas@gocmarineprogram.org
Juan José Cota-Nieto, Centro para la Biodiversidad Marina y la Conservación, A.C., juan.jose@gocmarineprogram.org
Brad Erisman, Scripps Institution of Oceanography, University of California San Diego, berisman@ucsd.edu
Octavio Aburto-Oropeza, Scripps Institution of Oceanography, University of California San Diego, maburto@ucsd.edu

The proper management of marine fisheries is crucial for maintaining the economic livelihoods and food security of coastal communities and protecting the structure and function of healthy marine ecosystems throughout the world. A change of paradigm where policies and frameworks include fishers and stakeholders is needed in order to overcome challenges of fish stocks overexploitation and depletion. As part of this vision, the Gulf of California Marine Program in the Center for Marine Biodiversity and Conservation have created a collaborative fisheries research (a type of citizen science) program in several communities in the region to understand spatial and temporal interactions between small-scale fishing activities, ecosystem processes, and managed areas (e.g., marine protected areas). By collaborating with all sectors in research, engaging in two-way exchanges of information during workshops and meetings, and disseminating all relevant information in a transparent manner, we are creating a common forum through which fishers, communities, stakeholders, and decision-makers have an equal and comprehensive understanding. We present two case studies highlighting small-scale fishing interactions with space-based management areas. In both communities we studied fishing activity related to the four - or more - most important commercial species. We see this approach as a key step on identifying the linkages of small-scale fishing activities, ecosystems processes and managed areas. Additionally, our approach helps on identifying best practices for fisheries. This process inspires communities and fishers to participate in the management process and facilitates the integration of scientific information within resource management strategies.

Dynamic territories in traditional people: A case study in two Marine Protected Areas in South Brazil
A territorial approach to the planning of management and development in marine protected areas (MPAs) contribute to a better understanding of traditional territories dynamic. The reconstruction of the trajectories of development enables to build, collectively with traditional people, the drivers of change and its outcomes, as well as to identify creative shifts in local livelihoods. We investigated traditional people within two MPAs at south Brazil, in order to understand the main drivers of changes and to design indicators of traditionality according to their individual and collective memories. Analysis of the trajectories of development is a system-thinking and participatory approach, taking into consideration sociopolitical, socioeconomic, and sociocultural and social-ecological dimensions. Stakeholders took part of the analysis by assessing and by giving new meanings to results, allowing for an analysis of potentials and obstacles to a territorial approach to management and development at the MPAs. As a result, MPAs magnified the collapse of social-ecological systems, caused by the inefficacy of management agencies in considering traditional territories in planning and management of the MPAs. Drivers of changes influence for dynamic changes in these traditional territories, with a variety of livelihoods in space and time. Current policies on management and economic development neglect traditional territories as well as they failed in keeping resilience of coastal ecosystems which also affect local livelihoods.

**Fishing strategies of artisanal fishers in response to landscape changes in southern Chile**

Tracy Van Holt (Global Economic Dynamics & The Biosphere Programme, The Royal Swedish Academy of Sciences, Stockholm, Sweden and East Carolina University, NC, USA)
Beatrice Crona (Global Economic Dynamics & The Biosphere Programme, The Royal Swedish Academy of Sciences, Stockholm, Sweden)
Jeffrey C. Johnson (East Carolina University, NC, USA)

Establishment of industrial tree plantation systems is becoming an increasingly extensive land-use transition globally– fuelled by the shift from primarily supplying domestic energy and wood-product to supplying global pulp markets and the proposed carbon markets. Land-use changes, including tree plantations, have been shown to be associated with higher nutrient load in adjacent coastal waters with potential impacts on marine ecosystems. One potential impact of high nutrient loads is an increased incidence in phytoplankton blooms, which in turn decreases the quality of harvested benthic invertebrates, leading to a reduction in its market price. This study examines if harvesting behavior of fishers’ is influenced by the nutrient load impacts brought about by tree-
plantation establishment in southern Chile. We show that the harvesting profiles of small-scale fishers vary according to land use patterns and the consequential nutrient loading. Catches of fishers working in areas near tree plantations were comprised mainly of finfish whereas fishers working far from tree plantations harvested mainly benthic invertebrates. We discuss the implication for fisheries management.

Marine protected areas and fishery displacement: testing hypotheses in the northern Channel Islands, California

Cristiane Elfes (University of California Santa Barbara)
Crow White (California Polytechnic University San Luis Obispo)
Steve Gaines (University of California Santa Barbara)
Ben Halpern (University of California Santa Barbara)
David Siegel (University of California Santa Barbara)

Abstract Spatial fisheries management is increasingly common, yet displacement of fishing in response to MPAs and other no-take zones remains poorly understood. Closing valuable or easily accessible areas to fishing may directly impact food security and profits for fishing communities, particularly in the first years following MPA designation. In addition, MPAs may concentrate fishing effort to smaller areas, leading to overharvesting and negative biodiversity impacts. Thus, understanding fisher responses to MPAs and other spatial closures is needed to provide for more realistic expectations of the ecological and socioeconomic effects of such policies. In this study we examine fishing distribution data before and after the establishment of 13 (11 no-take) MPAs in the northern California Channel Islands. Fishers in this region use small to medium sized vessels, targeting sea urchin, spiny lobster, crab and finfishes. We test the main hypotheses presented in the literature on MPA effects on fisher distribution, including: 1) MPAs cause a reduction (loss) rather than reallocation of fishing; 2) fishers redistribute primarily along the outside border of MPAs to minimize displacement distance and assimilate potential benefits from MPA spill over; and 3) fishers reallocate based on suitable habitat and/or resource distribution. We show how the factors described by these hypotheses play a role in the spatial distribution of fishing post-MPA establishment and discuss the how findings can be used to develop a predictive model of vessel reallocation.

Assessing the spatial distribution of small-scale vessels’ operations from VMS data in the southeastern Mexico

Edgar Torres-Irineo, Cinvestav del IPN, Unidad Mérida. Mérida, Yucatán, México.
edgar.torres@mda.cinvestav.mx
Silvia Salas, Cinvestav del IPN, Unidad Mérida. Mérida, Yucatán, México.
marquez.silvia@gmail.com
Jorge Iván Euán-Ávila, Cinvestav del IPN, Unidad Mérida. Mérida, Yucatán, México.
Abstract
Monitoring fishing effort allocation of small-scale fisheries (SSF) has been challenging for assessment and management, mainly at an operational fine-scale. The use of Vessel Monitoring Systems (VMS), implemented mainly in industrial vessels, has provided detailed information about their spatial distribution, helping hence to assess and control fishing effort. Recently, in Mexico, a VMS for small-scale fleets was developed and tested in several fishing communities of the southeastern Mexico. To evaluate fishing effort distribution one of the challenges, as in other fisheries, is to know if vessels are fishing or in transit, so the real fishing mortality is excerpted. For SSF it can be difficult to split as vessels operate with different fishing gears and target different species and land in a wide spread area. Furthermore, the allocation of the fishing effort is influenced by target species availability and weather conditions. The aim of this study is to 1) determine fishing operations of small-scale vessels through machine learning methods (random forest) and 2) to characterize the fishing grounds through the species distribution modeling approach. The results highlight the usefulness of VMS to small-scale fisheries assessment with the respective management implications. Characteristics associated to fishing grounds contribute to our understanding of fishing patterns influenced by environmental conditions, and can indirectly evidence the spatial distribution of target species. We discuss the implications on management and assessment of this first attempt to use VMS data in SSF.

Introduction
Spatial distribution of fishing effort can affect trends in catch rates and can be incorporated into planning of spatial management procedures (Daw, 2008). During the fishing process each fisher may choose different options about where and when to fish, but limitations imposed by environmental or market variability influence the way fishers allocate their fishing effort to exploit resources given particular human, social, and cultural context (Salas and Gaertner, 2004). Understanding spatial fishing effort allocation can allow identifying fishing areas characterized by specific environmental conditions, as well as fishers’ responses when implementing spatial management (McCluskey and Lewison, 2008).

Fishing effort allocation has been assessed at large spatial scales when data is available. In industrial fisheries, skippers usually report geographical positions of fishing activities in logbooks. However, for small-scale fisheries (SSF) in developing countries it has been difficult obtaining this type of information, hindering the implementation of spatial management. In this sense, the introduction of vessel monitoring systems (VMS) has allowed access to data related with the vessels’ spatial distribution, providing high-
resolution data of fishing grounds (Jennings and Lee, 2012). VMS were introduced to support management authorities to verify if vessels are fishing at a time, and if they are in areas where is allowed to fish (Lee et al., 2010). Because VMS data only reflect the vessel geographical position, some methods have been developed to identify vessel activity, i.e. fishing, searching, and cruising (e.g. Joo et al., 2013). In some cases, spatial effort distribution has been used to indirectly reflect the spatial dispersion of target species (e.g., Bertrand et al., 2008). In the case of SSF, the range of vessels’ spatial distribution is restricted due to their low motility. Combination of fishing information with species distribution can improve the knowledge for management. Hence, fishing grounds can be characterized using satellite remote sensing information (Chassot et al., 2011) coupled with species distribution models (SDM). SDM use environmental and/or geographic information to explain observed patterns of species occurrences (Elith and Graham, 2009). These models are used to both characterize species niche and their potential spatial distribution (Elith et al., 2006). Detailed information about species’ ecological and geographic distributions is fundamental for forecasting and for definition of management schemes (Elith et al., 2006).

In the southeastern region of Mexico, small-scale boats (8 and 12 m long) represent 90% of the fishing fleet (Fernández et al. 2011) where close to 15,000 people benefit of direct jobs, and a high proportion of total catch comes from the small-scale fleet that targets highly valuable species. In the region, species targeted include Caribbean lobster (Panulirus argus), Mayan octopus (Octopus maya), and red grouper (Epinephelus morio), which vary in proportion through the fishing season. Small-scale boats usually perform daily fishing trips and operate near shore. Most fishers can switch among target species throughout the year, depending on species availability, regulations and market demand, changing the fishing gear used. All these issues make difficult the management of the main fishing resources in the region.

Recently, in 2010 a VMS for small-scale fleets in southeastern Mexico was developed and tested. This pilot system allowed learning about the extent of the spatial distribution of small-scale vessels in the region, which was unknown before. However, as stated earlier, VMS data do not necessarily reflect all vessels’ activities at sea; hence filter analysis is needed to know these activities. This information can be useful to get information regarding fishing grounds and their characteristics. In this study information coming from a VMS for SSF helped to identify fishing and transit positions and to define and characterize potential fishing grounds associated to these locations. The approach can be implemented to systematize and analyze information to a fine-scale obtained from a vast amount of data coming from VMS.

**Methods**

VMS data were collected from 11 fishing ports comprising Tabasco, Campeche, Yucatán, and Quintana Roo states. Data was collected during 7 months monitoring system was in operation (November 2012-June 2013). A total of 191 vessels participated in the test and about 1,608 fishing trips were recorded, resulting in around 50,000 geographical
coordinates. Each vessel position was recorded every 30 minutes. For the definition of fishing and transit positions, observers on board were recording information during some of the fishing trips. Observers’ logbooks included fishing activity along each fishing trip, i.e. fishing or transit. For each fishing trip observed several variables at each position were computed: speed, heading, changes of speed and turning angles between the previous and the current position, and between the current and the next position. To characterize the time of day when fishers perform their fishing activities, time was recorded as well. A discriminative model (i.e., random forest: RF) was used, which is an alternative approach for inferring behavioral states within recorded trajectories (see details of this modeling approach and validation of the RF in (Joo et al., 2013). 50% (7) of fishing trips observed were used as the training data set and the other 50% as the testing data set. The resulted RF was used to classify the VMS data, i.e., if vessels were in fishing or in transit.

For the species distribution modeling, fishing records were considered as presences and transit records defined as absences. As environmental variables associated with the VMS records were not available for VMS records, monthly data from MODIS Aqua satellite images (cell size of 4 km) were used (http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3 gui.cgi?instance_id=ocean_month), i.e., sea surface temperature (sst) and chlorophyll (chl), embracing VMS time period. Moreover bathymetry data from GEBCO (http://www.gebco.net/) was employed. These layers were resized to cells of 1 km and were restricted to depths above 300 m because of the extent of VMS data. Then the corresponding variable value for each coordinate in a monthly basis was extracted. The SDM was performed through the BIOMOD procedure (see details of this modeling approach and model validation in (Thuiller et al., 2009)) was implemented in the R statistical software. This modeling approach allow performing several model options (e.g., generalized additive/linear models, regression trees, random forest) to estimate the range of species distribution. A key feature of BIOMOD is that it can generate ensemble models which ameliorate the prediction of SDM (Araujo and New, 2007). The ensemble models use a combination of single-models choosing those with the evaluation of a metric threshold. Finally, the predictions of probability of vessels’ spatial distribution were carried out averaging monthly values of sst and chl, plus the depth layer. These predictions were mapped to identify the actual fishing grounds and to forecast potential fishing grounds given specific characteristics.

**Results**

In the RF model, three observed variables depicted the higher importance value, but their importance in each case changes according with the vessel activity identified. In order of importance, speed, hour, and heading, identified the transit activity. Whilst for fishing activity, the order of variables was: hour, speed, and heading (Table 1). The overall RF accuracy was high (0.904). Regarding behavioral modes, fishing seems to be the easiest mode to identify, in which, F1 was 0.653. Likewise, the greatest recall (i.e., percentage of real segments where the true mode is correctly inferred) value corresponded to fishing (0.799), while the precision was identical for both fishing and cruising (Table 1).
Table 1. Variable importance and metrics of the random forest model evaluation.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Model evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Cruising</td>
</tr>
<tr>
<td>hour</td>
<td>92.87</td>
</tr>
<tr>
<td>heading</td>
<td>53.20</td>
</tr>
<tr>
<td>heading.delta.1</td>
<td>28.98</td>
</tr>
<tr>
<td>heading.delta.2</td>
<td>44.31</td>
</tr>
<tr>
<td>speed</td>
<td>160.01</td>
</tr>
<tr>
<td>speed.delta.1</td>
<td>9.58</td>
</tr>
<tr>
<td>speed.delta.2</td>
<td>15.00</td>
</tr>
</tbody>
</table>

For SDM the RF and the classification tree analysis (CTA) depicted high values of true skill statistic (TSS), which was used as threshold (0.4) to build the ensemble model which yielded the best performance (Table 2).

Table 2. Metrics of evaluation for single-models and for the ensemble model selected (Mean TSS ensemble model).

<table>
<thead>
<tr>
<th>Single-models</th>
<th>Mean TSS ensemble model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>TSS</td>
</tr>
<tr>
<td>GAM</td>
<td>0.14</td>
</tr>
<tr>
<td>CTA</td>
<td>0.40</td>
</tr>
<tr>
<td>RF</td>
<td>0.62</td>
</tr>
<tr>
<td>MARS</td>
<td>0.20</td>
</tr>
<tr>
<td>FDA</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Testing
data
dSensitivity
Specificity
| Testing data | 0.72 | 0.719 | 0.917 |
| Sensitivity  | 83.54| 83.54 | 84.28 |
| Specificity  | 88.36| 88.36 | 87.66 |
Figure 1. Ensemble model forecasting from performed BIOMOD for species distribution models. Color scale represents the probability of perform fishing operations. Black points are the fishing positions predicted from the random forest model.

The ensemble model with better evaluation metrics was the MeanTSS model, where probabilities from different models were first transformed to presences and absences with the threshold established, maximizing the value of TSS. The ensemble model forecasting showed high probability (> 0.8) to perform fishing operations off the coast in the Gulf of Mexico. In the Yucatan shelf and the Caribbean, high probabilities were observed near the coast, from Sisal to Cozumel (Figure 1).

Discussion and conclusions

This is the first study to evaluate the spatial distribution of small-scale vessels in the southeastern Mexico. The set of statistical methods used allowed us taking advantage of VMS data. However, two shortcomings when developing this study were found: 1) the information from fishing trips with observers was low and were done in one fishing port, hence an increase on the number of fishing trips with observers in other fishing ports is necessary to expand and validate information, and 2) only three environmental variables were used, it would be interesting to include other variables such as surface currents, wind speed, type of sediments, and/or wave height, which are during fishing operations. Despite these shortcomings, the results offer analytical tools that allow having an insight on the vessels’ spatial distribution and their potential fishing grounds in the region. This information can be useful for fisheries assessment and for coastal planning (Pascual et al., 2013).
The use of a VMS in the region showed the potential to help understanding on fleet dynamics in order to improve spatial fisheries management plans. Nowadays, the implementation of a VMS in the region is challenging, from acceptance of fishers to be monitored until the costs of the devices and satellite communication, because in the region an estimated of about 20,000 small-scale vessels operate. Implementation of these systems in small scale fisheries demand the development of a platform to recording the daily catch in an integrative way with records of fishing trips coming from VMS; data from observers on board of small vessels increases the potential of the gathered data (Gerritsen and Lordan, 2011). Other important consideration is to know the type of fishing gear used by the vessels. Complete picture of catch, effort and gears employed by small-scale fleets can facilitate the definition of management units which consider species assemblages related to each fishing method (Ramírez-Rodríguez and Ojeda-Ruíz, 2012). These management units can be used with SDM and predict potential fishing grounds per unit. With these results, it is expected that both fishers and managers can be incentivized by the potential benefits of using VMS through its implementation in the region.

References


Regular session 1.5: Stewardship and sustainability

Marine resource management from a local governance perspective. Re-implementation of traditions for marine resource recovery

Jaime Aburto (Universidad Católica del Norte, Millennium Nucleus Ecology and Sustainable Management of Oceanic Islands)
Carlos Gaymer (Universidad Católica del Norte, Millennium Nucleus Ecology and Sustainable Management of Oceanic Islands, CEAZA)
Carlos Tapia (CESSO)
Francisco Cárcamo (Universidad Católica del Norte, IFOP)
Enzo Acuña (Universidad Católica del Norte, Millennium Nucleus Ecology and Sustainable Management of Oceanic Islands)
Andrés Bodini (Universidad Católica del Norte)
Wolfgang Stotz (Universidad Católica del Norte, CEAZA)

Eastern Island is one of the most isolated places in the world. However, an extreme decline in marine resources has been detected, as most of marine resources are overexploited. Top-down regulations, including fishermen and boats registration, ban and minimum catch length, implemented by the central fishery authorities at 4000 km from the island do not represent the cultural heritage and interest of Rapa Nui people. A participatory process, that included capacity building, was developed to understand, from a bottom-up perspective what people think about resource management and the most suitable tools for recovering coastal resources.
One of the traditional ways to protect marine resources are the tapus (prohibitions) that regulated the fish harvest in the past. Tapu began when Matariki, the eyes of the king (the
pleyades) disappeared from the sky, in the autumn equinox and extended to the miro titipi (when the leaves sprout) in spring. The period of tapu is known as Nga ava’e tonga (month during which the fish rest). Since this moment, most of the big fish like tuna were banned. According with the tradition, the elders said that people who ate the fish under tapu got asthma, however the real reason behind the ban was to protect the fish reproduction. At present tapus are not respected. The main reason is the high economic activity related with the tourism that demand fish like tuna all year around. However, many Rapa Nui people agree that tapu re-implementation is the best alternative to recover marine resources.

**Fisheries co-management in Costa Rica: challenges and opportunities for stewardship**

Helena Molina-Ureña (Universidad de Costa Rica)  
Luc Fargier (Université La Rochelle)  
Hans Hartmann (Université La Rochelle)

It is said that Costa Ricans have lived our lives with our backs against the seas. The long-standing absence of integrated coastal zone management approaches in the national agenda is a serious drawback, and fisheries management has not been a priority. The body of law of the Republic of Costa Rica establishes that the administration, management, ordination, strategic planning and budgeting, as well as other the actions regarding the use of the nation’s natural patrimony, pertains exclusively to the centralized government. It is the only Central American country in which co-management is not a valid mechanism to improve efficacy of Protected Areas, a situation pervasive to coastal fisheries resources. Nevertheless, effective participation by resource users attempt to circumvent this setback. In fact, several exemplary processes are being validated by the central government. Interestingly, small-scale fishers are leading the charge. Despite many sources of threats to coastal zone sustainability, strategic alliances and collaboration among local communities, central and local governments, academia, NGOs, and responsible consumers might be able to turn things around. Three examples of efforts on both the Pacific and Caribbean coasts are provided, as case studies from which valuable lessons can be drawn. The first one deals with the mechanisms for community-based requests to declare some inshore zones Marine Areas for Responsible Fishing. The second case reviews participatory monitoring efforts, and the third example details efforts to control lionfish invasion impacts.

**Demographic and environmental determinants of the artisanal fishermen ecological knowledge: a comparative analysis in the Colombian Caribbean coast**
What are the diverse meanings of conservation for communities “on the ground”, and what motivates environmental stewardship? There are different ways of approaching these questions, for example, through governance and institutional analysis, or through commons and livelihoods. Here I take an approach that has not been developed well in the literature, with the intent that it will complement current thinking. I have a two-part argument. First, I show that community objectives tend to be multiple. Second, I argue that social enterprises are a potentially useful venue toward community conservation. On the first point, people who carry out community conservation often point out that their “conservation” is about making a living, keeping resources productive, and sometimes about community control of resources or social/cultural values. A survey of UNDP Equator Initiative conservation-development projects, and similar cases around the world, indicate a diverse list of community objectives. No two cases have the same objectives but they all have multiple objectives. Regarding the second point, social enterprises are not based on the familiar utilitarian-economic models but rather on an economic model in which resources provide for broader goals – economic, political and social/cultural. Social enterprises are a good fit with the idea of multiple objectives because they tend to respond to multiple needs of a community such as job provision, self-determination, and coastal environmental protection.

Illegal fishing methods and its impacts on fishing community; A case study of Mannar District of Sri Lanka

Augustine Sosai Siluvaithasan, Associate Professor, Department of Geography, University of Jaffna, Sri Lanka

Using illegal fishing methods in the form of dynamite, stupefying substance, other noxious, harmful materials or substance and bottom trawling methods are common practice throughout the coastal areas of Sri Lanka, especially in the northern Sri Lanka. As a result, marine resources especially, corals, mangroves, mammals the marine organisms of the sea bed and aquatic resources have not only been destroyed but also disrupted. In addition, valuable human life has been lost in these illegal processes. On the whole, it affects the entire fishing community. The fisheries act 1996 of ministry of Fisheries and aquatic resources strongly prohibits the above mentioned illegal fishing methods. Further, the department of fisheries in Mannar has also taken action to prohibit illegal fishing methods, such as tree logs, concrete logs, stones, car bodies, monofilament nets, and tree branches for cuttlefish (squid) fishing in the district since 2010. There was an urgent need for identifying the prohibited or illegal fishing activities and the use of dangerous or harmful substances in fishing. The present study was carried out in Mannar coastal area from June 2013 until the later part of December 2013. Such
Identification was focused on the major threats and impacts on the fishing community and the socio, economic and ecological impacts through case studies, field surveys and library methods. The study targets to find out appropriate planning and remedies to minimize illegal fishing and to save the coastal fishing community.

“Conservation-scapes” of marine mammal bycatch in small-scale fisheries: A transdisciplinary approach to studying the interface between conservation and fisheries management

Tara Whitty, Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography

Bycatch of marine mammals in small-scale fisheries is a primary threat to marine mammals globally. Mitigating this bycatch represents a challenge at the interface between megafauna conservation and small-scale fisheries management; however, considerable data gaps exist regarding the magnitude and characteristics of bycatch and related fishing effort, and the relevant community and governance contexts. To address this, I developed the transdisciplinary approach of “mapping conservations-scapes” to study bycatch of Irrawaddy dolphins at four sites in Southeast Asia. From 2010 to 2013, I applied this approach (using ecological and social science methods) to examine: (1) the overlap between dolphins and fishing gear, and the number of bycatch events; (2) social, cultural, and economic drivers of fishing effort; (3) the governance-related opportunities and obstacles for managing fishing effort and mitigating marine mammal bycatch. Results suggest that bycatch at these sites is unsustainable for resident subpopulations of Irrawaddy dolphins, with considerable overlap between dolphins and fishing activity. Approaches to and challenges facing local fisheries management vary across the four sites, with the strongest prospect for bycatch mitigation being the site with highest community participation in marine resource user associations, engagement of government agencies, and some degree of alignment in perceived dolphin conservation goals and small-scale fisheries management goals (with dolphin bycatch reported in industrial fisheries that illegally encroach upon small-scale fishing grounds). This study demonstrates that studying conservation-scapes yields a broad view of the key elements linked to bycatch mitigation, revealing whether and how conservation goals might align with general fisheries management goals.

Can shrimp aquaculture be made resilient? A case from northwestern Sri Lanka

Eranga Galappaththi (University of Manitoba)
Fikret Berkes (University of Manitoba)

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Large-scale shrimp aquaculture by large companies has a poor record of social and environmental impacts, and of survival – a non-resilient outcome. In Sri Lanka, large shrimp farming corporations started in early 1980s, but went bankrupt by the mid-1990s because of shrimp disease outbreaks. However, small-scale shrimp farming, which started in early 1990s, managed to survive the disease challenge; there were about 600 farms in 2013. Explaining the apparent resilience of small-scale operations (as opposed to the failure of the large-scale ones) is the objective of this paper. How have small-scale shrimp farmers built resilience in social-ecological systems (SES)? What are the sources of resilience? We examined shrimp aquaculture operations in three coastal communities using a case study approach.

We analyzed social-ecological resilience with a four-part framework. (1) Living with uncertainty: Shrimp farmers deal with the uncertain nature of the shrimp business by controlling (rather than trying to eliminate) disease. (2) Nurturing diversity: Farmers tend to diversify their income sources to include other activities. They spread disease risk by dispersing pond waste water in space and time. (3) Using different kinds of knowledge: Farmers combine their experience with large-scale (failed) companies; their own experience; government technical knowledge, and new knowledge from adaptive management (the “zonal crop calendar” system). (4) Creating opportunities for self-organization: Farmers have built on their experiences with producer cooperatives (samithi) to self-organize into a multi-level community-based management structure.

**Speed Session 1.6**

**Pre- and post-implementation processes of Exclusive Fishing Zones for artisanal fishers: Lessons from Northern Choco, Colombia**

Viviana Ramírez-Luna, Fundación Colombiana para la Investigación y Conservación de Tiburones y Rayas SQUALUS (Colombia). Canada, email: vivianar@mun.ca

**Abstract**

This case study draws upon interviews with key informants and artisanal fishers from two communities to explore the factors that shaped the pre- and post-implementation processes that have influenced knowledge of, engagement with, and responses to the establishment of an Exclusive Fishing Zone in Colombia (Chocó-EFZ). Results showed that conflicts between sectors and perception of corruption triggered the Chocó-EFZ implementation process. This process involved the participation of all sectors (industrial, artisanal, and government). Levels of involvement, knowledge, and understanding were uneven between and within sectors. The Chocó-EFZ seems to have been somewhat effective at mitigating conflicts between artisanal fishers and industrial shrimpers but has been less successful at mitigating conflicts between the former and industrial tuna seiners. The Chocó-EFZ is supporting an existing informal community-based management in the community of Huina and is promoting the development of a co-management regime in
the community of Bahía but is facing challenges posed by gillnetters and beach seiners in both communities. The main elements that jeopardized the continuation and modification of the Chocó-EFZ (as of 2013) were the power struggle among stakeholders, the failure on the part of government to make the Chocó-EFZ permanent and expand its seaward boundary, and the debate related to the definition of territory including what belongs to whom and who should decide in granting fishing rights to one sector.

Introduction

Exclusive Fishing Zones (EFZs) are a type of place-based management tool often used to mitigate conflicts between sectors by allocating fishing rights to one user group. Some conflicts include those between industrial and artisanal fishermen, locals and outsiders, aboriginal and non-aboriginal groups (e.g. LeDrew 1988, Bailey 1997, Davis et al. 2006, Gelcich et al. 2010). Little attention has been paid to the processes through which EFZs are developed, the conditions that trigger such initiatives, or to the factors that shape their design (e.g. Bourillón-Moreno 2002, Davis et al. 2006).

This work contributes to the limited literature on pre- and post-implementation processes associated with EFZs and their significance for the operation and sustainability by examining in detail the events related to an EFZ implemented in the Chocó Province on the Colombian Pacific coast in 2008 (Chocó-EFZ hereafter). Pre-implementation goes from late 1990s to 2008 and post-implementation from 2008 to January 2013, before the area was extended and implemented permanently.

The Chocó-EFZ was initially implemented as a temporary measure and the goals include mitigating conflicts between the industrial and artisanal fisheries (which were granted fishing rights), encouraging participation by local fishers in co-management, and promoting food security of local communities (not discussed here) (ICA, 2008). Until 2013, the Chocó-EFZ extended from the coastline out 2.5 NM, incorporated two major urban centers (Juradó and Bahía) and 22 villages (ICA, 2008). Inside the zone nets and industrial and commercial exploratory fisheries were banned, while artisanal longlines and handlines, and sport fisheries were allowed inside and outside the zone.

This study adapts the “step zero” governance framework Chuenpagdee and Jentoft (2007: 657) developed to answer the following questions: 1) What conditions and drivers triggered the processes that led to the establishment of the Chocó-EFZ?; 2) Who initiated the negotiations and communications?; 3) Is the Chocó-EFZ achieving its goals?; 4) What factors are likely to support or constrain the continuation of the Chocó-EFZ?

Methods

Between July 2010 and February 2011, face-to-face, semi-structured interviews with 11 key informants were conducted: artisanal sector (6), government (3), ACODIARPE (1, shrimp organization), and ANDI (1, tuna organization). Informants were asked about their background, involvement with the Chocó-EFZ, the situations that triggered it, how the configuration was defined and whether the goals were being achieved, how fishing sectors were impacted by the zone, and their thoughts about the future of the Chocó-EFZ.
In Bahía and Huina (small fishing-dependent village), both within the Chocó-EFZ, interviews with 25 artisanal fishing households were conducted. Part of the interview asked what fishers knew about the Chocó-EFZ and their participation. Published, unpublished, academic and non-academic literature was also reviewed (see Ramírez-Luna 2013 for full discussion of methods).

**Results**

The Chocó-EFZ process was triggered by conflicts between the artisanal and industrial fisheries. However, the nature of the conflicts and the response to mitigate them varied according to the sector. One conflict engaging artisanal longliners and industrial deep water shrimpers (fishing in the area since 1950s) within the first 2.5NM started in the late 1990s; it involved gear conflicts (longlines were dragged away by shrimpers) and bycatch impact (longline species were caught as bycatch by shrimpers). Another conflict involving artisanal handliners and industrial seiners started in the early 2000s, when seiners started fishing closer to shore. Competition for the tuna resource was the core of this conflict; tuna was caught in inshore waters by seiners, leaving little fish for handliners on coastal waters.

Two responses to mitigate the gear conflicts originated within the artisanal sector in the late 1990’s. The first response was by an artisanal fishery multistakeholder organization (GIC-PA) led by a NGO that had a large impact on the community while it was active (1998-2004). They started negotiations with ACODIARPE and drafted potential EFZs based on fishers’ knowledge. However, conflicts continued, the EFZs were never implemented, and there is no evidence of any relationship between these negotiations and the Chocó-EFZ process. There was no scientific assessment or consultations about the configuration of the Chocó-EFZ; and decisions were made by government after private meetings. The second response was initiated by a fish trader from Bahía, a person with post-secondary education and work experience inside and outside of Bahía. He tried to find solutions to the gear conflicts between the longliners working for him and shrimpers by going to the port authorities; although his actions did not lead to the current Chocó-EFZ. Although the GIC-PA and the trader had the same goals, the lack of trust and communication prevented them from coming together.

The process that triggered the creation of the Chocó-EFZ was the encroachment by a tuna vessel on the artisanal fishing grounds in 2007 and the concerns about corruption. After this incident, the fish trader, ANDI, ACODIARPE, and the government got together in private meetings throughout 2008. The fish trader had been elected as the artisanal sector representative by the community as he became recognized locally as a knowledgeable person and with the skills to negotiate with the industrial sector. Participation of ACODIARPE and ANDI started at different points in time and their points of view about the Chocó-EFZ differed. ACODIARPE strongly opposed the permanent implementation of the Chocó-EFZ, arguing that their food security and jobs were in jeopardy. ANDI vigorously opposed the expansion beyond the 2.5 NM, arguing that the design was appropriate to prevent conflicts between artisanal fishers and seiners.
Definition of territory, what belongs to whom, and why, and who decides when granting fishing rights are other points of disagreement about the Chocó-EFZ. Organizations specialised in legal matters started partnerships with the GIC-PA and used the legal framework that supports the rights of black communities over their territories (Ley 70 1993) to demand the permanent implementation of the Chocó-EFZ.

Regarding fishers’ participation, the perception of corruption in government and in the community and the fact that communities located away from Bahía were not usually involved in initiatives such as the Chocó-EFZ were preventing fishers from participating in decisions related to fisheries management. This showed limitations in communication, monitoring, and enforcement with communities away from Bahía.

The Chocó-EFZ seemed to constitute legal support for an informal community-based management regime found in Huina that has been promoted since early 2000s, as well as promoting the development of a co-management regime in Bahía. However, in both communities net users were posing challenges, as most of them refused to give up using their gear for different reasons: high social costs, sense of unfairness (why industrial fishers were allowed to use nets) and economic loss (gillnets would be replaced by longlines, which was not a profitable fishery by 2010).

Discussion and Conclusion
The development of the Chocó-EFZ was a path dependent process, as both process and progress evolved as the zone was negotiated and implemented (Chuenpagdee and Jentoft 2007). Conflicts between sectors have been the main trigger for the establishment of EFZs elsewhere (e.g. LeDrew 1988, Bourillón-Moreno 2002, Gelcich et al. 2010). Likewise, the Chocó-EFZ was established to mitigate conflicts between the artisanal and industrial fishing sectors. However, origin and spatial and temporal scales of conflicts were not homogenous, adding different elements to the Chocó-EFZ process.

Learning about the historical and cultural relationship between users and the resources reveals how relationships influence the success of the marine spatial planning process (e.g. Davis et al. 2006, Pomeroy and Douvère 2008). The long-standing dependence of shrimpers on the resource has made it difficult to exclude them from the Chocó-EFZ. Although the tuna sector had a recent history on inshore grounds, this sector substantially influenced the Chocó-EFZ design. Intense lobbying by the tuna sector as in Chilean industrial fisheries (Peña-Torres 1997) and corruption in the institutions as in the Pacific Islands region (Hanich and Tsamenyi 2009) may explain the inaction on efforts to extend the seaward boundary of the Chocó-EFZ.

The fish trader and the GIC-PA had in common that they had an informal beginning and developed into more formal proceedings and settings, perceived that they were capable of resolving the gear conflicts, found the required resources, sought to take control of the problem, and were influenced by external forces (e.g. NGOs, post-secondary education). All of these things are among the conditions needed to start the initiative and bring in and
formalize new ideas (e.g. Chuenpagdee and Jentoft 2007, Marín and Berkes 2010). The way to communicate their ideas and to get the community involved differed. The GIC-PA was more effective in getting people to identify the existence of a problem and giving them an opportunity to provide input into solutions, which is important when developing initiatives (e.g. McCay 2002). The consequence was that most interviewees emphasized the GIC-PA’s role in the Chocó-EFZ establishment, rather than the role of the trader.

The Chocó-EFZ seemed to be mitigating conflicts with shrimpers (although surveillance strategies to prevent encroachment were needed) but not with seiners. This could be associated with the scale at which conflicts occurred as shown by Olsen et al. (2011). Conflicts between longliners and industrial shrimpers occurred at a local geographical scale targeting low mobility species in well-defined, coastal areas, protected by the Chocó-EFZ. On the other hand, conflicts with seiners occurred at a larger geographical scale, targeting tuna (highly migratory species) in offshore waters by seiners and in coastal waters by artisanal fishers. The Chocó-EFZ would have to be large enough to increase the availability of tuna for artisanal fishers; consequently management challenges would increase.

The Chocó-EFZ seemed to be contributing to co-management by benefitting those already involved in community-based management (Davis et al. 2006) as in Huina, a type of community tied to place, history and identity (Jentoft et al. 1998), where historically kinship ties have governed land management (Mosquera 1999), fishers have developed their own regulations for the use of gears similar to farmer-managed irrigation systems (Ostrom and Basurto 2011), and where there is leadership, another institutional variable supporting community-based management (Jentoft et al. 1998, Davis et al. 2006). In-depth research in communities such as Huina may reveal how individuals invest their time, effort, and resources in developing community-based management systems.

The Chocó-EFZs may also be contributing to co-management by creating incentives for artisanal fishers (e.g. Chuenpagdee and Jentoft 2007) in Bahía, where the GIC-PA started an alliance with a restaurant in 2009 with positive outcomes (“De la cantidad a la calidad” 2012). It was expected that eco-labelling would support the permanent implementation of the Chocó-EFZ on the basis that it is protecting the fishing grounds where local fishers carry out their activity in a responsible manner (Fundación MarViva 2011).

On the other hand, struggle with netters poses new challenges when developing the co-management and shows that there are some serious limitations in the effectiveness of this top-down management approach. Co-management has also the potential to integrate values and knowledge of the industrial fishers into management (Orbach 1977, Foster and Vincent 2010). This is a need considering that disagreements between the industrial and artisanal could be irreconcilable (notions of sea tenure, what belongs to whom, and why, and who decides). Consequently, reaching agreements about the rules of the game is more problematic (Bavinck 2005). Finally, Saavedra-Díaz (2012) suggested a framework to support adaptive co-management in Colombia that should be built at local, regional, and
national levels and with input from major stakeholders. This could foster co-management implementation and prevent uncertainty (Chuenpagdee and Jentoft 2007).

The Chocó-EFZ may be an opportunity to build a legal framework within a “legitimacy-building process” (Pinkerton and John 2008:689) that supports a co-management regime in Colombia with achievable socio-economic and ecological goals, place and gear-based management tools combined, and informed by appropriate scientific and traditional knowledge. Efforts to establish new agreements could produce new debates (or extend old ones), particularly if perceptions of corruption, power imbalance, unfairness and economic loss and lack of trust among stakeholders persist.

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**Development and small-scale fishery in the Brazilian northeastern region**

Luclécia Cristina Morais da Silva, UFPE, Brazil lucrisms@yahoo.com.br

Graduate Program in Anthropology (PPGA)

Beatriz Mesquita Jardim Pedrosa, FUNDAJ, Brazil beatriz.mesquita@fundaj.gov.br

Graduate Program in Fisheries (PPG-RPAn/UFRPE) and Fundação Joaquim Nabuco

**Abstract**

The artisanal fishery in Brazil is concentrated in the northern and northeastern regions (72.4% of fishers). The research was conducted methodologically inserted in the anthropology of fishing and aimed at understanding the social and environmental problems of small-scale fishers in their historical context. Several bibliographical sources, documentary and journalistic material were employed to analyze artisanal fishery in Sirinhaém, Pernambuco – Northeast of Brazil. The coastal community gathers 1050 fishers of different modalities of small-scale fishing, who are being particularly impacted by new economic development projects aimed at increasing tourism in the region. The impact of such growth is primarily reflected in the decrease in the amount of fish and fishers, as well as fisher displacement to other fishing areas or productive activities. There has also been an increase in the number of fishers who are simultaneously performing other activities of additional income. In the region under study, there is a large population of fishers that tries to perpetuate their culture amid all the rapid changes that have hit the coastal region. This research tries to draw attention to the existence of many different agents of transformation and changes in the social life of fishers.

**Key-words:**

Small-Scale Fishing, Traditional Territories, Development.

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Introduction

This research reports the artisanal fishery activity in the municipality of Sirinhaém, located in the Brazilian northeastern region. The artisanal fishery in Brazil is concentrated in the northern and northeastern regions (72.4% of fishers), where fisheries are being impacted by land speculation and economic activities, such as tourism and aquaculture, in addition to overfishing, habitat degradation, pollution and climate change.

Artisanal fishery is still very strong in the region, but many changes resulting from those ventures can already be observed communities social dynamics. The impact of such growth is primarily reflected in the decrease in the amount of fish and fishers, as well as fisher displacement to other fishing areas or productive activities.

Tourism was never a strong activity in the city due to the lack of municipal encouragement and the regional environmental conditions - an open water coastline with a steep slope and constant high pollution of its river. Those factors keep tourists, who consider the beach “dangerous”, polluted and “violent”, away from the region, even though in Sirinhaém there are a few summerhouses that belong to people with smaller purchasing power, compared with other southern coastal beaches in the region.

Therefore, aiming at understanding the social and environmental problems faced by artisanal fishers and at identifying the phenomena that influence and contribute to the migration from the local fishing activity, we carried out a qualitative analysis of the social dynamics experienced by the fishermen and fisherwomen in the municipality of Sirinhaém, located on the northeastern coast of Brazil.

Methodology

The qualitative method was used because the conceptions, beliefs and values of people are revealed by interpretative analyzes (Alves-Mazzotti and Gewandsznajder, 1999). The procedures used were: literature, field observations and interviews with key social actors. The information obtained from the observations was associated with the interviews in order to converge research results with the same object of analysis. The contextualization of heterogeneous sources aims at providing greater reliability within the narratives (Beaud and Weber, 2007).

The interviews were done throughout the year of 2013. In addition, the collection of empirical data was carried out through the participation in the community meetings. The number of interviews was not initially determined. Some interviews were planned to be done with artisanal fishers of different forms of fishing by the "snowball" method (Bernard, 2005), as well as other local participants (researchers and local managers). The interviews were collected until no new ideas appeared, in other words, using the concept of saturation of the material (Glaser and Strauss, 1967), where the most important aspect is not the number of samples, but understanding the elements of analysis contained in the interviews and statements, once the reports, as private as they might be, depict social practices of a specific time set in the world where the individual belongs to. At the end of the fieldwork, twelve fishers, two participants of non-governmental organizations, two local managers and one researcher were interviewed.

The place
Sirinhaém is 80 km from the city of Recife, with an area of 374.611 km², an official population index of 40,296 inhabitants and different districts: Barra de Sirinhaém, Santo Amaro and Ibiratinga. The main socioeconomic activities are the ethanol and sugar industry and artisanal fishery. In the coastal district of Barra de Sirinhaém, there are 13,810 inhabitants, most of who are involved in the fishing activity, despite the fact that this traditional activity does not appear in the official data, which only mentions as main economic activities agriculture, agro-industry, services and trade.

In the district of Barra de Sirinhaém, it is possible to find many sorts of fishers: from the estuary (female shell fishers), from the river, from the sea. In general, fishers or relatives of fishers can be found in almost every house in Barra de Sirinhaém, where walking along the local streets it is common to see women, fishers or not, and children processing crustaceans in front of their houses. Children learn their parents’ craft very early - girls learn to go to the estuary to extract shellfish and crustaceans, while boys learn to sail across the Sirinhaém River.

**Fishery activity and culture**

There are different types of fishing gears and fishing in the region: traps (fish and lobster), gillnets or “caceia” nets, trawl nets (shrimp), bottom lines, surface lines or longlines. In the river and in the estuary, manual collection (crabs and bivalve mollusks), casting nets and gillnets are used. The estuarine fishery is very strong in the region.

According to the species and fishing place, there are changes not only to the fishing gears, but also to the most appropriate time to fish - winter or summer. Fishers reported that fishing is possible throughout the whole year; however, during the winter the weather might hamper the fishery activity and it is common to use the strategy of changing fishing gears during the winter-to-summer season.

The shrimp fishery (trawl net) is harmful to the sustainability of the marine environment because of the capture of by-catch (Tischer and Santos, 2001). Many fishermen are aware of this problem, having also reported that the best would be to have a closed season for shrimp, since "trawling ruins everything; it brings all kinds of fish." However, as Tischer (2003) also notes, many “tratadeiras” (women who handle the fish - about fifty) work trying to use the by-catch ichthyofauna that comes in Sirinhaém’s shrimp fishery. Many women were observed to depend on such activities as income.

Women are always present in the fishery dynamics, being commonly found in front of their houses picking crustaceans in the late afternoon, after having returned from the mangroves. As well as being an additional income to their households, those activities allow financial autonomy to purchase personal items. More income can be earned by going to other more productive estuaries. They usually go to other northern coastal cities and sell the production at local restaurants.

It is easy to find fishers leaving or coming back to the harbor or estuary. Local people time is ruled by the tide. They are always organizing and fixing their fishing gears while planning for their next journey to the sea.

The number of vessels in the region has historically decreased. A retired officer from the Environmental Federal Office and a Barra de Sirinhaém resident stated that:

“My job was to find out this area’s amount of production and at that time (10 years ago) there were 245 vessels in Barra de Sirinhaém.”
Today, according to data provided by the community, there are about 120 vessels. However, there are about six to seven boats in the harbor without activity due to the lack of fishers to work. Paid employment has generated loss of sociability within the fishery community.

In Sirinhaém, although some artisanal fishers have already resigned fishing professionally, there are still a large number of fishers, mainly women, in estuarine fisheries.

“As a whole, in Barra de Sirinhaém there are 3700 fishermen, there are 576 (women) and 353 (men) associated in the community nowadays.” (Fisherman and President of Fisher Guild Z-6)

**Environmental impact and new social dynamics**

Many local changes have taken place due to the persistent pollution from sugarcane plants and the consequent decrease in fish stocks, as well as an increase in paid employment owing to a port complex installation in the area (Suape) and tourism. Therefore, it is currently very difficult to make a living only from artisanal fishery, so there is an increase in the number of fishers who are simultaneously performing other activities for additional income.

Artisanal fishers choose different ways to set their presence in space and time (Woortmann, 1990). Within the fishery community, there is a search for strategies of social reproduction, in which even if in some cases there is the addition of other productive activity, there have also been alternatives of ownership of the sea and estuary from a new configuration.

This process occurs by the search for new fishing areas in the surroundings or even in other states, as well as from the practice of marine tourism activities, thus creating a way to continue in the marine environment, in other words, to continue to exist.

In the last 10 years there has been an increase in the labor supply to nautical tourism due to the large public visitation to places near Barra de Sirinhaém, such as Santo Aleixo Island and Carneiros Beach, by local vacationers and tourists. There is a heavy flow of vacationers’ boats from Toquinho Beach (a private beach marked by the estuary and the mouth of the river Sirinhaém) and tourists in catamarans from different companies, with many of these marine vehicles driven by fishers.

These impacts from tourism on fishery activities tend to increase due to mega-enterprise projects for the region. The nautical tourism has generated conflict between artisanal fishers and local marinas as there are a growing number of speedboats and jet-skis in the estuary. The fishers report that they are not against the arrival of vacationers, even because the presence of tourists facilitates the direct sale of fish and increases the local income, but there needs to be supervision and planning of the waterfront and of the motorboat traffic on rivers.

According to the report of a female shell fisher:

"The speedboats don’t respect us, when they see fishers, the fisher in their little boats... Once, they nearly killed us, at the speed that it was coming; only God to save us, the canoe vanished. In the river there are no waves, but with their
speed, the waves get so big that they nearly destroy everything” (female shell fisher)

The local population in general is not informed about the projects for the region, confirming the strategy of disinformation as a means to avoid any form of resistance (Acselrad et al., 2009). According to Oliveira et al (2009), most of the actions in the southern coast of Pernambuco present themselves as paradoxical and inconsistent, due to a speech that seeks to bring greater social and environmental responsibility, but which is reflected in actions that merely emphasize the economic dimension.

In the fishery activity, there are similar tensions to those experienced by peasants who live in contemporary rural contexts, because, according to Moura (1988), the peasant distinguished him or herself internally, having his or her forms of production and organization of life redefined, though remaining identifiable as such. Despite some subordination to the capital reproduction gear, the contradiction inherent to this power relation has also emerged, which has originated social differentiation processes that seek recognition of an otherness not yet uncharacteristic in its essence (Wanderley, 2011).

Conclusion

On the Pernambuco southern coast there is a large population of fishers that tries to perpetuate their culture amid all the rapid changes that have hit the coastal region. This research tries to draw attention to the existence of many different agents of transformations and changes in the social life of fishers.

The changes brought about by tourism (besides the Suape port complex and old activities) have led to the fragmentation of the social group and to the impact on the marine-estuarine environment. The major tourism projects that are planned to be installed in the municipality are likely to cause socio-spatial segregation and further interfere in the fishers’ daily practices.

New strategies for adaptation and reaffirmation of their ways of life were observed, in other words, ways to continue to be "free": either by inserting themselves into other productive practices performed simultaneously with the artisanal fishery, or by trying to move to other fishing areas.

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Human factors influencing acceptance of bycatch reduction devices in small-scale shrimp trawl fisheries of south Brazil

Rodrigo Pereira Medeiros, Centro de Estudos do Mar, Universidade Federal do Paraná, Brazil, rodrigo.medeiros@ufpr.br
Fanny Vessaz, University of Ghent, Belgium, f.vessaz@hotmail.com
Guilherme D’Orey Gaivão Portella, Centro de Estudos do Mar, Universidade Federal do Paraná, Brazil, guidgportella@gmail.com

Abstract

Bycatch in shrimp trawl fisheries is a recognized issue tackled with technological modifications such as Bycatch Reduction Devices (BRDs) aiming to improve gear selectivity. Bycatch also represents an important source of livelihood diversification in small-scale shrimp fisheries, enhancing food security and income. Therefore, an integrated understanding of the local socio-ecological context is required for an effective implementation of BRDs. We evaluated the effect of socio-economic dimensions and fishers’ attitudes on the acceptance of BRDs at the Protected Area of Anhatomirim (Santa Catarina state, South Brazil). Data was collected through semi-structured interviews, informal conversations and workshops. Loss of valuable bycatch and link to the management system constrain willingness to use BRDs, enhancing the need for local adaptation of BRDs through a cooperative process. Fishers’ participation can enhance legitimacy of BRDs. It was observed that beyond a technological modification, an integrated and participatory approach to BRDs generates insights into alternative management strategies involving fishers’ collaboration.
Introduction

Known collectively as bycatch, the capture of non-target species or under-sized juveniles of target species, often ending up discarded, is one of the main environmental impacts of the world fisheries. It is particularly significant in shrimp trawl fisheries that represent 27.3% of total world estimated discards (Kelleher, 2005). This issue has been tackled with technological modifications such as Bycatch Reduction Devices (BRDs), aiming to improve gear selectivity, which showed positive reduction in bycatch without significantly affecting the shrimp catch (Broadhurst, 2000; Eayrs, 2007).

Overall, research has focused on technological aspects and ecological impacts of BRDs and a lack of socio-economic contextualization, leading to low compliance, has been criticized (Campbell & Cornwell, 2008). An integrated approach of the local context is essential in small-scale fisheries where beneficial bycatch – the byproduct - can represent an important component of livelihoods by enhancing food security and providing alternative income sources, thus modulating the relevance of bycatch mitigation strategies such as BRDs (Gillet, 2008; Medeiros et al., 2013).

Among southern Brazilian small-scale fisheries, the seabob shrimp Xiphopenaeus kroyeri accounts for approximately 20% of the total crustacean catch (IBAMA, 2007). Sustained research showing significant reduction in bycatch is ongoing since 2008 in the South Brazilian small-scale seabob shrimp fishery and three types of BRDs have been tested: Nordmøre grids, square-mesh codends and escape panels (Cattani et al., 2012; Silva et al., 2011; 2012). Yet, implementation of BRDs can be prevented by their negative impact on fishers’ incomes through exclusion of beneficial fish species (Branco et al., 2006). There is lack of information regarding the importance of byproduct in fishers’ livelihoods and an integrated understanding of the local socio-economic, institutional and ecological context is required (Branco et al., 2006).

At last, understanding the integrated socio-ecological context of the fishery through stakeholder involvement is fundamental to develop and implement solutions possible and acceptable for all, especially in small-scale fisheries (Campbell & Cornwell, 2008; Hall & Mainprize, 2005; Lewison et al., 2011). Early involvement of fishers can foster development of adaptive solutions, thereby enhancing legitimacy of bycatch management measures (Hall et al., 2007; Kennelly & Broadhurst, 2002; Lewison et al., 2011). BRDs for instance have shown success in exchange of knowledge, promoting adaptations of these devices, and in building trust relationships among stakeholders in South Brazilian small-scale shrimp fisheries (Medeiros et al., 2013; Silva et al., 2013).

Through semi-structured interviews and workshops, we evaluated the effect of the following human factors on the acceptance of BRDs at the Anhatomirim Protected Area (APA) (Santa Catarina state, South Brazil): fishers’ perceptions of bycatch reduction and BRDs; and fishers’ involvement in the development of bycatch mitigation strategies. This
approach to BRDs finally aimed at exploring ecological, social and economic trade-offs for effective and acceptable bycatch mitigation strategies.

**Methods**

**Study area**

The Environmental Protected Area of Anhatomirim (EPAA) (27°22′48″ S 048°32′58″ W) is located in the north east of Santa Catarina Island, in the state of Santa Catarina, South Brazil. It is a sustainable multiple use area with 2,850 ha of marine area. Inside the EPAA, industrial trawlers (horsepower (HP) higher than 115) are prohibited and there are 59 small-scale shrimp trawlers, representing 32% of the fishing fleet within EPAA. The trawling fleet can be separated into two types, the small-sized and the medium-sized fleet, with structural (e.g. trawl dimensions, power (lower or higher than 45 HP)) and functional (e.g. one or two fishers on board of a small-sized or medium-sized trawler respectively; longer fishing trips for medium-sized trawlers) differences. Out of the six penaeid species present in the area, the main targets are: the seabob shrimp (X. kroyeri); white shrimp (Litopenaeus schmitti); and the pink shrimp (Farfantepenaeus paulensis and F. brasiliensis) (Guanais et al., 2014).

A management plan was formally published in 2013 including a zonation of EPAA with specific regulations for each activity. A zone was created for implementation of trawling regulations to be developed in collaboration with fishers (ICMBIO, 2013). Under this framework, a long-term cooperation project between fishers and researchers from the Center for Marine Studies (Federal University of Paraná) was initiated in 2012 in the area to evaluate the potential of BRDs. Census of boats and demonstrative experiments to show the functioning of BRDs to fishers were conducted.

**Data collection**

Evaluation of human dimensions was performed by means of 15 semi-structured interviews, 2 workshops followed by an informal evaluation of the participatory process by the participants, and informal conversations with stakeholders. A total of 36 fishers from EPAA were reached during field visits from March to May 2014.

The main purpose of data collection procedures was to yield information about fishers’ perceptions on bycatch, the importance of byproduct and bycatch reduction; as well as the impact of the participatory aspects on fishers’ perceptions and attitudes relative to potential bycatch reduction strategies. Using multiple sources of evidence helped ensuring the validity of the findings of this case study by triangulation (Bernard, 2006). All interviews, workshop results and field notes from personal observations were coded and analysed qualitatively.

**Results and discussion**
Significant differences arise in fishers’ perceptions when the analysis is separated by boat class, for instance majority of fishers from the small-sized fleet consider the byproduct of low economic importance (66.6%) whereas fishers of the medium-sized fleet judged it of medium to high importance (87.5%). When asked about relevance of bycatch reduction strategies, opinions were mostly positive with 57.1% indicating that “yes” it would be relevant, yet more than a quarter stated that “it depends” (versus “no” and “don’t know”). From the small-sized fleet, all indicated that it would be worth to reduce overall bycatch (sorting the catch on board is time-consuming, byproduct is not frequent as stated some fishers), whereas fishers from the medium-sized fleet were more cautious, with 50% stating: “it depends” due to various factors (e.g. season, which portion of the bycatch would be reduced). It was made clear from fishers that answered “no”, “it depends” and “don’t know”, that keeping large valuable fish was fundamental.

Overall, the pattern is complex and variable and bycatch reduction strategies such as BRDs require adaptation to the local context to ensure their acceptance by both fleets, as it is recommended in multiple frameworks for bycatch management (Broadhurst, 2000). A key aspect to incentivize selective gear is to show the economic gains in conservation in resonance with local socio-economic attributes (Hilborn et al., 2005). For instance in the medium-sized fleet, fishers indicated the importance of economic benefits derived from the byproduct: substantial benefits to be gained from the use of BRDs (e.g. less byproduct but greater shrimp catch leading to higher total income) have to be precisely analysed to develop relevant incentives for local fishers and foster acceptance.

Their conflict-laden relations with the regulation system also influence fishers’ attitudes negatively. They have no trust in the management system, feel neglected by it and apprehend that BRDs will be implemented without their consent. The creation of a zone in EPAA for collective development of trawling regulations is thus a window of opportunity for change and can enhance fishers’ cooperation. For instance, this study showed positive outcomes from the workshops: collaboration between fishers and researchers to reach a consensus; fishers’ willingness to engage in the development of bycatch mitigation strategies through BRDs; shared learning; and potential to build trust relations. These benefits from a participatory process are cited in the literature (Hall et al., 2007; Hall & Mainprize, 2005). Fishers’ involvement does not ensure adoption of bycatch mitigation strategies such as BRDs, but success in influencing positively fishers’ perceptions depends on a clear presentation of the objectives and consideration of fishers’ different perspectives on bycatch reduction (Campbell & Cornwell, 2008).

Timeline of the research approach is also to be highlighted (Fig. 1). This study emphasized the essential continuity of a participatory process to deliver positive outcomes linked with acceptance of BRDs. Implementation of BRDs is ensured to be perceived as legitimate by all fishers through a learning-by-doing process where fishers are actively involved in the decision of future steps. Participatory aspects should not be limited to consultation and involvement during research experiments (e.g. tests of BRDs) and after analysis: fishers have to be involved in the analysis process and not only communicated with results (Fig. 1) (Stringer et al., 2006; Trimble & Lázaro, 2014).
Without this fundamental step, resistance can unfold among fishers and prevent adoption of BRDs. In this study, perceptions on BRDs were negative, enhanced by a lack of communication with fishers after the experiments with BRDs were conducted in the area. However, after discussion in the workshops, fishers eventually appreciated the adaptive potential of BRDs and approved testing if adapted to their needs.

**Conclusion**

In order to assess possible futures for management, scenarios have to be developed by integrating the different perspectives of all stakeholders and data on the efficiency of
BRDs from future experiments; following scenario analysis has to be conducted with the collaboration of fishers, managers and researchers (Stringer et al., 2006). This approach will allow directing effectively future efforts towards an implementation of BRDs under an adaptive governance strategy.

Outcomes of this study will be integrated in the management plan of EPAA. Beyond a technological modification, an integrated approach to BRDs generates insights into alternative management strategies. Patterns observed and lessons from the methodology used can be transferred to other shrimp trawl fisheries and foster implementation of acceptable sustainable fisheries management strategies on a larger scale in Brazil.

References


**Ecological footprint of artisanal fisheries in the coast of Jalisco**

Myrna Leticia Bravo Olivas
Rosa María Chávez Dagostino (Universidad de Guadalajara)

Small scale fishing worldwide is an important resource that provides input protein to the inhabitants of the coastal areas, where a large proportion of the population lives in poverty. For Latin America is estimated that artisanal fishing occupies 90% of the fishermen in this region. The declining catches, overexploitation of species, the quality of life of fishermen and environmental impacts are associated variables that have been questioned in the world, therefore the sustainability of this activity. Aim of this paper is to analyze small-scale fisheries on the coast of Jalisco through the capture and species composition, and the ecological footprint evaluated through fishing cooperatives. From 2002 to 2012, a total caught of 22,319 t was distribute in 73 groups, where 92 % were fishes. From samples taken in five fishing cooperatives of the coast of Jalisco, 141 species were identified, fishes dominated. The spotted rose snapper (Lutjanus guttatus), red snapper (Lutjanus peru) and bull mackerel (Caranx caninus), constituted the 26% of the samples. Fishing cooperatives eco-efficiency in terms of CO2/t catch was 0.2 for each of the four cooperatives analyzed. Primary production required to support catches was 4'240,378 t, their footprint indicates that have appropriated from 0.01 % to 0.05 % of the biocapacity of the area in the study period.

**Community-based marine science: a collaborative study on the abundance and life-history of Octopus cyanea in Kaʻūpūlehu, Hawaii**

Ilysa Iglesias, Marine Conservation Fellow, The Nature Conservancy, Hawaii

In repose to continued declines in marine resources in Hawaii, there has been a recent pivot towards community-based marine stewardship. Kaʻūpūlehu community members have assumed the responsibility for replenishing marine life in their local area through the
development of a sustainable fisheries management plan. However, there is a dearth of relevant information available for their target species, Octopus cyanea, upon which to make these management decisions. In this study, we collaborated with local octopus fishermen to devise a method for assessing the abundance of *O. cyanea*, as well as determining pertinent life-history characteristics. We collaboratively developed novel protocols for determining the local density of octopus using an expanding circle search, consistent with fishing methods. Further, *O. cyanea* were aged for the first time in Hawaii via stylet increment analysis, the data from which contributes vital information to the sustainable fisheries plan. Both of these methods incorporated the immense local-knowledge of fishermen from inception to completion, and serves as a mutually beneficial model for community-based marine monitoring.

**Enhancing the productivity in small scale fishery of lobster Panulirus argus through use of “casitas” (artificial shelters) in Celestun, Yucatan, Mexico**

Veronica Rios (Instituto Nacional de Pesca)
David De Anda (Instituto Nacional de Pesca)*
Juan Carlos Espinoza (Instituto Nacional de Pesca)

Successful use of artificial shelters to enhance productivity of lobster fisheries in several Caribbean countries (Cuba, Mexico, Belize, Bahamas), is an element by which this practice has spread to other countries and other areas those where used. In Mexico "casitas" are used in the Bays Ascension and Espiritu Santo in Quintana Roo and Rio Lagartos and San Felipe in Yucatan. In 2005 use of "casitas" extend to Celestun Yucatan to fishing sites with limited availability of natural shelters. 120 "casitas" were introduced through the Cooperative Nohoch Cuch, in order to reduce operating costs, accidents risk during extraction (hookah diving) and also encourage selective fishing obtain higher value products in the market. A first “casitas” evaluation benefit is made. We did diving campaigns for reviewing structures during close season 2012. Were recorded bottom type, physicochemical parameters, lobsters number and fauna and flora observed. The 100% of “casitas” was found on bottom composed of sand, seashells and seagrass. In 54% the “casitas” were observed between 1 and 8 lobsters (2 ± 2.5 average), average length and weight respectively were 12 cmLA and 100 gPA. Other species observed were nurse shark Ginglymostoma cirratum, chacchi Haemulon plumieri and angel Pomacanthus arcuatus. Although "casitas" number was reduced, we can say that increases productivity, gasoline consumption is lower that recorded for traditional fishing and harvesting of "casitas" made safe through free diving. Catches selection is possible, however there are three obstacles to get it: poaching, poor surveillance and market.

**Enhancing fishermen compliance in reduction of fisheries impacts in the Upper Gulf of California biosphere reserve and Vaquita Refuge, through a comprehensive education and training program**
Valdivia-Jiménez Paloma Alejandra, Intercultural Center for the Studies of Deserts and Oceans, Mexico, paloma@cedointercultural.org
Barrera-Aguirre Felipe, Intercultural Center for the Studies of Deserts and Oceans, Mexico, felipe@cedointercultural.org
López-Herrera Leonor, Intercultural Center for the Studies of Deserts and Oceans, Mexico, leonor@cedointercultural.org
Wong-López Cuellar Efrain, Intercultural Center for the Studies of Deserts and Oceans, Mexico, efrain@cedointercultural.org
Pérez-Valencia Sergio, Intercultural Center for the Studies of Deserts and Oceans, Mexico, svalencia1793@cedointercultural.org
Turk-Boyer Peggy, Intercultural Center for the Studies of Deserts and Oceans, Mexico, peggy@cedointercultural.org

Abstract
Since 2009 small-scale fishermen in the Upper Gulf of California and Colorado River Delta Biosphere Reserve, in Mexico, have been required to work under a regional Environmental Impact Study (EIS) in order to fish in this protected area. The EIS requires fishermen to propose and implement a series of activities to reduce the impacts of their fisheries on the ecosystem. To give fishermen the tools and create enabling conditions for active and willing engagement in the EIS, a comprehensive education and training program was designed and has been implemented for two years. The EIS education program includes a communication strategy, production of educational materials, and implementation of workshops in the Reserve’s fishing communities (906 boats, 173 cooperatives/permit holders). The goal of the program is to raise awareness about marine resources, regulations and good fishing practices and to train fishermen in the use of fishing logbooks and other procedures required in the EIS. The program’s impact on fishermen is being evaluated through the use of baseline and follow up surveys. We developed indicators to measure compliance in workshop attendance and logbook registries. In general, all indicators and surveys show a positive trend towards increased acceptance, understanding and participation in the EIS. Follow up steps focused on encouraging fishers to comply with specific management actions and empowering them as community leaders to promote and work towards sustainable fisheries, including surveillance, and giving them access to market incentives. Never before has such a comprehensive education program been conducted with fishermen in the region.

Introduction
In Mexico, since 2009, small-scale fishermen of the Upper Gulf of California and Colorado River Delta Biosphere Reserve have been required to work under a regional Environmental Impact Study (EIS) in order to fish in the buffer zone of this protected area. The Intercultural Center for the Study of Deserts and Oceans (CEDO) was invited by fishermen to help them implement their first EIS and then developed a new Study for them, where fishermen identified impacts and proposed specific mitigation actions in participatory workshops held in 2010 and 2011. This EIS was approved at the end of
2012, and requires fishermen to conduct a series of activities to reduce the impacts of their fisheries on biodiversity and fisheries. A comprehensive awareness and training program was designed to give fishermen the needed tools and create enabling conditions for active and willing engagement in the EIS, this program has been implemented for the last two years.

The goal of the program is to raise awareness about marine resources, regulations and good fishing practices and to train and motivate fishermen in the use of fishing logbooks and other procedures required in the EIS.

Base line and follow-up surveys were implemented to measure the impact this program is having on fishermen, measuring their changes in perceptions and knowledge related to their EIS obligations. Direct observations also offer important insights into the impact of the program. We developed indicators to measure compliance in participation in workshops and logbook registry. In general, all indicators show a positive trend towards increased acceptance, understanding and participation in the EIS, with some variation from community to community. The program relies on creating a positive incentive system including awards and public recognition for outstanding compliance. The right negative incentives for lack of compliance are also necessary, and have been more challenging to achieve.

The program is contributing to the EIS goals with fishermen through: 1) generation of accurate and useful information for fisheries management in the logbook program; 2) increasing fisher understanding of the impacts of their fisheries on the ecosystem, fisheries, biodiversity and endangered species such as vaquita; 3) increasing understanding of existing environmental and fisheries regulations; 4) increasing understanding of the mitigation measures needed to reduce the impacts of fishing activities on biodiversity and fisheries; and 5) Providing evidence to prove fisher compliance with some of the legal and voluntary measures proposed in their impact studies.

The program is now focused on encouraging fishers to comply with specific management actions and empowering them as leaders to work towards sustainable fisheries, including surveillance, and access to market incentives. Never before has such a comprehensive education program been conducted with fishermen in the region and the fruits of this effort are just now coming to bear.

**Raising fishermen awareness, capacity and compliance**

From 2012 to 2014, a total of 122 workshops were implemented to train the Upper Gulf small-scale fishing cooperatives and permit holders in the importance of filling out logbooks and the correct way to do so. Also, in these workshops we have taken a personal approach in our work to involve fishermen in the EIS process and to increase their awareness and understanding of the importance of improving their fishing practices by reducing impacts on biodiversity and fisheries, and to provide tools and training to comply with specific mitigation measures. To date, 88.3% of the 906 boats have been represented in at least one training workshop.

To support and strengthen the awareness and training workshops conducted with fishermen, we implemented a communication campaign in the Upper Gulf communities. The strategy included development and distribution of educational materials (printed
materials and videos) and a radio campaign to disseminate information to fishermen about fisheries regulations, such as closed seasons for individual fisheries, EIS obligations, and good fishing practices. Workshops, meetings and events were also announced by radio, at GSC in the streets, and banners were hung in strategic locations.

To evaluate the effectiveness of the awareness and training program, we assessed the change in knowledge and perceptions of fishermen from the beginning of the new EIS process (approved in December 2012) and one year after implementation of the program (December 2013). Baseline surveys (n=224) were applied before the first set of workshops were conducted in 2013 and follow-up surveys (n=72) were applied one year later, to the same group of fishermen. We will apply the same surveys at the end of 2014 to document the impacts of this program two years after its implementation.

Fishermen’s grades (0 to 100%) were low in both before and after surveys for the knowledge questions asked; but all three communities showed an increase in grades, and knowledge gained in the follow up surveys (Table 1). A paired t-test (α=0.05) was applied to make statistical comparisons. The follow up grades were significantly higher than base line surveys at GSC (p=0.009) and SFE (p=0.002), while at PPE the increase was not significant (p=0.413) (Figure 1). These results give evidence of the positive impact that the awareness and training program is having on fishermen’s knowledge about the Reserve, the EIS and mitigation actions, and the logbook training. We are also able to relate knowledge gained with the level of fishermen participation in workshops; at the beginning, the PPE community was not as participative as the other communities and this was reflected in the lack of a significant increase in knowledge, unlike what was observed in the other communities. Only a small portion of the fishing grounds of the Puerto Peñasco community are in the Reserve. This and the complete lack of surveillance by authorities, coupled with the increase in fishing by outsiders from southern communities, has impacted this community’s interest in the EIS. Through the education program, however, that situation is changing, and fishermen are beginning to participate more. The challenge is to increase their knowledge about the EIS and their responsibilities even more, as this empowers them to become more active participants.

The survey results also confirm the general change in fishermen’s perceptions that we have observed since the beginning of the project. In our first encounters with fishermen, before the 2012 EIS was approved, they showed a lack of confidence in the process and there was a lot of misinformation about the EIS and about fishermen’s responsibilities. After one year of persistent attempts to reach all fishermen with the program, most fishermen believe that the EIS is working and they think that it benefits the environment, and as a consequence, it benefits their fisheries production. They also reflected a greater appropriation of the EIS process, with the formation of the Community Advisory Boards in each community, for example. These Community Boards have started to work in an organized way offering fishermen a platform for negotiations with authorities that can bring benefits to EIS fishermen and better implementation of the project.

Another indicator of success has been the increase in compliance with EIS mitigation measures, which is our ultimate goal. In the case of the endemic fish, Gulf corvina (Cynoscion othonopterus), fishermen agreed to stop fishing one day each tide cycle (during the species’ reproductive peak) to let the corvina populations recover. In the case of the black murex snail (Muricanthus nigritus), fishermen worked together with trading
enterprises and authorities to achieve the mitigation measure to voluntarily stop fishing one month in the Upper Gulf Reserve, as part of the EIS requirements. Additionally, two EIS cooperatives built their blue crab (*Callinectes bellicosus*) traps with one side not covered by plastic, to facilitate their rapid corrosion in case they are lost in the ocean, which is also one of their mitigation measures.

**Table 1.** Average grades in baseline and follow-up surveys applied to EIS fishermen at the beginning of the 2012 EIS authorization and after one year of implementation, respectively.

<table>
<thead>
<tr>
<th>Community</th>
<th>Baseline 2012</th>
<th>Follow up 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPE</td>
<td>59.2</td>
<td>62.3</td>
</tr>
<tr>
<td>GSC</td>
<td>62.7</td>
<td>69.3</td>
</tr>
<tr>
<td>SFE</td>
<td>56.8</td>
<td>73.6</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>59.6</strong></td>
<td><strong>68.4</strong></td>
</tr>
</tbody>
</table>

**Figure 1.** EIS fishermen change in grades on knowledge surveys applied before CEDO’s Training and Awareness Program begins (n=224), and one year after this Program was executed (n=72).

*Significant differences (p ≤ 0.05).

**Definition of indicators for a logbook program**

One of the main goals of the EIS awareness and training program is to teach fishermen the importance of collecting data on their fisheries, to show them how to fill out the logbooks correctly, and to motivate their compliance and improve on the quality of the data they are taking. This logbook program represents a huge challenge, for many reasons: 1) fishermen are not used to filling out logbooks at all, 2) even if some fishermen
do fill out the logbooks, there is uncertainty about the reliability of their data, and 3) fishermen don´t see any surveillance by authorities relating to implementation of the EIS in the Reserve, and this is a necessary incentive to motivate their compliance and to validate their rights to be part of the EIS.

The logbooks are delivered to fishermen and returned to CEDO’s field monitors every two months, for review and data capture. The number of logbooks turned in per boat is the best way to document fishermen compliance and assimilation of the custom of filling out logbooks. There are already some signs of progress as can be consulted in Figure 2. We will keep tracking this parameter to see future trends.

The amount or completeness of information that fishermen are gathering was evaluated analyzing a sample of logbooks from 2011 to 2013. The results show an increase in the days of activity recorded, as well as in the number of logbook sections filled out (Figures 3 and 4). Also, in 2013 fishermen increased their recording of days that they did not fish, which is one of the things we stressed with them in the training sessions.

To evaluate the quality of the information, we graded the accuracy of the data they are taking in logbooks (0 to 100%). The results show in general that the three communities are filling out the logbooks in a very acceptable way, as they obtained high grades (more than 80%, Figure 5).

![Logbooks filled out by fishermen in 2013](image)

**Figure 2.** Trend in percentage of logbooks filled out by EIS fishermen and returned to CEDO monitors on a bimonthly basis in 2013 in the three communities of the Upper Gulf Reserve.
Figure 3. Trend in the average number of days per month registered in logbooks by the EIS fishermen in 2011 (n=50), 2012 (n=17) and 2013 (n=60) in the three Upper Gulf Communities. *Total registered days: represent the sum of the fishing and non fishing days registered.

<table>
<thead>
<tr>
<th></th>
<th>Total days</th>
<th>No fishing days</th>
<th>Fishing days</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>8.2</td>
<td>1.9</td>
<td>6.3</td>
</tr>
<tr>
<td>2012</td>
<td>10.5</td>
<td>2.8</td>
<td>7.7</td>
</tr>
<tr>
<td>2013</td>
<td>16.5</td>
<td>6.5</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Figure 4. Trend in the logbook sections filled out by the EIS fishermen in 2011 (n=51), 2012 (n=16) and 2013 (n=62) in the three Upper Gulf Communities.

<table>
<thead>
<tr>
<th></th>
<th>Fishing day</th>
<th>Target capture</th>
<th>Incidental capture</th>
<th>Endangered species</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>80.8</td>
<td>75.8</td>
<td>69.1</td>
<td>24.0</td>
</tr>
<tr>
<td>2012</td>
<td>70.0</td>
<td>66.7</td>
<td>51.6</td>
<td>43.8</td>
</tr>
<tr>
<td>2013</td>
<td>93.2</td>
<td>90.9</td>
<td>76.2</td>
<td>56.9</td>
</tr>
</tbody>
</table>
Conclusion
The Environmental Impact Study awareness and training program has increased understanding and awareness among participating fishermen about the importance of improving fisheries practices to reduce impacts on biodiversity and fisheries. It is providing the tools and training to enable fishermen to comply with specific mitigation measures. Fishermen perceptions and engagement in the EIS are also changing in a positive direction. The program is offering a suite of positive incentives to motivate fishermen to participate in the programs and is taking important steps towards creating a culture of compliance. To have a balanced incentive system, however, negative incentives, i.e. enforcement and fines levied by the government, are also necessary. Steps are being taken to try to motivate the government to do its job as well.
There is still work to do to increase levels of participation in workshops and to reach our goal for getting 100% of the boats represented, but there has never before been such a comprehensive effort to educate and actively engage the region’s fishermen in management on this scale. Despite these challenges, the level of participation is impressive.
We are making slow, but steady progress in getting fishermen compliance in filling out logbooks, as evidenced by the indicators we developed. Fishermen are filling out more logbooks and recording more accurate information, which reflects the impact of training workshops. The reliability of the data they are taking can be assessed in the future using the indicators we defined.
The formalization of a decision-making committee or board for the EIS in each community has been instrumental in addressing many of the challenges we are facing. This and the education program are working together to create a common vision and empowering these leaders and the entire community to move towards sustainable use and conservation of resources in the Reserve.
Knowledge gap on ecological impacts of fishing gears in Thailand

Wichin Suebpala, Faculty of Sciences, Ramkhamhaeng University, Thailand
Ratana Chuenpagdee, Faculty of Arts, Memorial University, Canada
Thamasak Yeemin, Faculty of Sciences, Ramkhamhaeng University, Thailand
Suvaluck Satumanatpan, Faculty of Environment and Resource Studies, Mahidol University, Thailand
Kungwan Juntarashote, Faculty of Fisheries, Kasetsart University, Thailand
Corresponding author: wichin.s@gmail.com

Abstract
Fishing, no matter how it is done, in a small- or a large-scale operation, using fixed or mobile gears, has ecological impacts on fisheries resources. Knowing how different gears operate, what type of impacts they generate, and whether small-scale and large-scale fisheries differ in their impacts is helpful in setting rules and policies. Knowledge about ecological impacts of fishing, especially in small-scale sector, is, however, not always readily available, making it difficult to employ an ecosystem-based approach to fisheries management and to achieve sustainability. This study contributes to addressing this knowledge gap in Thai fisheries, by compiling existing information about fishing gear studies and analyzing their ecological impacts. The study focuses on two main types of impacts, i.e. bycatch and habitat damages. Bycatch are incidental catching of species which are little or non-valuable as well as in a juvenile stage, including forage fish, mega-fauna, seabirds, sea turtles, corals and sponges. Habitat damages are alteration of seafloor (e.g. corals, sponges, seagrasses, soft/hard bottoms) due to fishing gears. The initial results reveal that most of the literatures focus on the amount of trash fish and other non-target species accidentally caught in trawling and dredging. Gear impacts on marine mammals, especially dugongs, and on seabird and sea turtles, are also found. Very little is known about impacts of small-scale fishing gears like traps, gillnets and lines. With an exception of trawling impacts on coral reefs and sponges, information about habitat damages from all gears is generally limited, despite general acknowledgment about their impacts. The next step in the research is to integrate scientific and fishers’ knowledge about ecological impacts of fishing gears.

Keywords: ecological impacts, fishing gears, knowledge gap, Thai waters

Introduction
Thailand has a coastline of about 3,000 kilometers (Department of Marine and Coastal Resources 2012), spreading over 23 provinces in the Gulf of Thailand and the Andaman Sea. A large maritime boundary (Exclusive Economic Zone of about 323,500 km² according to Hydrographic Department 2012) and various natural habitats such as tidal flat, mangrove forests, seagrass beds, coral reefs, underwater pinnacles, etc.,
contribute to high primary productivity in Thai waters and also serve the areas as important fishing grounds in this region.

Fisheries are important to the local and national economies and in the country’s international trade and also play a very important role in food security (Lymer 2008, Juntarashote 1998). Before 1960s, small pelagics, mainly Indian mackerels (Rastrelliger spp.) and anchovies (Stolephorus spp.), were caught by small-scale or artisanal fishers operating mainly fixed and simple gears, and supplied to local markets (Pauly and Chuenpagdee 2003). Owing to the increased global demand of fisheries product, Thai fisheries were rapidly developed, staring with trawl fisheries for catching demersal fish (Pauly and Chuenpagdee, 2003). Also, purse seine fisheries were introduced in the early 1980s for catching pelagic species. The number of fishing vessels had been increased rapidly since then, contributing to high volume of landings. As a result, Thailand became one of the important global exporters of fisheries products (Lymer 2008). With the rapid increase in fishing intensity and lack of appropriate management, the long-lived fish with higher trophic level have been overexploited, transiting the fish stocks to short-lived species with lower trophic level. The phenomenon that Pauly et al. (1998) call “Fishing down food webs” illustrating unsustainable fisheries system took place in the Gulf of Thailand (Pauly and Chuenpagdee, 2003).

From 1995 to 2011, the quantity of marine fisheries production went from 2,827 MT to 1,610 MT, an average declining rate of 3.8% per year (Department of Fisheries 2012). It is not only heavy exploitation, however, that generates concerns. Many reports reveal that fishing has impacts on coastal and marine environment in terms of reduction of species diversity and destruction of important habitats such as coral reefs, seagrass beds, sea floors, etc. (Jennings and Kaiser 1998, Jackson et al. 2001; Dulvy et al. 2004, Erftemeijer and Lewis 2006, Mangi and Roberts 2006, Shester and Micheli 2011, Sangil et al. 2013). Besides the overfishing that can cause collapse of fisheries, there is a collateral impact, which fishery managers pay less attention to (Morgan and Chuenpagdee 2003). The collateral impact have been defined by Morgan and Chuenpagdee (2003) as “Unintentional or incidental damage to sea life or seafloor habitat caused by fishing activities directed toward other types of sea life. The collateral impact includes bycatch and habitat damage”. Not only target species are caught during fishing, but also other non-target species such as sponges, echinoderms, sea turtles, dugongs, birds etc. which can be injured or killed during fishing. Furthermore, sensitive biological habitats and the organisms living in such areas can be harmed due to contacting between fishing gears and sea floor. Besides, indirect effects of fishing on fragile habitats like coral reefs have also been found; for examples, Althaus et al. (2009) illustrated that the sediments generated by trawling nearby the reefs may alter coral growth, coral recruitment and distribution of benthic communities. All these impacts mentioned above may cause negative impacts on biodiversity, food webs, ecosystem function and services. The impact which is being generated during fishing by different fishing gears produces different level or severity of such impacts. Knowledge about the collateral impacts of each fishing gears is important for effective fisheries governance.
Globally, several studies have been conducted to identify both absolute and relative impacts of fishing gears on bycatch and habitat damages (Morgan and Chuenpagdee 2003, Fuller et al. 2008, Innes and Pascoe 2010, Moore 2010). In Thailand, the information and knowledge about these impacts is likely lacking. The first phase of the study aims to illustrate the extent of this knowledge gap in Thai fisheries, by compiling existing information about fishing gear studies and analyzing their ecological impacts. Findings from this phase provides basis for the next step in the study, which relates to comparative assessment of small-scale and large-scale fishing gears in Thailand.

**Methodology**

The first step in knowledge gap analysis is to gather and review the existing literature regarding ecological impacts of fishing gears in Thailand. Both Thai and English language research papers, technical reports, annual report, newsletters, theses and dissertations, and project reports relevant to above topic were searched through online databases including the Web of Science, SpringerLink, ScienceDirect, ProQuest, Thai Library Integrated System (ThaiLIS), organization’s websites or libraries, and university’s online libraries. The web search was conducted during March – April 2014 using the main keywords including ‘impacts’, ‘fisheries’, ‘fishing gears’, ‘bycatch’, and ‘habitat’. Secondly, we made direct contact with the relevant organizations such as Fisheries Department, Department of Marine and Coastal Resources, Regional Fisheries Research Station, Southeast Asian Fisheries Development Center (SEAFDEC), in order to gather other information not available online.

**Results and Discussion**

Like other countries, fishing gears in Thailand are very diverse ranging from large-scale with sophisticated operation to simple, small operation. Small-scale fisheries tend to operate inshore with smaller boats, while large-scale fisheries are conducted further offshore. At least 36 fishing gears are now being operated in Thailand, nine of them are large-scale and the rest are small-scale (Table 1). In 2011, Large-scale fisheries are responsible for about 83.24% of the total landing (1,610,418 tons), according to the Fisheries Statistics conducted by the Department of Fisheries. The majority of small-scale fisheries catches are included in these estimates.

<table>
<thead>
<tr>
<th>Large-scale fisheries</th>
<th>Small-scale fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Otter board trawl</td>
<td>1. Crab gill net</td>
</tr>
<tr>
<td>2. Pair trawl</td>
<td>2. Shrimp gill net</td>
</tr>
<tr>
<td>5. King mackerel drifting gill net</td>
<td>5. Beach seine</td>
</tr>
<tr>
<td>7. Push net</td>
<td>7. Lift net</td>
</tr>
<tr>
<td>8. Dredge</td>
<td>8. Squid falling net</td>
</tr>
</tbody>
</table>

Table 1 Current fishing gears in Thailand
10. Anchovy falling net
11. Long line
12. Bottom long line
13. Handline and Pole & line
14. Trolling line
15. Shallow water Set net
16. Fish trap
17. Crab trap
18. Squid trap
19. Octopus trap
20. Shrimp trap
21. Long trap
22. Bamboo stake trap
23. Jellyfishes scoop
24. Shellfish collecting
25. Harpoon
26. Blast fishing
27. Poison fishing

Sources: Department of Fisheries (2012) and the data from personal observation

In general, small-scale fisheries include a small minority of fishers who fish without boats or with non-powered boat. The majority of them fish with outboard powered boat (82%), and the other 6% use inboard powered boat of less than 5 GRT (Chuenpagdee and Juntarashote, 2011). In addition to engine size, type of employment is another criteria differentiating small-scale from large-scale, with small-scale fisheries relying more on family members while large-scale sector hires crew members.

The literature search on ecological impacts resulted in 159 documents, published between 1979-2012, with relevant information. The majority of information was found in technical reports (Figure 2). Most of the data are ‘gray literature’ reported by public agencies, mainly the Marine Fisheries Research and Development Bureau of the Fisheries Department, SEAFDEC, and universities.
The initial results of the knowledge gap analysis reveal that most of the literatures focus on the amount of trash fish and other non-target species accidentally caught in trawling and dredging, especially otter board trawl. Bycatch (amount of trash fish, sea turtles, sharks and some invertebrates) can be extracted from the catch composition data. According to our estimation using the Fishery Statistics in 2011, about 20.99% of the total landing is bycatch majoring with trash fish (98.1%). Gear impacts on marine mammals, especially dugongs, and on seabird and sea turtles, are reported in some gray literatures. Very little is known, however, about impacts of small-scale fishing gears like traps, gillnets, lines, lift net, octopus trap, long trap, jellyfish scoop and harpoon. With an exception of impacts of trawling and dredge on coral reefs, sponges, seagrass beds, information about habitat damages from all gears is generally limited (Table 2).
habitat damages are generally qualitative. Further research is required to properly analyze

fishing gear is very limited. Bycatch statistics

on impacts of trawls and dredges. Knowledge about ecological impacts of small-

The literature review conducted in the first phase of the study reveal the heavy emphasis

Conclusions and next steps

The literature review conducted in the first phase of the study reveal the heavy emphasis on impacts of trawls and dredges. Knowledge about ecological impacts of small-scale fishing gear is very limited. Bycatch statistics are included in catch composition, while habitat damages are generally qualitative. Further research is required to properly analyze

<table>
<thead>
<tr>
<th>Fishing gears</th>
<th>Bycatch</th>
<th>Habitat damages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Invertebrates</td>
<td>Ground fish</td>
</tr>
<tr>
<td>1. Otter board trawl</td>
<td>57</td>
<td>47</td>
</tr>
<tr>
<td>2. Pair trawl</td>
<td>45</td>
<td>34</td>
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<tr>
<td>3. Beam trawl</td>
<td>34</td>
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</tr>
<tr>
<td>4. Purse seine</td>
<td>34</td>
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</tr>
<tr>
<td>5. King mackerel drifting gill net</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>6. Mackerel Encircling gill net</td>
<td>40</td>
<td>34</td>
</tr>
<tr>
<td>7. Push net</td>
<td>41</td>
<td>37</td>
</tr>
<tr>
<td>8. Dredge</td>
<td>40</td>
<td>34</td>
</tr>
<tr>
<td>9. Deep water set net</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>10. Crab gill net</td>
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<td>1</td>
</tr>
<tr>
<td>11. Shrimp gill net</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>12. Squid trammel net</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>13. Mackerel and Mullet gill net</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>14. Krill scoop net</td>
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<td>1</td>
</tr>
<tr>
<td>15. Beach seine</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>16. Lift net</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>17. Squid falling net</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>18. Cast net</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>19. Anchovy falling net</td>
<td>-</td>
<td>-</td>
</tr>
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<td>20. Long line</td>
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<td>-</td>
</tr>
<tr>
<td>21. Bottom long line</td>
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<td>6</td>
</tr>
<tr>
<td>22. Handline and Pole &amp; line</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>23. Trolling line</td>
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<td>-</td>
</tr>
<tr>
<td>24. Shallow water set net</td>
<td>1</td>
<td>1</td>
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<tr>
<td>25. Fish trap</td>
<td>3</td>
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<tr>
<td>26. Crab trap</td>
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<tr>
<td>27. Squid trap</td>
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<tr>
<td>28. Octopus trap</td>
<td>-</td>
<td>-</td>
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<tr>
<td>29. Shrimp trap</td>
<td>-</td>
<td>-</td>
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<tr>
<td>30. Long trap</td>
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<tr>
<td>31. Bamboo stake trap</td>
<td>35</td>
<td>35</td>
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<tr>
<td>32. Jellyfishes scoop</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>33. Shellfishes collecting</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>34. Harpoon</td>
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<td>-</td>
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<tr>
<td>35. Blast fishing</td>
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<td>1</td>
</tr>
<tr>
<td>36. Poison fishing</td>
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</tr>
</tbody>
</table>

Conclusions and next steps

The literature review conducted in the first phase of the study reveal the heavy emphasis on impacts of trawls and dredges. Knowledge about ecological impacts of small-scale fishing gear is very limited. Bycatch statistics are included in catch composition, while habitat damages are generally qualitative. Further research is required to properly analyze
the extent of bycatch and habitat impacts from different fishing gears based on existing information. A method to conduct impact rapid assessment will be developed and employed to determine impacts of small-scale fishing gears in the next step.

References
Fish as food: challenges in incorporating fish into Newfoundland’s alternative food networks

Chloé Madeleine Poitevin, Memorial University, Newfoundland, Canada, cm.poitevin@mun.ca
Ratana Chuenpagdee, Memorial University, Newfoundland, Canada, ratanac@mun.ca

Alternative food networks have been developed to challenge the conventional globalized food system by emphasizing localized and alternate ways of producing, distributing, consuming, and thinking about food. In Canada, the idea has taken off in agricultural sector, with promotion of farmers markets, community-supported agriculture and local food movements. For the most part, the inclusion of fish in such networks has been limited because fish, and the fisheries, are valued more for their role as an export commodity than their contributions to livelihoods, culture and the local food system. This absence is particularly striking in Newfoundland where fisheries are historically and culturally significant. The current export-oriented structure presents a major concern to local food security and sustainability, as well as to the viability of small-scale fishing communities. This study therefore examines the opportunities and challenges in developing alternative food networks in Newfoundland fisheries, and strengthening food security. Specifically, through in-depth interviews with fisheries stakeholders, the study aims to assess the extent to which locally harvested fish is a part of the local food system,
and evaluate the alternativeness of three emerging alternative food networks. In this paper, one of these networks related to a traceable seafood initiative on the southwest coast of the province is presented.

**Introduction**

Food systems can be defined as the set of relations, processes, and institutions that are involved in not only the components relating to the production of foods, but also the broader elements that pertain to distribution, research and eating, and at different scales (Olson et al., 2014). An increasing amount of literature points to the significant impacts of the conventional food system, resulting in growing ecological and socio-economic concerns. Consequently, there is increasing issues related to consumers’ health, as well as ecological and ethical implications of conventional food production. Many of these concerns may be addressed by way of alternative food networks (Maye et al, 2008; Harris, 2010). As a response to environmentally and socially harmful practices associated with conventional agriculture, alternative food networks (AFNs) is conceived as alternative ways of thinking, producing, marketing, distributing and eating food (Harris, 2010). AFNs seek to reconnect actors along the food supply chain, foster decentralized and democratic decision-making processes, and re-localize food systems (Watts et al., 2005). These alternatives may be categorized by relative strength or ‘alternativeness’, in order to indicate the degree to which they diverge from conventional practices (table 1) (Harris, 2010; Watts et al., 2005; McCarthy, 2006, Kirwan, 2004).

<table>
<thead>
<tr>
<th><strong>Table 1.</strong></th>
<th>Conventional Food System</th>
<th>Weak AFNs</th>
<th>Strong AFNs</th>
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<td>Globalized production and distribution</td>
<td>Place-based production, global markets</td>
<td>Localized production, distribution and consumption</td>
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<td>Production methods based on scientific and technological innovation</td>
<td>Ecologically-responsible methods based on technological innovation</td>
<td>Ecologically-responsible methods based on traditional knowledge, alternative techniques, minimal external inputs</td>
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(Watts et al., 2005; Wittman, 2011)

One of the most apparent gaps in AFN research concerns the lack of inclusion of fisheries, as most studies have focused on land-based food systems. Lowitt et al. (2013) note that the marked absence of fish in local food and sustainable food movements in Canada is at odds with the nation’s vast freshwater and marine fisheries resources (Lowitt et al., 2013). The issues that alternative food networks seek to address in conventional agriculture are similarly present in the commercial fisheries, particularly with regards to social, economic and environmental sustainability. These issues are apparent in Canada’s fisheries, as, for the most part, fisheries policies support larger-scale and export-oriented...
operations, and fail to recognize the importance of fish in assuring food security, and sustaining local economies and food systems (Food Secure Canada, 2011).

In response to these issues, there have been emerging AFNs in the fisheries, to help build relationships between fish harvesters and consumers, traceability, and improve access to and availability of sustainable and local fish and seafood. However, AFNs have been particularly slow to emerge in Newfoundland’s fisheries comparatively to other coastal provinces. This is despite the important role that fisheries have played in the socio-economic development of Newfoundland, and continue to contribute significantly to the economy and the food system (Kurlansky, 1997; DFA, 2013). The Atlantic cod fishery spurred the settlement of the island, and remained an important economic driver until the collapse of cod stocks and the subsequent moratorium in 1992 (Bavington, 2010). The current fishery is primarily export oriented, with snow crab and shrimp having replaced Atlantic cod as the primary commercial species following the moratorium in 1992 (DFA, 2013; Mather, 2013; Foley, 2012).

Though AFNs in the fisheries are limited, the number of AFNs in Newfoundland’s agricultural systems has increased. There is a growing network of farmers’ markets and direct marketing schemes for agricultural products in the province, as well as a rich history of self-provisioning practices in terms of berry picking, hunting and recreational fishing (Temple et al., 2012; Lowitt, 2013). However, there are significant barriers that limit alternate and informal markets, as well as the development of AFNs in the fisheries, due largely to the current provincial and federal legislation (Murphy and Neis, 2012).

**Study areas**
The purpose of this research is to evaluate the alterity of emerging AFNs in Newfoundland that include fish, and to examine the opportunities and limitations in further development of these initiatives. The study looks at three areas of Newfoundland, on the southwest coast and the Avalon Peninsula, where some form of AFNs seem to exist. While there are currently no formalized AFNs in Newfoundland’s fisheries, these cases provide an opportunity to examine emerging alternatives, in terms of how they arise, organize and operate. This study also examines the ways in which AFNs may help create a place for fish in the local food system in Newfoundland. Drawing from an interactive governance and governability concept, the research looks at the contributions of fisheries to local food systems, and whether fisheries AFNs are able to present a sustainable and appropriate alternative to conventional practices.

The three initiatives examined in the study are: (1) a traceable seafood project called ThisFish, managed by the Fish, Food and Allied Workers Union (FFAW) on the southwest coast of the island; (2) the network of retailers and restaurants in the St. John’s area seeking to include and promote locally caught and sustainable fish; and (3) the Petty Harbour Fisherman’s Cooperative on the Avalon peninsula, which has incorporated sustainable fishing methods into their practices. The selected initiatives embrace goals, principles and values that are alternative to conventional practices, including environmental sustainability, social responsibility, and localized food systems and
markets. Equally, these initiatives participate in various aspects of the supply chain, namely harvest, processing, distribution, marketing and retail.

**Methods**
The study primarily employs in-depth, qualitative interviews targeting a variety of stakeholders involved in selected initiatives in Newfoundland’s fisheries. Data collected from interviews are analyzed to determine the strength and structures of the alternative fisheries initiatives using set criteria, based on the governability assessment framework. Governability assessment involves an examination of all aspects of the fisheries system, including the natural and social systems that are being governed, the governing system, and elements of the meta-level of governance, such as values and principles, in determining whether they contribute to make the system more or less governable (Chuenpagdee, 2011; Kooiman and Jentoft, 2009). A comparative analysis of the three case studies offers lessons and possible options about how to better integrate fish as part of the food system in Newfoundland.

The study also relies on secondary data, drawn largely from policy documents and grey literature. This literature review provides an overview about the institutional actors and structures governing the food system and the fisheries, and the ways in which fish contributes to community food security and livelihoods.

The interviews are semi-structured, and encompass a set of predetermined themes and open-ended questions, with possibilities to ask probing and follow-up questions (Cope, 2006). Approximately 30 respondents have been selected using purposeful sampling and snowballing in order to include a range of stakeholders participating in the chosen initiatives. These include fish harvesters (the term used to refer to fishers in Newfoundland), program administrators or managers, processors, buyers, retailers, fisheries union members, and government fisheries managers.

**Preliminary results**
Though the study is currently underway, the majority of interviews have been completed for the ThisFish project in the Port aux Basques area. ThisFish is an initiative started as a fisher-led project in British Columbia, in collaboration with a non-governmental organization, Ecotrust Canada, in which fish harvesters recognized the need to embrace traceability, particularly for market reason and out of curiosity as to where their fish was going. In Newfoundland, the FFAW was looking to create a traceability project and thus partnered with ThisFish in pioneering the initiative in the Port aux Basques area, starting with lobster and later halibut. In general, fish harvesters taking part in the program are provided with tags for their fish with a numerical code that consumers, upon purchasing the fish, can enter on the ThisFish website. This code will lead them to the associated fish harvester’s profile and allows them to make contact, if they wish to do so. These profiles contain pictures and videos of the harvesters, along with information about their boat, crew and gear types used.
The FFAW worked toward developing a way in which minimal effort was required on the part of fisher harvesters to participate in the project in order to ensure a larger number of participants. According to the traceability coordinator for the FFAW, the most work done by fish harvesters is the creation of their online profiles. After these are completed, fish harvesters need only to tag their fish and respond to consumer’s messages, if desired. The current project in the Port aux Basques area, now in its second year, began with lobster and has since grown to include halibut as of this year. Both fisheries are small-scale and inshore, with the lobster harvesters using speedboats of approximately 20 feet in length and lobster traps, and halibut harvesters employing long lines with hooks and vessels of approximately 30 feet in length (ThisFish and Ecotrust Canada, 2013; DFO, 2010).

The participating harvesters interviewed expressed great interest and curiosity in knowing where their fish goes, and many were pleased to receive feedback from consumers for the first time thanking them for the fish they caught. Both the harvesters and the FFAW traceability coordinator stated that the fish caught by ThisFish harvesters was generally of higher quality, which may be due to the product being traceable back to the harvester generating more pride in their work.

The higher quality product has generated interest from restaurants in the St. John’s area. The director of the Restaurant Association of Newfoundland and Labrador revealed that, following the ThisFish official launch in May 2014 by the FFAW, a group of restaurants and a retailer in the St. John’s area have been working to acquire the traceable halibut from the southwest coast of the province (Port aux Basques area) with the assistance of the nearby processing plant. One restaurant owner said that this was one of the first times restaurants have chosen to work together towards achieving a common goal.

The network of restaurants in St. John’s is another area considered in this study, as many are attempting to highlight and promote traditional Newfoundland cuisine and locally sourced foods, particularly fish and seafood. More work is underway to examine this network, along with fisherman’s cooperative in Petty Harbour. There also seems to be a connection that exists between St. John’s and Petty Harbour, as it is the closet fishing community in operation and a growing tourist destination. In terms of ThisFish, questions have arisen concerning the sustainability of the initiative, along with the marketability of traceable products, particularly as harvesters are currently not receiving more money for their higher quality products. In order to ensure that such a project continues, all the actors along the supply chain must be involved and committed to maintaining the initiative. In terms of further developing AFNs in the fisheries, there are concerns with regards to the lack of policy support, particularly in terms of the restrictions on direct sales of fish. Although there is interest on the production and consumption ends of the supply chain for alternatives, there is seems to be a need for more support from governing actors to create incentives and opportunities for AFNs to take hold.

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**Synergies for stewardship and governance of multiple-use coastal areas:**

A case study from Koh Chang, Thailand
Abstract
Coastal areas are made up of diverse, complex, and dynamic ecosystems that attract numerous operations such as tourism, fishing, and conservation. As these operations are not always compatible, efforts to integrate them in a holistic manner often result in marginalizing certain groups. For example, an establishment of a marine park in coral reef areas may favor conservation and tourism stakeholders, but disadvantage small-scale fishing people. Instead of exploring strategies that seek to control operations and minimize interactions, this study aims to take a closer look at operations that co-exist and the potential for synergies. This article argues that greater attention to relationships among different operations in coastal areas is an important step in exploring synergies for environmental stewardship and governance of multiple-use areas. Using Koh Chang, the second largest island of Thailand, as a case study, this research seeks to examine the nature of relationships and the potential they have for forming synergies, which are conducive to stewardship and governance.

Introduction
As one of the most complex multiple-use areas in the world (Griffis and Kimball 1996), coastal areas support a range of stakeholders and operations. Operation heterogeneity, with conflicting interests and aspirations, increases the overall complexity of the social system (Jentoft et al. 2007). In turn, different uses can lead to issues of competition and conflict among coastal operations sharing limited space and resources—often at the expense of the environment (Oracion et al. 2005; Fabinyi 2008). Operations associated with tourism, fisheries and conservation, in particular, are commonly found to exist together in coastal areas around the world and, in many cases, are comprised of groups whose immediate use or interaction with the coastal environment are in contrast with one another. In order to address this issue, many technical solutions have been pursued in an attempt to manage conflicts.

Represented by a wide body of literature, strategies such as multiple-use zoning, marine protected areas (MPAs), community-based management (CBM), and ecotourism promotion as well as an assortment of rules, regulations, and restrictions have been advocated as means to mitigate user impacts, including those associated with tourism, fisheries, and conservation. In general, these approaches exemplify management strategies in which their application seeks to control users’ access, activities, and interactions with one another (McClanahan 2011). However, many of the aforementioned management interventions have been ineffectual in the fulfillment of their intended goals for sustainable resource use (Degnbol et al. 2006).

The challenges management strategies have had in attaining their respective goals has been suggested by Jentoft and Chuenpagdee (2009) to be a result of applying standardized solutions to problems that are too often portrayed as benign and simple. In actuality, issues linked to resource management, or societal problems in general, are
inherently complex—or wicked. Wicked problems are problems that are multifaceted and difficult to define. Subject to many known and unknown factors and influences, wicked problems cannot be easily remedied with a technical fix. In many cases, they are ongoing and ever changing, and thereby warrant long-term attention and reassessment (Jentoft and Chuenpagdee 2009).

With the recognition of the complicated nature of societal problems, there is impetus to utilize a different approach to the management norm when it comes to understanding and addressing issues associated with multiple-use areas. Specifically, this study employs a governance approach, which offers a broad lens to address wicked problems through the acknowledgement of their inherent complexity. Interactive governance, in particular, offers a holistic perspective via a systems approach in which the governing system, natural and social systems-to-be-governed as well as the interactions between them form a basis for inquiry. Each system can be described and analyzed through their system properties of diversity, complexity, dynamics, and scale, which correspond to the respective system variables: components, relationships, interactions, and boundaries (Chuenpagdee and Jentoft 2009). Based on these attributes, interactive governance will form the conceptual framework of this study. With an understanding of the systems, this study intends to focus on the system property of complexity through the assessment of relationships among coastal operations associated with tourism, fisheries, and conservation.

In line with interactive governance theory, this study acknowledges that different coastal operations rarely exist in isolation of one another. Interrelationships among different operations can be a source for potential synergies. Synergies represent relationships that have positive emergent capabilities (Nevo and Wade 2010) and thus, have potential to unveil opportunities for addressing complex problems, such as governance of multiple-use coastal areas. Opportunity creation is a key tenet to interactive governance theory, which seeks to explore new ways to approach persistent societal problems (Kooiman et al. 2005). Given the diversity of operations that take place in coastal areas, this study aims to gain an understanding of the potential for existing relationships to form synergies that improve governance as well as care for natural systems, or environmental stewardship.

Environmental stewardship is a term that is frequently used within resource management literature, yet often lacks an explicit definition (Westphal et al. 2014). In most cases, it is a concept that ultimately refers to humans’ duty or responsibility to care for nature (Worrell and Appleby 1999). Similar to interactive governance, stewardship also offers a perspective that is broad in scope and includes a wide variety of interests and meta-level attributes—such as ethics, values, and beliefs—to provide insight to human relationships and interactions with nature (Worrell and Appleby 1999).

More specifically, the purpose of this research is to explore the potential for synergies among tourism, fisheries, and conservation operations, which are conducive to environmental stewardship and governance of coastal areas. This study intends to analyze synergy potential by looking at relationships and other related factors among coastal
operations. As an illustrative case study, this research will take place within the coastal areas of Koh Chang—an island located in the eastern Gulf of Thailand. First, a description of the study area of Koh Chang will be provided, followed by preliminary findings based on field observations and key informant interviews.

**Koh Chang Case Study**

Koh Chang, Thailand’s second largest island, is a part of the greater Mu Koh Chang archipelago, situated in the upper Gulf of Thailand in the eastern province of Trat. Koh Chang is known for its lush terrestrial rainforest as well as its diverse and dynamic coastal ecosystems, comprised of mangrove forests, rocky and sandy beaches, mudflats, seagrass beds, and fringing coral reefs (Roman 2004). The island’s coastal ecosystems, in turn, support a high level of biodiversity (UNEP 2003) as well as tourism, fisheries, and conservation related operations. Koh Chang—as characteristic of many coastal areas and particularly those in the Gulf of Thailand—face a range of threats from human-related pressures, including overfishing, destructive fishing, poor tourism practices, land and marine-based pollution, coastal erosion from development (UNEP 2008), as well as damage from natural phenomena, such as coral damage inflicted by storms and coral bleaching events.

Local economies have historically been based in agriculture and fisheries; however, within the last thirty years Koh Chang has undergone significant socio-economic and institutional changes. In 1982, the Department of Forestry established Mu Koh Chang National Park (Rochanarat 2007). The park boundary encompasses 47 islands, including Koh Chang. Despite the presence of fishing villages on the island, the park encompasses these areas within its demarcation and inhabitants were permitted to stay (Jentoft et al. 2011). In the early 2000s, tourism development expanded due to government policies and effective marketing schemes (Roman et al. 2007; UNEP 2008). Devastation to Thailand’s Andaman coastline caused by the Indian Tsunami in 2004, also caused tourism in the Gulf of Thailand, and particularly Koh Chang, to increase (Roman et al. 2007). For instance, approximately 900,000 tourists visited the Mu Koh Chang National Park in 2012, which was a significant growth compared to the 330,000 tourists to visit in 2003 (Piriyapada and Wang 2014). Rapid development and inadequate planning and infrastructure has lead to environmental issues, such as water shortages, sewage pollution, coastal erosion, as well as increased pressure on coral reef ecosystems from snorkeling and SCUBA diving (UNEP 2003).

Although issues of non-compatibility and conflict have arisen among coastal operations, there are two key institutions that have assisted in building a foundation for environmental stewardship in Koh Chang. The first institution being a coral reef demonstration site led by the United Nations Environment Programme (UNEP)-Global Environment Facility’s (GEF) initiative from 2005-2008. Under this project, many activities were pursued in attempt to minimize coral reef degradation whilst supporting local peoples’ livelihoods. Thus, UNEP-GEF activities involved a wide range of local stakeholders, including small-scale fishers, tourism operators, community members, and governing agencies through processes that emphasized knowledge, capacity and network
building. Second, Koh Chang was selected to be the pilot site of a newly formed public organization established under the office of the former Prime Minister in 2004, known as the Designated Areas for Sustainable Tourism Administration (DASTA). DASTA aims to encourage sustainable tourism in Koh Chang and surrounding areas, and it works closely with local communities to facilitate conservation and sustainable development initiatives through interactive environmental-oriented processes, which were inclusive of coastal stakeholders and governing agencies. Based on these factors, Koh Chang provides an ideal place to pursue this research topic.

Synergy Potential for Stewardship and Governance in Koh Chang
As mentioned above, there are governance challenges commonly associated with multiple-use areas, which have been evident from field observations and key informant interviews. However, there have also been examples of interactions and relationships, which exemplify potential opportunities for improved governance and enhanced stewardship in the area. Some of these positive relationships include the role of DASTA as a coordinating agency, local people’s acceptance towards the tourism sector, as well as the existence of community-based conservation and sustainable tourism organizations.

Key governing institution, DASTA, maintains positive relationships with the villages and is highly regarded among local village representatives. DASTA both initiates and responds to project requests and provides support through start-up funding, education and training. DASTA also maintains communication with communities through monthly village meetings. Over the last ten years, it has facilitated numerous conservation-related projects, inclusive of stakeholders from tourism and fishery operations, including beach and reef garbage cleanups, mangrove reforestation, coral transplantation, artificial reefs establishment, sewage treatment, and waste management programs.

The general perception of tourism on the island is positive. Residents of the island consider the tourism sector to be important in providing alternative livelihoods and supplementary income. Tourism, along with increased conservation efforts, has been attributed as strengthening community cohesion in fishing villages as it has provided locals with a reason to stay when faced with declining fish stocks. However, the impacts of mass tourism, which has largely concentrated on the west coast of the island, are widely recognized. Fishing villages on the east and southeast coast of the island, for instance, participate in tourism, but want to be in charge of the decision-making regarding development to prevent outside businesses taking control. Current tourism activities supported in these areas include guesthouse and homestay accommodation and activities such as, kayaking, mangrove nature walks, snorkeling, boating, and fishing. With support from DASTA, the communities have committees in place to manage tourism development.

Following UNEP-GEF and DASTA-led projects as well as support from local and provincial governing agencies, local-based organizations for sustainable tourism practices and conservation efforts exist. Some of the initiatives include a cooperative for kayak tours in mangrove areas, monitoring against illegal fishing, a fishers’ club for sustainable tourism as well as participation in crab bank projects.
Conclusion

An understanding of the factors and relationships that indicate potential for synergies among different operations in multiple-use coastal areas is important not only to learn about where issues of incompatibility and conflict among coastal operations lie, but also where opportunities to enhance stewardship and improve governance may occur. Given that fisheries, tourism, and conservation operations often do co-exist in coastal areas around the world, there is motivation to pay greater attention to the latent potential and positive aspects of relationships, which could be nurtured and supported. In turn, an understanding of potential synergies can play an important role in establishing context-appropriate management interventions that aim to foster synergies among different operations.

References


Limits to MPA governability: Conservation boundaries and resource use compatibility in Southern Brazil

Mirella de Oliveira Leis, Memorial University, Brazil, mirella.deoliveiraleis@mun.ca
Ratana Chuenpagdee, Memorial University, Canada, ratanac@mun.ca

Abstract
Marine Protected Areas (MPAs) have been widely advocated as a strategy for marine resource conservation and fisheries management worldwide. Their designation is endorsed internationally through the Convention on Biological Diversity target of protecting 10% of world’s oceans by 2020. However, the urgency surrounding the establishment of new MPAs in order to meet the goal may create a false sense of conservation, as the measure of success is expressed only in terms of the area covered, but not in their implementation. This is the case in developing countries such as Brazil, where few marine conservation outcomes are apparent, and the focus is still on designating new MPAs instead of effectively implementing existent ones. There is a need to address MPA implementation from a different perspective, acknowledging them as socially constructed institutional arrangements that are context-dependent and in need of
stakeholders’ support. The purpose of this paper is to apply interactive governance perspective to examine MPA implementation, focusing particularly on the identification of governability challenges arising from compatibility of natural and institutional boundaries to resource uses. The study takes place in the coast of Paraná State, Southern Brazil, where the Marine National Park of Currais Islands has just been announced in June of 2013, to protect biodiversity-rich areas. A governability assessment is employed to analyze what features of the natural and social systems, and the governing system associated with this new MPA that may either foster implementation or create difficulties. Findings from this study enable the identification of challenges to governability, as a step towards exploring opportunities to effective implementation of this MPA, and elsewhere.

Introduction
Marine protected areas (MPAs) have been widely advocated as a strategy for marine resource conservation and fisheries management worldwide (Rice et al. 2012). MPAs encompass a “(...) clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values”, under the overall broad definition of protected areas by the International Union for Conservation of Nature (Dudley 2008, p.8). As MPAs are broadly defined, they encompass a range of objectives, from preservation or restoration of biodiversity to improvement of socioeconomic conditions through conservation, of both traditional management practices and natural resources (Pomeroy et al. 2005; Dudley 2008). This implies different levels of restriction of access to resource use, and therefore various types of MPAs, ranging from no-take zones to multiple-use areas (Pomeroy et al. 2005; Dudley 2008). The designation of an MPA can result from a top-down (i.e. state) or a bottom-up (community-driven) initiative; and the mode of governance can also vary, from hierarchical to co-governance, and self-governance (Jentoft et al. 2007).

MPAs are endorsed internationally through the Convention on Biological Diversity (CBD) as a tool that contributes to the target of protecting 10% of world’s oceans by 2020. However, the current rush to create new MPAs in order to achieve the CBD target may contribute to generating a false sense of conservation (Agardy et al. 2011; Rife et al. 2013), as areas designated for protection have often failed in achieving their objectives (Agardy et al. 2011). There also has been a tendency to prioritize “ease of establishment over need for protection” (Devillers et al. 2014, p.1), or in other words, designating large and remote MPAs whilst the protection of more highly threatened areas, where implementation is difficult and costly, is undermined (Devillers et al. 2014). The CBD target only takes into account the area designated for protection, while effective implementation of MPAs remains a challenge worldwide (Rife et al. 2013; Wise 2014), due in part to lack of data and technical, financial, and logistical support (Pomeroy et al. 2005). Additionally, Jentoft et al. (2007) present some of the issues to the governability of MPAs including scale problems, regarding size, location and design; difficulty in achieving stated goals and in making ecological and social objectives compatible; and lack of buy-in from stakeholders resulting in resistance and non-compliance. Other issues may rise from an excessively bureaucratic system associated with poor inter-institutional
coordination and lack of professional motivation, which contribute to generate a pessimistic environment amongst managers and governors resulting in few conservation outcomes on the ground, as observed by Gerhardinger et al. (2011) in Brazil.

In spite of the fact that MPAs have been extensively studied from different approaches, interactive governance has not been used to frame an empirical study about MPAs before. Interactive governance provides a lens to look at MPAs not as a technical solution to management problem, or a tool to be implemented in a vacuum. Instead, it recognizes them as socially constructed institutions, embedded in a particular context, and therefore dependent on stakeholder support (Jentoft et al. 2007). Interactive governance and governability offer a means to analyze systems with a focus on the interactions that happen between a system to be governed, comprised by its natural and social systems; and a governing system (Kooiman and Chuenpagdee 2005; Chuenpagdee and Jentoft 2013). The governability assessment framework has been applied to the Wider Caribbean region (Mahon 2008), to the capture fisheries of Bay of Bengal (Bavinck and Salagrama 2008) and lake Malawi fishery (Song and Chuenpagdee 2010).

Assessing governability involves different stages, starting from the evaluation of the features of the system-to-be-governed: diversity, which represents the number, variety and characteristics of the components of the system (species, stakeholders); complexity, as the relationships between the components, the architecture of the system (e.g. food chain, overlapping institutions); dynamics, or interactions between the components, and more specifically the fluctuations caused by these interactions and that contribute to induce change (e.g. population growth and migration); and scale, which refers to the spatial and temporal extent to which the system’s features have influence, whether correspondent with the borders of the ecosystem or the institutional boundaries or not (Kooiman and Bavinck 2005; Kooiman and Chuenpagdee 2005; Mahon 2008).

Drawing from this analytical perspective, the research explores the challenges to the implementation of a newly-designated MPA in Paraná, Southern Brazil, the Marine National Park of Currais Islands. It is a biodiversity-rich region targeted for conservation but coexists with high natural resource uses, which adds to the potential implementation challenges. The Marine National Park of Currais Islands has just been designated in June 2013, and the management plan is being developed, providing thus opportunities for input and discussions.

**Study location**

Located in southern Brazil, the State of Paraná coastline extends almost 100 km, intersecting two main water bodies, the Guaratuba Bay in the South and the Estuarine Complex of Paranaguá (25º 30’ S/48º 25’ W) in the Central-North part. The Marine National Park of Currais Islands encompasses an area of 1,360 ha, designated by the Law 12,829 published in June 20th of 2013 (L12829/2013) under the Brazilian National System of Conservation Units (SNUC) category of “integral protection”, which corresponds to the IUCN’s category II. The objective of the Marine National Park of Currais Islands is to protect three oceanic islands located six nautical miles offshore for
their importance as nesting areas for bird species and as a unique habitat for marine species.

More specifically, this research took place in the fishing communities located in Pontal do Paraná (Pontal do Sul, Atami, Barrancos, Shangri-lá, Carmery, Ipanema and Praia de Leste), where small-scale fishing people have traditionally used the marine area, where the new MPA is established (Medeiros and Azevedo 2013).

**Data collection**
Data collection involved a literature review related to the natural and social aspects of the coastal zone of Paraná state. Background information was also gathered to describe the governing system. This provided baseline and context to examine aspects of the system-to-be-governed and the governing system properties that may give rise to governability challenges (Song and Chuenpagdee 2010). The second phase of data collection involved preliminary visits to the coastal communities in early July of 2014, when field observation and informal interviews with key informants took place. This phase of the research helped to gain a broader understanding of the context and issues of the region and to make contacts with community members. The final stage involves surveys and mapping exercise with small-scale fishing people in Pontal do Paraná to obtain their perspectives about the new MPA. This paper reports the results from the first two phases.

**Results and Discussion**

*The Marine National Park of Currais Islands as part of a valuable and complex natural system*

The Currais Archipelago (25°44’ S; 48°22’ W) is formed by three rocky oceanic islands located six nautical miles off the coast of Paraná State, where depths range from 1.5 to 18 m on the inner continental shelf that presents a slope of 1/700 m from 12 to 15 m and is mainly dominated by a sand-muddy sediment composition (Veiga et al. 2004). These consolidated substrates make a particularly rare natural environment in Paraná coast (Hackradt et al. 2011) and are known to support an abundant and species-rich community encompassing 20 species of ascidians (Rocha and Faria 2005). The area also functions as habitat for reef fish fauna, including 48 fish species in 30 families, 11% of which are endemic to the Brazilian coast (Daros et al. 2012), and one fish species, Atlantic Goliath Grouper *Epinephelus itajara*, is considered critically endangered (Hackradt et al. 2011; IUCN 2014). In addition, the archipelago provides the main breeding colony for more than 5,000 pairs of the resident bird species Brown Boobies *Sula leucogaster* (Martins and Dias 2003), Magnificent Frigatebirds *Fregata magnificens* and Kelp Gull *Larus dominicanus* (Krul 2004; Carniel and Krul 2010). These bird species are considered of least concern according to IUCN (2014).

The numerous marine species form complex relationships. For instance, key informants differentiated resident reef fish species using the area as a nursery ground, from “passing” fish species, like mullets (*Mugil sp.*) and cavala (*Scomberomorus cavala*), which according to them would be “resting” in the islands after migrations and before reaching areas closer to the coast. They have also cited the relationship between the increase in
turbidity in the water column as a result of dredging activities as having a notable effect on sea-bob shrimp availability.

Further, the Currais Archipelago is situated in dynamic coastal zone, with great spatial and temporal variability. In winter, the more frequent passage of cold fronts associated with storm surges may cause an increase in the astronomical tidal range of up to 0.8 m (Marone and Camargo 1994), which is known to contribute to coastal erosion (Quadros et al. 2007). An interaction between nine species of birds and discards from artisanal fisheries in Pontal do Paraná was documented by Carniel and Krul (2012), especially involving the Kelp Gull _Larus dominicanus_ that nest in Currais Islands. The fishing gear used related to its selectivity showed to influence the number of birds congregated at Pontal do Paraná beaches in different seasons, being less numerous during the trawl closed-season when fewer discards are available.

Finally, the Marine National Park of Currais Islands is under the influence of the estuarine complex of Paranaguá, which exports nutrients, organic matter and sediments to the inner continental shelf (Lana et al. 2001). It provides shelter, feeding and nursery grounds for many non-resident and migratory species, as well as sea turtles. This open system boundary creates governance challenges, as effects on the MPA are due not only to activities taking place in and around the area but also to the estuarine system, not protected under the same legislation.

**Small-scale fishers and other users of the area**
The land use in the Paraná littoral is primarily directed towards tourism activities, artisanal fisheries, nature conservation efforts and port development (Pierri et al. 2006). The total population of 265,362 inhabitants (IBGE 2010) is unevenly distributed in seven municipalities, grouped by Pierri (2003) in rural (Morretes and Guaraqueçaba), port (Paranaguá and Antonina) and touristic (Pontal do Paraná, Matinhos and Guaratuba) municipalities. Scarcely populated vast areas under conservation coexist with large port municipalities and beach tourism along the coast (Pierri 2003). Artisanal fisheries constitute the main source of income for the 11,000 fishers that live in 60 fishing communities in the region (Andriguetto-Filho et al. 2009).

In Pontal do Paraná, there are about 104 canoes in the seven communities included in the study. Like other communities in the region, their fishing practices and gears used, as well as the targeted species, vary following the natural settings and resource availability (Andriguetto-Filho 2003). They use drift and bottom gillnets to target finfish and shrimp, and bottom trawl for shrimp in the inner continental shelf. Hook and line fishery and spearfishing also take place in the region, as an alternative to other fishing practices (Medeiros and Azevedo 2013) and mainly practiced by tourists.

Although fishing is part of the traditional and cultural heritage, coastal development has led to demographic and social change, due mainly to intense migration of people from neighbor states looking for job opportunities related to port and tourism expansion on the coast (Pierri 2003). Since there are not enough jobs, the intense increase in population is one of the causes for increased poverty in the region and inadequate human settlement, generating environmental problems (Pierri 2003).
Added to this, beach tourism during summer is responsible for a sharp and fast increase in the resident population of up to six times, with a record of an increase from 250,000 to up to 1.5 million (Pierri 2003). As a result of urbanization and tourism impacts, introduction of new technologies and breakdown of social values, there is a decline in beach seine fishing practice, which targets mullets during the winter and constitutes the oldest fishing practice in the region (Andriguetto-Filho et al. 2009; Pinheiro et al. 2010). According to Andriguetto-Filho (2003), all fishery systems have undergone social and technical transformations in the last decades, introduced by market and tourism pressure and nature conservation initiatives. An example of the latter is an initiative of an eNGO (MarBrasil), in partnership with the University (UFPR), to install artificial reefs as an anti-trawling system along the coast and open-water mariculture (Brandini 2013).

The governing system
As a National Park, the Currais Islands are governed and enforced at a Federal level by the Chico Mendes Institute for the Conservation of Biological Diversity (ICMBio), which is under the Ministry of Environment (MMA), and is responsible for managing Federal Conservation Units, while informed by the Brazilian National System of Conservation Units (SNUC). The enforcement of environmental legislation is also performed by the Environmental Police and the Environmental Institute of Paraná (IAP) at a State level, and the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) at a Federal level. This various governing institutions operating at the federal, regional and local levels, sometimes with similar duties assigned, have overlap responsibilities despite the hierarchical structure. It is not clear how these institutions relate to each other.

Governments are not the only actor in the governing system. Fishing communities of Pontal do Paraná have their own “colônia”, which is an association of fishers that is recognized by the Brazilian Law 11.699/2000, with the objective of defending fisher’s rights and interests. The Movement of Artisanal Fishers of Paraná state (MOPEAR), created in 2008, is an example of organization of fishers who fight for their rights and for the recognition of their traditional livelihoods, connecting them with one another and with the governmental institutions. In fact, they are part of the community-driven initiatives that drive the change in the governing system. With respect to the MPA, they work with fishing communities to recuperate the traditionally occupied territories and fight for the social acknowledgement of their traditional livelihoods.

The governing interactions
The Marine National Park of Currais Islands was designated without any public consultation, which means that there is an overall lack of mechanisms to encourage and allow participation and communication between those governed and the governing system. Artisanal fishers, directly affected by the MPA, were neither consulted nor informed about the National Park creation. They only learn about it through media. Collaboration between the ICMBio and the variety of resource users is lacking and needs
to be increased in order to enhance legitimacy and accountability of the MPA. The lack of open communication also restricts opportunity for learning and adaptation.

**Governability challenges to the Marine National Park of Currais Islands**

In general, the challenges to the MPA governability arise from the combination of a highly diverse, complex and dynamic natural and social systems-to-be-governed that operates at a large scale, governed through an institutional arrangement that did not provide any meaningful governing interactions. According to Lana et al. (2001), the problems related to fisheries in Paraná State are not well addressed by the management plans, because of the absence of detailed ecological knowledge, a centralized and bureaucratic model of natural resource management and lack of participation of local communities on decision-making. The current centralized and bureaucratic model of natural resource management, with low support from the communities and low enforcement is known to lead to failure in coastal resource conservation in the region, as in this case it resembles an open access regime of resource exploitation. In this context, the participation of local stakeholders in the decision-making process need to be encouraged by the structure of existing governing institutions, opening space for innovation and adaptation. Enhancing governability would be possible in this case by focusing on increasing quantity and quality of governing interactions (Song and Chuenpagdee 2010). This is probably the case for the coastal zone of Paraná state, where the structure of governing institutions has the potential towards enhancing interactions between stakeholders and among institutions for collaboration.

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Significant inventory loss: catching the released?: Experiencing escaped farmed atlantic salmon on Newfoundland rivers in the Coast of Bays region

Christopher Baird, Memorial University, Master of Arts Candidate; Geography

Recreational fishing is the most common form of fishing in North America and fishing for Atlantic salmon represents an important and profitable tourist industry in Newfoundland and Labrador, Canada. Over 130,000 anglers take part in recreational angling in Newfoundland and Labrador annually. However, the rise of recreational salmon angling in Newfoundland has been paralleled by a rise of industrial salmon farming along the south coast of the island. Farmed salmon escape their sea cages, often and in large numbers, wherever they are grown. Recreational salmon anglers in Newfoundland have begun to catch escaped farmed salmon on pristine wild salmon
rivers. This paper investigates the impact of interactions between recreational salmon anglers and escaped farmed salmon.

The increased frequency of interactions between recreational anglers and escaped farmed salmon has been well documented in the media, but the long-term effects and complex meanings attached to these interactions have yet to be fully explored and understood. While anglers clearly make distinctions between wild and farmed fish, government officials and industry representatives recognize few distinctions; as evident through their narratives of escape events. Recreational anglers, however, often view aquaculture escapees as alien invaders, while the fish farming industry maintains they are simply lost revenue. This paper outlines and assesses the impact of escaped farmed salmon on recreational salmon anglers experiences on the water and reports on responses from key informant interviews conducted with anglers in the coast of bays region of Newfoundland.

Plenary 2: Assessment, sustainability and stewardship

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Small-scale fisheries: a global reassessment of their catches

Daniel Pauly, UBC

It is widely understood that the only global fisheries statistics that are currently available, i.e., the data submitted by member countries to the Food and Agriculture Organization of the United Nations (FAO) underestimate the contribution of small-scale fisheries (artisanal, subsistence and recreational), but the extent of this underestimation has never been rigorously assessed. The Sea Around Us, as part of its goal of quantifying human impacts on global marine ecosystems undertook, and has now concluded, a twelve-year activity wherein the fisheries catches by sector of all maritime countries of the world were reconstructed from the bottom up, for the years 1950 to 2010. Selected results from this
effort will be presented, which allow for re-assessments of the global role of small-scale fisheries in contributing food security, and their relationship vis-à-vis industrial fisheries.

**Governance and community conservation in coastal-marine contexts and the implications for small-scale fisheries**

Derek R. Armitage, The Environmental Change and Governance Group University of Waterloo, Canada

A decade ago Berkes (2004:628) argued that community conservation is about governance and conservation action that ‘starts from the ground up but deals with cross-scale relations’, and that a more nuanced understanding is needed of people, communities, institutions, and their interrelations at various levels. Limited progress has been made in this regard. However, new ways of governing in relation to the environment are emerging with important implications for the practice of conservation. In particular, understanding how community conservation is influencing and being influenced by emergent hybrid (e.g., public-private) and network governance arrangements is particularly important. Our aim in this paper is to explore: 1) how different and hybrid governance arrangements might promote community conservation in ways that sustain in particular the well-being of small-scale fishers and the ecosystem services upon which they depend; 2) whether the interests of local resource users (e.g, small-scale fishers) in conservation practices are matched by meaningful involvement in decision processes at multiple levels; and 3) how governance processes emerging in complex conservation situations might be adaptive to social-ecological change and uncertainty.

**How BIG are small scale fishers in the Post 2015 development agenda**

Karin Fernando, Centre for Poverty Analysis, Sri Lanka

On the road to designing and deliberating the next development framework that will replace the existing Millennium Development goals (MDGs) in 2015, a lengthy consultative route is underway. The objectives of these discussions have been to propose an “ambitious” and “transformative” agenda by which the world can tackle poverty eradication. The rhetoric is acknowledging that environmental degradation is no longer an acceptable consequence of development and that climate change is “the greatest challenge of our time”. Hence the main thrust of the overall framework and goals is based on bringing about a sustainable development model. It is currently at the final stages of formulation before the United Nations convenes the negotiation process with the Governments in September 2014. From this point on it is vital that stakeholders and lobby groups work with their governments to include areas of vital importance into the agenda.

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especially to ensure that “no one is left behind” and that the frame is truly transformative. In this conversation, in fact in any conversation that is tackling poverty and vulnerability, needs of small scale fishers, and others who are reliant on small scale fisheries related livelihoods (who make up over 100 million poor people) should be captured and adequately discussed. In addition it is important to investigate this sector as small scale fisheries also has direct link to issue of food security and nutrition for poor people.

This presentation will provide a snap shot of the proposed goals (both the Millennium Development Goals and the Sustainable development Goals) and discuss how small scale fishers, their needs and issues are being incorporated into this framework. It will also bring out positions made by groups or others who are working on fisheries related issues. The presentation will be based on the ongoing debates and position papers related to the MDG and SDG processes. It will focus more on concerns for small scale fishers in developing countries, particularly South Asia.

Special session 2.1: The social and cultural wealth of small-scale fisheries
Organized and chaired by: Derek Johnson (University of Manitoba, Canada)

Synopsis:
In research and writing on small-scale fisheries, there has been a rich and vital vein of work on their social and cultural dimensions, particularly in the areas of maritime anthropology and sociology. That work has been subordinate, however, to the much larger literature on small-scale fisheries’ governance. The panel is the product of the project Too Big to Ignore: Global Partnership for Research on Small-scale Fisheries (TBTI) and, specifically, its Working Group 3 entitled Broadening the Scope which is concerned to highlight knowledge of the social and cultural value of small-scale fisheries. We foreground the diverse ways in which small-scale fisheries enrich the social fabric of which they form part. With reference to the social wellbeing perspective, ecosystem services approaches, and research on place and identity, the contributors to these panels seek novel ways to demonstrate the contributions of small-scale fisheries. Among other lessons, the panels’ papers reinforce the importance of careful attention to the contextual factors shaping the perceptions and values that inform fisher and fishworker economic and political engagements. Contributions to the panel come from Asia and Oceania, Europe, and Latin America. While mostly qualitative in orientation, the studies seek to engage with quantitative efforts to argue for small-scale fishers' social and cultural contributions.

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**A conceptual framework for understanding small-scale fisheries using cultural ecosystem services (CES) and sense of place (SOP)**

Tim Acott and Julie Urquhart (University of Greenwich), t.g.acott@gre.ac.uk; j.urquhart@gre.ac.uk

In the marine environment, there is increasing attention on an ecosystem approach to fisheries, but understanding the cultural services derived from aquatic ecosystems and the coastal zone is poorly understood and there is no agreed consensus for the evaluation of cultural ecosystem services. Drawing on work carried out as part of two European Interreg 4a projects, CHARM III (Channel Integrated Approach to Marine Resource Management) and GIFS (Geography of Inshore Fishing and Sustainability), we report on work developing a conceptual framework for understanding small-scale fisheries (SSF) through the lens of CES and SOP. The framework builds on the Millennium Ecosystem Assessment and subsequent modifications of the concept, for instance the UK National Ecosystem Assessment. We adopt a process driven relational approach to capture the complexity of the connections between nature and society. This helps to make visible many tangible benefits of SSF that might otherwise remain hidden from the perspective of policy makers. The development of a robust conceptual framework is the starting point for exploring new methods and approaches for capturing the importance of SSF for individuals and society.

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**Carole White**
Changing faces and places. Place identity and resilience in the Cromer crab fishery, UK

**Discussion period 1**

**Julian Idrobo**
Adaptation to environmental change through the lens of wellbeing: The case of small-scale fishers on the Atlantic forest coast of Brazil

**Natasha Stacey**
The Bajau of eastern Indonesia

**Alice Ferrer**
Revisiting the Municipal fishers of Western Visayas, Philippines

**Andrew Song**
Highlighting multifaceted values of a small-scale swimming crab fishery near Yeonpyeong Island, South Korea

**Discussion period 2**

**Adam Jadhav**
Taking stock of small-scale fisher diversity: A statistical attempt to paint a nuanced picture of Indian fishing communities

**Maarten Bavinck**
Enhancing the wellbeing of Tamil fishing communities: The role of self-governing uur panchayats along the Coromandel Coast, India

**Gayathri Lokuge**
Cultural and ideological values vs economic return: The case of artisanal fishers in the era of mechanization

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**Women’s Contribution to Social Cohesion in Coastal Communities:**
Cases from Belgium, Britain, France and the Netherlands

Minghua Zhao & Esther Copete Murillo (University of Greenwich)

In Europe, as in other world regions, social cohesion has become an important theme in social policy in the new millennium. Women’s employment, their access to and construction of networks amongst themselves and with others as well as their participation in the mainstream institutions are considered as important dimensions of social cohesion. This paper aims to examine women’s contribution to social cohesion in these dimensions. The primary data is drawn on existing research conducted as part of a European Interreg 4a 2 Seas project ‘Geography of Inshore Fishing and Sustainability (GIFS)’. The investigation has been conducted in fishing communities in four countries along the English Channel including England, Belgium, France and the Netherlands. Interviews, focus groups and observations were employed as the main methods of data collection. The paper will start with an examination of two major contextual aspects: (a) fisheries, fishing communities and women; (b) social cohesion in theory, in policy and in scholarly discussions and debates. The discussion will then move to an analysis of women’s activities in three areas: (a) their engagement in various sector of the fisheries; (b) their construction and management of networks; (c) their participation in mainstream institutions. Some discussion and conclusion will be drawn in the final section. The findings of the research have good potentials contribute to both knowledge and policy making in fisheries in Europe and beyond.

Changing faces and places. Place identity and resilience in the Cromer crab fishery, UK

Carole White (University of East Anglia, UK)

The Cromer crab fishery has a high symbolic value and identity associated with the town. It is a specialised small-scale fishery, and has undergone social, economic and environmental changes suggesting some level of ‘resilience’. The first part of the case study investigates processes related to place identity and belongingness. In particular, I question the significance of a traditional fishery in shaping values and relationships in a wider coastal community where competing place identities have developed. Secondly, I analyse the relational aspects of those involved in the fishery and social relations grounded in place between different actors in terms of shaping adaptive capacity and resilience. The third part examines issues of social renewal and concerns for the future of the fishery due to the lack of 'new blood' by examining the changing relationships to place. I also highlight some of the tensions between individual and social needs and what this means for 'resilience'. Finally, I discuss the role of place identity in shaping participation in decision-at different levels of governance. Data used for this research includes in-depth interviews, observation, questionnaires with photo elicitation methods, as well as secondary data comprising of audio-visual materials, official documents and
statistical data. This research makes links between the local case study and the wider region, and draws out some of the implications for place identity and resilience of coastal fishing communities facing significant changes which is relevant to other cases around the world.

Revisiting the Municipal fishers of Western Visayas, Philippines

Alice Joan G. Ferrer (University of the Philippines Visayas), aj_ferrer2005@yahoo.com
Jinky C. Hopanda (University of the Philippines in the Visayas Foundation, Inc.)
Benedict Mark Carmelita (University of the Philippines in the Visayas Foundation, Inc.)
Terence Dacles (GIZ-Environment and Natural Resources Development)

The Philippines is an archipelago where about three-fourths of the population live in coastal areas. It ranks 11th as a top fishing nation in the world and the fisheries is a very important industry in terms of food, income and livelihood. Specifically, municipal fishing (using fishing vessels at most 3 gross tons, or fishing not requiring the use of fishing vessels, and using passive gears; small-scale capture fisheries) employs a large number of people and have been contributing to about 30% of total fishery production in the country.

Available data sets on municipal fishers in selected sites in Region VI (Western Visayas) will be re-examined using the lens of WG3. These data sets were collected through surveys and Focus Group Discussions in 2008 (2 coastal municipalities in southern Negros Occidental; 7 coastal municipalities in northern Iloilo Province), 2009 (3 coastal municipalities in Iloilo), and 2012 (1 municipality in northern Negros Occidental; 1 municipality in southern Iloilo). The focus will be to describe the socio-demographic-economic and fishing characteristics of the municipal fishers, the importance of fishing activity to them, their values and beliefs on the fishery resources, their perception of the state of the fishery resources and its challenges, and their participation and contribution in fishery management.

A ‘value-contribution’ matrix: capturing multifaceted contributions of a South Korean small-scale swimming crab fishery

Andrew Song (amsong@mun.ca)
Ratana Chuenpagdee (ratanac@mun.ca)
Department of Geography, Memorial University of Newfoundland, Canada

This chapter proposes a ‘value-contribution’ matrix and applies it to a swimming crab fishery in South Korea to facilitate a systematic and comprehensive capturing of small-scale fisheries’ societal contributions. In the matrix, objective, subjective, and relational
values are first identified for the various stakeholders such as fishers, community, and the wider society. Through consideration of these values, multifaceted contributions of the swimming crab fishery were examined and their implications drawn. Around the world, small-scale fisheries have been unduly dismissed in policy despite its ubiquity. This analytical tool could prove to be a useful guideline to the task of highlighting their varied (both positive and negative) contributions. Learning about which values are being emphasized or threatened, and for whom, and the consequences they generate for stakeholders’ wellbeing, could point to alternate ways of creating a more governable fishery and help towards alleviating fishery sustainability challenges.

Adaptation to Environmental Change through the Lens of Wellbeing: The Case of Small-scale Fishers on the Atlantic Forest Coast of Brazil

Carlos Julián Idrobo (Natural Resources Institute, University of Manitoba, Winnipeg, Canada), cjdrobo@icloud.com

Small-scale coastal communities around the globe are dealing with environmental change associated with the fisheries crisis, integration with global markets and climate change. Understanding how coastal people adapt to these challenges is not only a theoretical but also a practical concern that relates to the continuity of ways of life associated with small-scale fishing practice and the sustainability of the natural resource base on which they depend. In this chapter, I examine how people from the small coastal community of Ponta Negra, located in the Juatinga Ecological Reserve on the Atlantic Forest Coast of Brazil, have experienced and responded to environmental change in their recent history. To do so, I employ the social wellbeing framework that provides a multidimensional lens to assess how people’s current situations as well as their desires and aspirations shape and have been shaped by their relations with their environment. Melhorar (to improve) is a common theme in the narratives of people from Ponta Negra. These narratives allow us to reflect upon how people negotiate the social, cultural and other trade-offs associated with changing livelihoods strategies that are progressively reducing local reliance on the natural resource base and increasing dependence on wage labour, out-migration and the growing regional tourism economy. Examining the case of Ponta Negra through the wellbeing lens allows us to visualize the challenges and opportunities small-scale fishers face in a changing world.

The Bajau of eastern Indonesia

Dr Natasha Stacey, Charles Darwin University, Darwin, Australia. natasha.stacey@cdu.edu.au
Abstract
The Bajau represent one of the most widely dispersed indigenous groups in South East Asia. Recent estimates indicate a total population of approximately one million, with around 200,000 living in areas of high biodiversity in the islands of eastern Indonesia. Bajau culture is intimately connected to marine environments on which they depend for subsistence and cash income as well as their cultural identity. Culturally defined patterns of fishing activity (including migratory) unite all sectors of Bajau communities through catching, consuming, processing and trading of marine resources. Fishing provides the focus for individual and communal relations within villages and across extensive kin and trading networks. The maintenance and transmission of indigenous language and knowledge between generations occurs through socialisation in livelihoods and related social and cultural activities. As such, customary beliefs and practices in relation to boats and sea spirits endure among the Bajau, and are primarily oriented to ensuring return on fishing effort. Bajau small-scale fisheries (SSF) in eastern Indonesia therefore present a highly relevant case study. We will explore the three dimensions of social wellbeing in the Bajau context and identify a suite of indicators which are most sensitive to endogenously developed and exogenously induced variations. Utilising our collective experience of Bajau society in diverse locations across eastern Indonesia we will test existing indicators, and with further ‘ground-truthing’ propose additional indicators. The case study offers the opportunity to explore the relevance of indicators across different Bajau communities, thereby presenting an insight into spatial variability within this unique maritime group.

Analyzing livelihoods of small-scale fishers in Bangladesh through well-being lens

Mohammad Mahmudul Islam, Department of Coastal and Marine Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh; Center for Marine Environmental Sciences (marum) Research Center for Sustainability Studies (artec), University of Bremen, Bremen 28359, Germany

The study aims at analyzing the livelihoods of small-scale coastal fishers in Bangladesh through using well-being approach as analytical lens. Using case study approach, this study collected qualitative data from four coastal fishing communities in Bangladesh. The result shows that several inter-related constituents of well-being determine the outcomes of livelihoods of the coastal fishing people in Bangladesh such as material and bodily wellbeing (e.g. lack of assets, weak and poor in appearance), freedom of choice and
action (e.g. bonded relationship of with money lenders), human security (e.g. security is lacking in the sense of both protection and peace of mind), social and psychological well-being (e.g. fishing as “low caste and mean” profession) the economics of happiness (fishing as a holy duty to feed mankind), poverty (multiple facets of poverty), capabilities (e.g. capabilities are weak because of the lack of information, education, skills and confidence), Gender (e.g. troubled and unequal gender relations), human rights (e.g. fishing rights), sustainable livelihoods, vulnerability (a wide range of vulnerabilities), social capital (e.g. social relations are discriminating and isolating) etc. This study confirms the important role of well-being approach in understanding the social and economic dynamics that are happening in the fishing communities as well as in developing appropriate policy for poverty reduction in small-scale fisheries in Bangladesh.

**Taking stock of small-scale fisher diversity: A statistical attempt to paint a nuanced picture of Indian fishing communities**

Adam Jadhav, Fulbright-Nehru Researcher with the National Centre for Sustainable Coastal Management (Chennai) and the Dakshin Foundation (Bangalore)

The people and practices of fishing in India vary incredibly, ranging from the quasi-commercial long-liner on a 45-day tuna trip to the single fisher poling a plank-built skiff across a sheltered lagoon. Such fisheries occupy unique and peculiar places in coastal economies and communities — as they do across the globe — but the variation of what all might be argued are “small-scale” confounds definition and measurement. As their diversity frequently makes small-scale fisheries less-than-legible, policymakers — perhaps captured by different economic logics — sometimes struggle to think of them as more than an aggregate group of failing firms locked in poverty. The Indian government labels many fishers — even those that are partly connected to commercial markets — as part of the underdeveloped “backward classes.” Resultant fisheries policy has focused overwhelmingly on homogenizing, capitalizing and “modernizing” fisheries with new boats, motors and gears. This paper attempts to quantitatively interrogate the idea of small-scale fisheries through an examination of large-n fisher census data from India’s Central Marine Fisheries Research Institute, highlighting their vast diversity and variability, within and across geographies. Using parts of the “social wellbeing” framework, this analysis notes some of the ways a widely diverse set of fisheries can be described, measured and valued beyond simple economic calculations. This nuanced statistical picture of India’s fisheries leads to an argument that policy should a) attempt to recognize (and even encourage) such diversity and b) shun overly simplified economic abstractions or top-down, high modern development prescriptions.
Enhancing the wellbeing of Tamil fishing communities: the role of self-governing uur panchayats along the Coromandel Coast, India

Maarten Bavinck (University of Amsterdam, The Netherlands)

Legal pluralism is a prominent feature in the governance of fisheries in Nagapattinam district, Tamil Nadu, and Karaikal, and it is with the role of customary village councils (panchayat) – or ‘private government’ (Macaulay 1986) that this paper is concerned. Uur panchayats still constitute a vital countervailing power, and a major force in the protection of the wellbeing of small-scale fishers in this region. Their role, and their very constitution, is, however, subject to change. This paper investigates the contemporary function of uur panchayats, paying attention especially to their activities with regard to the management of small-scale fisheries. These fisheries are under increasing stress due to environmental deterioration, as well as competition from other actors in the coastal realm. The introduction of ringseines is one of the hotly debated topics in the villages, sometimes seen as a last resort for small-scale fishers and their livelihoods, but otherwise as a major threat for their future. We investigate the manner in which uur panchayats have engaged with this contentious issue, and the institutional limitations they face. Their role in fisheries management is situated in a broader analysis of the manner in which they carry out their mandate of enhancing community wellbeing. To this end, we differentiate uur panchayats into various ideal-types.

Cultural and ideological values vs economic return: The case of artisanal fishers in the era of mechanization

Gayathri Lokuge (Centre for Poverty Analysis, Sri Lanka; PhD candidate, Wageningen University, The Netherlands)
Mohammed Munas (Centre for Poverty Analysis, Sri Lanka)

Ethnographic research among small scale fisher groups in the Eastern Trincomalee district of Sri Lanka shows us that despite the rapid mechanisation taking place within the sector, pockets and groups of artisanal fishers are still active. These methods preserve the fish stock for coming generations. Some of these groups are traditional beach-seine operators, women who collect molluscs from lagoons and trap fishers. This case study aims to explore why these groups continue to engage in artisanal fishing methods despite relatively lower economic returns? What are the other factors that are motivating them to continue these practices and keeping them within these artisanal methods? Using the basic premises discussed in sociology of economic life theory, we assume that these income generation activities are social activities and that they are embedded in the socio-cultural life-world of these fishers. Further, we argue that these artisanal fishers attach subjective meanings and values to these activities which are more complex than the sole aim of maximising profit.
Special session 2.2: Small-scale fisheries: governance and management strategies. Case studies from Latin America and the Caribbean
Organized and chaired by Chelsea Combest-Friedman (Fauna & Flora International, Belize, Katia Frangoudes (Université de Brest, France), and Maria Jose Espinosa Romero (Comunidad y Biodiversidad, A.C., Mexico)

Synopsis:

Small-scale fisheries (SSF) are significant at the global scale. They are important sources of income, food, and development opportunities in coastal regions, especially in developing countries. In addition, SSF represent ways of living, traditions and cultures. Due to the difficulty and cost to exclude others from exploiting the resource, and the increasing growth in the number of fishers, most SSF exhibit the same problems as other common pool resources: the overexploitation of the resources fishers depend on. Thus, many SSF face the need to implement effective management strategies to recover (naturally or artificially) the stocks and ecosystems in order to maintain SSF in the long term. Such strategies can include marine reserves and fish aggregating devices (FAD).

Both strategies are explored in this panel, in which fishers, NGOs, and academics share experiences and lessons learned through several case studies from Latin America and the Caribbean.

In the first session of the panel, academics and NGOs will share their perspectives on both strategies (marine reserves and FADs), specifically by addressing the followings: how marine reserves and FADs can be applied, why community involvement and strong governance structures are essential for design and implementation, and how these strategies can be combined with other management instruments (spatial zoning) and activities (tourism).

In the second session of the panel, small-scale fishers (the users) will present how they are self-organizing and putting in practice one of these strategies (marine reserves) in order to improve management and to maintain the health of the fisheries and the ecosystems they depend on. By presenting several case studies (from Mexico, Nicaragua, Honduras and Costa Rica), small-scale fishers will share the perceived benefits and limitations of this management instrument as well as the challenges and key lessons during the process of design, implementation, monitoring and evaluation. As marine reserves are not the only solution applied to all fisheries problems across the case studies, the panelists will present how they combine fisheries management instruments, especially for those areas beyond the boundaries of the marine reserves.

Overall, this panel provides the key ingredients for design and implementation of both strategies: marine reserves and FADs. It emphasizes the importance of fisheries governance, for which capacity building, mobilization of small-scale fishers, and collaboration between stakeholders (government, private sector, scientific institutes, NGOs and local communities) are required.
Small-scale fisheries (SSF) are significant at the global scale. They are important sources of income, food, and development opportunities in coastal regions, especially in developing countries. In addition, SSF represent ways of living, traditions and cultures. Due to the difficulty and cost to exclude others from exploiting the resource, and the increasing growth in the number of fishers, most SSF exhibit the same problems as other common pool resources: the overexploitation of the resources fishers depend on. Thus, many SSF face the need to implement effective management strategies to recover (naturally or artificially) the stocks and ecosystems in order to maintain SSF in the long term. Such strategies can include marine reserves and fish aggregating devices (FAD). Both strategies are explored in this panel, in which fishers, NGOs, and academics share experiences and lessons learned through several case studies from Latin America and the Caribbean.

<table>
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<th>Presenters</th>
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| Roberto Cubillo  
CoopeSoliDar R.L., Costa Rica | Carlos Antonio Martinez Ayala  
Asociación de Pescadores de La Rosita, Cuero y Salado (APROCUS), Honduras |
| Norman Flores  
LARECOTURH, Honduras | Daniel Antonio Ulloa Quintero  
Pescador artesanal, Cooperativa Puerto Galera, Galera, Ecuador |
| Marcio Rivera  
LARECOTURH, Honduras | Olivier Valverde Vega  
Asociación de Pescadores de Cabuya / CoopeSoliDar R.L., Costa Rica |
| Alejandro Cotto  
FUNDENIC, Nicaragua | Ivan Antonio Arriola Selva  
Coperativa de pescadore artesenale, Nicaragua |
| Vincent Gravez  
Fundacion Futuro Latinoamericano, Ecuador | Sergio Vazquez  
Comunidad y Biodiversidad, A.C., Mexico |
| Luis Bourillón  
Comunidad y Biodiversidad, A.C., Mexico | Claudia Talamantes  
Cooperativa: Mujeres del Golfo, Mexico |
| Olivier Guyader | Rodrigo Pantoja |
| Lionel Reynal | Juan Gabriel López  
Comité de Pesca y Acuacultura de Puerto Libertad, Cooperativa: Mojarra del Arrecife, Mexico |
| Katia Frangoudes | Graciela Quijada  
Comité de Pesca y Acuacultura de Puerto Libertad, Restaurante, Mexico |

**Governance of FAD’s fisheries activity in Martinique Island**
FAD experiences in French overseas territories started 1980 under the initiative of fisheries scientists and having as main objective to transfer fishing effort from reef fisheries to pelagic fisheries. MFAD’s could make pelagic fishing a regular activity and limit its practice within a geographical area compare to the traditional technique practising by follow schools of fish. Martinique’s regional authorities support this initiative because it could be a way to sustain fishers’ livelihood by creating new sources of income for local fishers and population. The MFAD’s were deployed thanks to regional and European public subsidies. The Regional Fishers organisation got the competency to deploy FAD’s and manage fisheries activity around them. For regional authorities this new role could straighten fisheries organisation role in fisheries management. This presentation examines the development of FAD’s, public and individual and the role of fishers’ organisation and administration in the management of this activity. The attitudes of fishers towards this development are an important source to identify the reasons of failure of success to achieve the governance of fisheries activity around FAD’s and also how to improve it.

Implicit territorial use rights on fishing aggregating devices : the example of small scale fisheries in La Désirade (Guadeloupe)

Moored Fishing Aggregating Devices (MFADs) have been a key area for fisheries development in Guadeloupe (Lesser Antilles) since the late 1980’s. Until recently, Guadeloupe’s fisheries policy was based on a weak regulatory system that in practice allowed free establishment of private MFADs to target large pelagic species. In order to mitigate the drawbacks of the non-regulated private FAD system, local professional organizations, with the support of the administration, decided in 2008 and 2009 to establish a network of collective FADs. This system was rejected by fishers and failed to improve the situation. In order to examine the reasons for this failure, a survey was carried to study the operating conditions on MFADs in the eastern part of Guadeloupe and especially around the island of La Désirade. The study identifies territoriality - private territorial use rights informally recognized by fishers - of MFADs as one the main organizational drivers in this fishery. The history, current structure and reasons for territoriality are analyzed. Despite cooperation mechanisms between fishers in particular to enforce territories and to share knowledge; conflicts exists for space, installation and
transfer of MFADs. These issues are discussed in the perspective of an improvement in the collective management of MFADs.

**Lesser Antilles moored FADs progress report on the past 15 years and sustainable development related issues**

Lionel Reynal (Ifremer, France)
Olivier Guyader (Ifremer, France)
Katia Frangoudes Université de Brest, France)

For the past 10 years, moored FADs fishing has continued to expand in the Lesser Antilles. This emerging fishing technique has taken up different features according to the countries. Because of its proven value for small scale fisheries in the islands, it has raised a set of issues.

In an attempt to provide answers, a working group was established under the aegis of the FAO / WECAFC (Western Central Atlantic Fishery Commission) and research were conducted in inter session. This paper presents the issues raised by decision makers and the progress made in various fields such as device design, governance of moored FADs parks and fisheries dynamics, the impact of fishing on the fish resources, knowledge of the main stocks targeted, observed aggregations around FADs, the fishing techniques used and their selectivity and product quality. An emphasis will be given on the taking into account of all these aspects for the sustainable development of moored FADs fisheries.

**Special session 2.3: Small-scale fishing communities and ecosystem stewardship: achievements and ongoing efforts**

Organized and chaired by: Cristiana Seixas (University of Campinas, Brazil), Tony Charles (Saint Mary's University, Canada), Patrick McConney (University of the West Indies, Barbados) and Rodrigo Medeiros (Center for Marine Studies. Federal University of Paraná, Brazil)

Synopsis:

This session aims to highlight the ongoing effort and achievements of many communities around the world in approaching ecosystem stewardship. We bring together the experience of researchers involved in four global and regional networks: Community Conservation Research Network (CCRN), Too Big To Ignore (TBTI), SocMon and TransForMar Network.

In the face of increasing livelihoods and environmental challenges, communities all over the world are coming up with creative ways to achieve sustainable development by
engaging in unique forms of governance. To better understand and support these efforts, The Community Conservation Research Network (CCRN) was formed to identify the governance arrangements that best support community-based solutions to improving livelihoods and ecosystem stewardship.

Too Big to Ignore (TBTI) is a global research network and knowledge mobilization partnership on SSF. TBTI is concerned, among other things, with the lack of understanding about both the impacts of SSF on ecosystem and the contribution of SSF to stewardship and conservation. The TBTI WG4 (Enhancing the stewardship) approach aims to bring attention to how ecosystem stewardship is transformed from concept to practice in small-scale fisheries.

The Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon) supports the establishment of site level socio-economic and marine monitoring programs, providing guidelines on how to do socio-economic monitoring useful for fisheries and coastal management at the site level. Globally six regions are successfully conducting SocMon.

The TransForMar network is devoted to build capacity among graduate students, young scholars, government agents, and community representatives to engage in participatory action research in order to promote participatory management processes in the coast of Brazil to improve small-scale fisher’s livelihood and biodiversity conservation.

<table>
<thead>
<tr>
<th>Presenter</th>
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<tr>
<td>Fikret Berkes</td>
<td>Community conservation: The reality of multiple objectives and the promise of social enterprises</td>
</tr>
<tr>
<td>Tony Charles</td>
<td>Overview of the CCRN and the application of its pioneering social-ecological systems lens to the study of how local-level environmental stewardship links with sustainable community livelihoods</td>
</tr>
<tr>
<td>Patrick McConney</td>
<td>Overview of TBTI WG4 framework, including the three dimensions of ecosystem stewardship – impacts, monitoring and stewardship</td>
</tr>
<tr>
<td>Thiago Serafini</td>
<td>Overview of the special issue of the Journal Desenvolvimento e Meio Ambiente, organized within the TBTI WG4 efforts to be released in December 2014</td>
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<tr>
<td>Rodrigo Medeiros</td>
<td>Lessons learned and will be seeking some synthesis, particularly regarding 1) dimensions of ecosystem stewardship; and 2) intra and inter-regional practical application of stewardship concepts</td>
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<tr>
<td>Maria Peña</td>
<td>The Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon) – one approach with high potential to enhance community level stewardship in the Caribbean</td>
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<tr>
<td>Cristiana S. Seixas</td>
<td>Overview of the achievements of the TransForMar network efforts over the past five years, highlighting lessons learnt from over 15 case studies and the perspectives for community stewardship over coastal resources in Brazil</td>
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<td>Steven Alexander</td>
<td>Local level dynamics in an emerging network of co-managed marine</td>
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<td>reserves in Jamaica</td>
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<td>Ana Carolina E.</td>
<td>Development of a participatory monitoring program of small-scale</td>
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<td>Dias</td>
<td>fisheries in a Southern Brazilian Coastal Community (Tarituba, in</td>
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<td>Paraty, Rio de Janeiro State)</td>
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<td>Maren Headley</td>
<td>Factors influencing the harvest strategies in the Punta Allen spiny</td>
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<td>lobster fishery and management implications</td>
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The panel is expected to include an introduction of 5 min, 1 presentation of 15 min by Fikret Berkes plus 8 presentations of 10 min each, with 20 min for discussion.

**Fikret Berkes** will discuss how the diverse meanings of conservation as understood by various communities ‘on the ground’ imply multiple conservation objectives such as livelihoods, productive ecosystems resources. Given this fact, he makes the unique proposal that social enterprises constitute a potentially useful venue toward achieving livelihoods and environmental stewardship. Since social enterprises are not based on utilitarian-economic models but on an economic model in which resources provide for a broad range of goals, a social enterprises approach can address multiple objectives as they respond to the diverse needs of a community from job provision to coastal environmental protection.

**Tony Charles** will provide an overview of the CCRN and the application of its pioneering social-ecological systems lens to the study of how local-level environmental stewardship links with sustainable community livelihoods. He will discuss the lessons that are being learned about livelihoods and ecosystems stewardship from the research being undertaken at the CCRN’s eleven global study sites and from an innovative online mapping tool that is crowdsourcing data on these themes from communities around the world.

**Patrick McConney** will present an overview of TBTI WG4 framework, including the three dimensions of ecosystem stewardship – impacts, monitoring and stewardship. **Thiago Serafini** will present an overview of the special issue of the Journal *Desenvolvimento e Meio Ambiente*, organized within the TBTI WG4 efforts to be released in December 2014; and **Rodrigo Medeiros** will discuss some lessons learned and will be seeking some synthesis, particularly regarding 1) dimensions of ecosystem stewardship; and 2) intra and inter-regional practical application of stewardship concepts.

**Maria Peña** will introduce The Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon) – one approach with high potential to enhance community level stewardship in the Caribbean. The experience of initiating monitoring at a variety of study sites connected mainly to fisheries and marine protected areas has demonstrated that heightened awareness, ownership and empowerment can be promoted through participatory socio-economic data collection, analysis, interpretation and communication.
Peña and McConney share some of these experiences with a view to recommending how community engagement in SocMon can be strengthened to contribute even more towards stewardship in some parts of the Caribbean.

**Cristiana S. Seixas** will provide an overview of the achievements of the TransForMar network efforts over the past five years, highlighting lessons learnt from over 15 case studies and the perspectives for community stewardship over coastal resources in Brazil.

**Steven Alexander** will examine local level dynamics in an emerging network of co-managed marine reserves in Jamaica. The Jamaican government established twelve Special Fishery Conservation Areas (SFCAs) - marine no-take zones - between 2009 and 2012, with more under consideration. Co-management arrangements were set between government and local non-governmental organizations and/or fisherfolk co-operatives that devolve to locals the roles and responsibilities (e.g. monitoring) associated with the day-to-day management of these zones. Alexander and Armitage undertake a comparative analysis of three SFCA governance networks – Bluefields Bay, Oracabessa Bay, and Orange Bay – to examine how their structure and function influence their inherent capacities for collaboration and collective action.

**Ana Carolina E. Dias** will present the development of a participatory monitoring program of small-scale fisheries in a Southern Brazilian Coastal Community (Tarituba, in Paraty, Rio de Janeiro State). Tarituba fishing grounds are located inside a no-take protected area established over the last 10 years. In order to mitigate conflicts between fishers and the protected area manager, a Term of Reference has been developed to allow artisanal fishing in the area. This Term requires monitoring fishing activities. Ana Carolina has been engaged with fishers and government staff in defining goals of monitoring and identifying parameters and indicators for such over the last few months. She will report on this experience and lessons learnt for future initiatives in the Brazilian coast.

**Duration of the session:** 2 hours

**Format of the session:** Presentations and discussions

**Theme 3:** Ecosystem Stewardship

**Community conservation: The reality of multiple objectives and the promise of social enterprises**

Fikret Berkes (Natural Resources Institute, University of Manitoba, Winnipeg, Manitoba R3T 2N2 Canada, fikret.berkes@umanitoba.ca)
Conservation is not only a Western scientific concept. Many resource-dependent coastal and small-scale fishing communities conserve their resources. But their concepts of conservation are often different from the scientific one. What are the diverse meanings of conservation for communities, and what motivates environmental stewardship? There are different ways of approaching these questions, for example, through governance and institutional analysis, or through commons and livelihoods. Here I take an approach that has not been developed well in the literature, with the intent that it will add another dimension to the current thinking on these questions. The argument is in two parts. First, I show that there are multiple reasons why communities engage in conservation, and that their objectives and the benefits they expect from conservation tend to be diverse. Second, I argue that social enterprises, the kind of development and business model that does not have profit-making as the sole objective, are a good fit with multiple objectives. Therefore, social enterprises are a particularly promising venue toward community conservation in small-scale fishing communities and elsewhere.

Community Objectives
Fisheries can be managed for biological yield, for economic revenue, for job creation, or for a number of other objectives. According to one count, there are more than twenty possible management objectives (Berkes et al. 2001). Some of these objectives are contradictory. For example, one cannot maximize the biological yield and the economic yield at the same time. But others are compatible: for example, conserving biodiversity and sustainable livelihoods. In other cases, multiple objectives can be accommodated by trade-offs. The optimum sustained yields approach is one example of an objective that tries to do that. However, fishery managers tend to favour single, “clean” objectives and resist mixing up biological and social objectives. In the area of conservation, for example, some biologists have argued that social objectives should never compromise biodiversity conservation.

From the point of view of coastal and small-scale fisher communities, the question of objectives seems to look somewhat different. Communities themselves are the best authorities on the question of appropriate management objectives, and what they imply for livelihoods and development. Local development, grassroots development (Chambers 1983), and community-based development (Berkes and Davidson-Hunt 2007) are some of the terms that refer to local-level development that follows community priorities, rather than some other development agenda, for example from governments or NGOs. Can communities have priorities? Communities are not homogenous entities, and most have different social groups with different interests (Agrawal and Gibson 1999). Nevertheless, most communities have distinct identities and leadership that can articulate community aspirations and objectives.

In a series of research projects undertaken with prize-winning conservation-development cases from the United Nations Development Programme (UNDP) Equator Initiative database, we examined the nature of community objectives both on paper and in the field (Berkes 2007; Seixas and Davy 2008; Seixas and Berkes 2010). We found that community objectives were often broader than resource managers’ objectives. Communities usually had not one but a range of objectives that could be economic, environmental, political, social and cultural in nature (Berkes 2013).
Table 1 summarizes four coastal and marine cases from the UNDP Equator Initiative pool of projects, plus two Canadian indigenous cases, and two other recent cases (Brazil and Indonesia). Each of the cases shows a wide range of community objectives for conservation. However, the classification of expected or anticipated community benefits as economic, environmental, political, social or cultural, is somewhat arbitrary. Community people themselves rarely see sharp distinctions between different kinds of objectives and benefits. What we might call economic benefits are seen as intimately related to the betterment of living conditions – social benefits. Restoring biological productivity is a key factor for improving livelihoods. Leadership has both social and political aspects. Empowerment may result in local control over resources, thus leading to new jobs, additional income, livelihood diversification, and strengthening of local cultural traditions.

Social Enterprises
Many of the cases in Table 1 have social enterprise characteristics. They are development projects of a particular kind: they did not have the sole objective to maximize profits but have multiple objectives instead. Social enterprises by definition are not based on the familiar utilitarian-economic models but rather on an economic model in which resources provide for broader goals – economic, political and social/cultural (Anderson et al. 2006). This is a value-based development perspective that has been used in the context of indigenous businesses (e.g., Davidson-Hunt and Turner 2012). But it may be equally applicable to coastal and small-scale fishing communities, where values and social relations are important for social sustainability, and in other communitarian contexts (Jentoft 2000).

Social enterprises are a good fit with the idea of multiple objectives because they tend to respond to the multiple needs of a community such as job creation, resource access, empowerment, ecological restoration and environmental health. Whereas global enterprises focus on providing growth in capital to shareholders, social enterprises strive to provide social dividends to community members and play a role in maintaining economically and socially viable communities. They often involve collective action, depend on the local resource base, and require partnerships and networks to make them work.

Food sharing is one indicator of social enterprise characteristics. The harvest of small-scale fisheries may be sold, consumed in the household, or shared within the community, providing a social safety net. In mixed-heritage Caícura communities in Paraty, Brazil, fishing was a livelihood activity reported by 70 percent of the households. Ninety-seven percent of these households indicated that some of the fish was consumed within the household, 75 percent shared with relatives, and 69 percent shared with neighbors and friends. Fish sold commercially represented smaller percentages (Hanazaki et al. 2013). In Gouyave, Grenada, West Indies, 93 percent of commercial fishers reported giving away a mean of 16 kg of pelagic fish per fisher, to community members after each trip. Further, beach seining operations left behind some lower-value fish to be gleaned and used by poorer members of the community (Grant et al. 2007).

Conversely, lack of shared benefits and single-minded pursuit of short-term gain are indicators of a fishery that does not have social enterprise characteristics. A case in point
is “roving bandit” fisheries that respond to distant market demands for a new “product”. They tend to fish out one area after another, and move on, before regulatory actions can be put into place. Roving bandit fisheries are not always carried out by outsiders. They frequently involve local fishers and divers supplying buyers and processors, as in the case of global sea urchin fisheries (Berkes et al. 2006). Here the fishery itself may be small-scale but the drivers are global markets, and there is no social enterprise.

Social and cultural benefits are not often among the explicit objectives of cases such as those in Table 1 but are nevertheless important in situations of social entrepreneurship (Berkes and Davidson-Hunt 2007). Social benefits may include improvements in social, educational and health services, and in social organization, such as the formation of women’s groups. They may be closely tied to economic benefits (as in the case of women’s savings groups) and empowerment. Social benefits were most obvious in the older and long-established cases, such as the Pred Nai mangrove restoration example (Senyk 2005).

Network-like partnership arrangements with linkages across levels seem to be common in many cases, for example, the conservation-development projects in the UNDP Equator Initiative. Partnerships typically spanned four levels of organization (local, regional, national, international) and involved ten to fifteen partners each (Berkes 2007; Seixas and Berkes 2010). The partners assist communities with a variety of tasks such as capacity-building for business management, raising capital, and technology transfer (Berkes 2007). Networks of partnerships are clearly important as well in ecological restoration projects, such as coral reef restoration in Bali (Frey and Berkes 2014) and in co-management.

**Discussion and Conclusions**

Regarding multiple objectives, a healthy environment is often seen to be related to sustainable livelihoods. People who carry out community conservation often point out that their “conservation” is about making a living, keeping resources productive, and sometimes about community control of resources, and social/cultural values. A survey of UNDP Equator Initiative conservation-development projects and similar cases around the world, indicate a diverse list of community objectives. No two cases have the same objectives, and they all have multiple objectives (Berkes 2013). In some cases, objectives emerged as the case developed. For example, in the James Bay (Canada) case, cultural and educational objectives emerged as the protected area nomination progressed. Even though the starting objectives in the cases in Table 1 were (and still are) diverse, in all cases livelihood and well-being tends to be the paramount objective. And of course livelihood and well-being concepts are multi-dimensional, and have economic, environmental, political, social and cultural components.

Economic development involving social enterprises is unique in that it is not based on the familiar utilitarian-economic models as provided by the classical dependency and modernization theories that have dominated development thinking (Anderson et al. 2006; Davidson-Hunt and Turner 2012). Rather, social enterprises are based on an economic model in which resources provide for broader goals – economic, political and social/cultural. Social enterprises are a good fit with the idea of multiple objectives because they tend to respond to multiple needs of a community such as job creation, self-determination, and coastal environmental protection.
The social enterprise approach is a good fit also with two ideas being discussed in the small-scale fishery literature: primary fisheries management and human-rights based fishing. The former refers to a minimum management goal where adequate management capability does not exist. In such situations, primary management can be aimed at food security, poverty reduction, and social and ecological resilience (Cochrane et al. 2011). The latter is a response to the “highjacking” of the property-rights concept by the neoliberal agenda, and argues that fishing rights are human rights (Charles 2011). It embeds fisheries governance within a broader perspective of human rights to achieve both human development and resource sustainability outcomes (Allison et al. 2012).

Social enterprises also fit well with the current dynamics of small-scale fisheries searching for new business models (http://www.pbs.org/newshour/bb/north_america-july-dec10-pledge_08-02/). Using market-based tools, small-scale fisher/entrepreneurs, for example, in ThisFish alliance, seek to connect consumers to producers, and to information about the source of the seafood they buy (http://thisfish.info/). The Slow Fish movement, borne out of the Slow Food movement and active in over 20 countries, promotes environmentally and socially sustainable, fair fisheries (http://www.slowfood.com/slowfish/). All of these developments go to show that conservation is consistent with sustainable livelihood goals, and that social enterprises are a particularly promising way to achieve both well-being objectives and the environmental sustainability objectives in coastal and small-scale fishing communities.

References


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<th>Case</th>
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### Proposed Tawich (Marine) Protected Area, Cree Nations of James Bay, Quebec, Canada

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### Peixe Lagoon National Park, Rio Grande do Sul, Brazil

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### Coral reef restoration, Les, Bali, Indonesia

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### Enhancing the stewardship in small-scale fisheries in Latin America and Caribbean: contributions of the special issue in the Desenvolvimento e Meio Ambiente journal

Thiago Z. Serafini, Departamento de Ciências do Mar – DCMar, Universidade Federal de São Paulo – UNIFESP, Brazil. thiago.serafini@unifesp.br
Rodrigo P. Medeiros, Centros de Estudos do Mar – CEM, Universidade Federal do Paraná – UFPR, Brazil. rodrigo.medeiros@ufpr.br
Patrick McConney, Centre for Resource Management and Environmental Studies – CERMES, University of the West Indies, Barbados. patrick.mcconney@gmail.com

### Abstract

An upcoming Desenvolvimento e Meio Ambiente journal special issue is on enhancing the stewardship in small-scale fisheries (SSF) in Latin America and Caribbean (LAC). The special issue was initiated in 2013 for publication in December 2014. With support from Working Group 4 of the Too Big to Ignore research partnership (WG4/TBTI), the objective of the issue is to encourage the stewardship of SSF in fisheries research and management in the LAC region. Ten articles cover the three main components of the WG4/TBTI theme (Enhancing the Stewardship): social-ecological impacts; monitoring systems; and stewardship in SSF. First, we present how the special issue is organized. Then, we describe the main contribution of each article to the theme. Finally, we draw conclusions from the individual articles into a synthesis that will be enriched by further discussion in a special session on strengthening the stewardship of SSF in LAC at the 2nd World Small-Scale Fisheries Congress.

### Background
Globally, many fisheries are in crisis. Small-scale fisheries (SSF) are very vulnerable since fisher livelihoods are often highly dependent on external conditions. However, knowledge about SSF is limited, and conventional management approaches cannot deal with the complexity of SSF (Salas et al. 2007). A global collective effort to increase knowledge, and elevate the profile, of SSF established the research partnership — Too Big to Ignore (TBTI). The network focuses on diverse issues concerning SSF. In the Latin America and Caribbean (LAC) region, Working Group 4 (WG4) focused on Enhancing the Stewardship as its theme.

WG4 discussed the need for a special issue on SSF stewardship in Brazil. It would be an opportunity to get new perspectives on SSF into fisheries research and management in the country. Then WG4 widened the scope, to include contributions from the entire LAC region and the TBTI network. The journal Desenvolvimento e Meio Ambiente (DMA, www.ser.ufpr.br/made) promptly agreed to organize and publish the special issue, and this was supported by TBTI. We became its invited editors and launched the call for contributions during the TBTI Latin America and the Caribbean joint workshop with WG4 held in Curitiba (southern Brazil) in August 2013.

The special issue call resulted in 26 article proposals from researchers in Brazil, elsewhere in LAC region, United States and Europe. All proposals were approved, but authors finally submitted 17 as first draft articles. After a double-blind peer review, 10 articles were accepted for the special issue (Table 1).

Table 1. Articles accepted for the special issue of Desenvolvimento e Meio Ambiente, on the Too Big to Ignore – Working Group 4 Latin America and the Caribbean theme

<table>
<thead>
<tr>
<th>Title</th>
<th>Region</th>
<th>TBTI/WG4 Themes</th>
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<tbody>
<tr>
<td>Segurança alimentar e pesca artesanal: análise crítica de discursos e práticas na América Latina</td>
<td>Latin America</td>
<td>Stewardship in SSF</td>
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<td>Denis Hellebrandt, Edward H. Allison, Anne Delaporte</td>
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<td>Marine Spatial Planning in Asia and the Caribbean: Application and Implications for Fisheries and Marine Resource Management</td>
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<td>As relações econômicas e a gestão compartilhada de recursos</td>
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Contributions to the special issue will inform discussion on enhancing stewardship in SSF in the LAC region in a special session at the 2nd World Small-Scale Fisheries Congress (2WSFC).

**Main contributions of the DMA special issue to the WG4/TBTI theme**

WG4 asks: What alternatives are available for minimizing environmental impacts and fostering stewardship within small-scale fisheries? To examine this broad issue, WG4 uses three main components each associated with a guiding question:

- **Social-Ecological Impacts**: How, and to what extent, do or will small-scale fisheries and aquatic environments impact upon each other?

- **Monitoring Systems**: What integrated practical systems for monitoring and evaluation exist, or need to be developed, to address the impacts of small-scale fisheries on aquatic environments and the reverse?

- **Stewardship in SSF**: What institutional arrangements for stewardship exist, or need to be developed, to allow small-scale fisheries to be responsible, adaptive and resilient social-ecological systems?

The topics addressed in the DMA special issue articles (all in press) contribute in various ways to these three components.

**Social-Ecological Impacts**
Defeo and colleagues evaluated the impacts of climate change, and the joint effects of globalization of markets and governance, using case studies of invertebrate SSF in Latin America. The condition of vulnerability forced by climate change could be aggravated in a context of weak governance, together with the erosion of traditional systems and poverty. The authors conclude that government institutions have not been able to adopt proactive and effective actions to deal with the combined effect of the fishery and climate change in pursuing SSF communities’ well-being.

Azevedo and Pierri corroborated these findings after analyzing recent Brazilian fishery policy. They suggest that increasing government promotion of public policies focusing on poverty reduction is exacerbating SSF communities vulnerability. The policies have a more social character, with unbalanced ecological and economic dimensions, resulting in long-term fragilities in SSF. They highlight the need for broad systematic measures for sustainable development of SSF in Brazil.

At the local level, the fragility of the government institutions handling social-ecological impacts in SSF communities was apparent in the study case of Spinola and colleagues. They evaluated a co-management process inside a Marine Extractive Reserve (RESEX in Portuguese) in southern Brazil. The RESEX’s deliberative council was not able to guarantee local rights for the fishers to use the resources at the time of implementation of a government infrastructure project. The authors discuss the capacity of the RESEX’s council to deal with local problems that involves social groups with high economic and political power.

Monitoring Systems

In the LAC region, there is a lack of long-term monitoring programs, especially with involvement of fishers in data collection (Salas et al. 2007). Collaborative approaches could improve the information available to the fisheries system through the recognition of local ecological knowledge, and provide a means of empowering local communities.

Malafaia and colleagues report on a participatory monitoring initiative developed in reef systems in northeastern Brazil. It was possible to obtain relevant data about spawning aggregations of reef fishes, which could support the SSF management. The fishers involved saw benefits from sharing their knowledge of the resource system. However, the success of this collaborative approach will depend on the continuity of the process for trust building among all the stakeholders.

Stewardship in SSF

Salas et al. (2007) highlight the need to strengthen aspects of SSF including: building local capacity for self-regulation and self-organization for participation in fisheries management; the establishment of equitable access and rights to fisheries resources among stakeholders; and the explicit consideration of socio-economic issues, especially taking into account the processes of globalization affecting many fisheries.
To achieve these, diverse groups must assist SFF communities through partnerships to provide a range of services and support functions, seeking to reduce poverty and conserve biodiversity at the same time (Seixas and Berkes 2010). In this sense, Hellebrandt and colleagues evaluated initiatives to promote food security in SSF and aquaculture contexts in Latin America. These ranged from large projects executed by international organizations to small-scale projects conducted by civil society, local government, and private sector. They demonstrated a striking divergence between project planning and implementation. Interventions that adopted food security in a simplistic manner, or purely at the level of discourse, were predominant.

These findings align with research by Trimble and colleagues, and Carneiro and colleagues, on the importance of extension projects to support the stewardship of SSF. In the first case, the authors describe an experience of participatory research in a SSF community in Uruguay, involving undergraduate and graduate research projects. They found that participatory research can enhance the student’s transdisciplinary growth, with emphasis on knowledge sharing. However, it is important that academia recognize the relevance of other actors to comprehend the research problem, in a manner of "science with people" as opposed to "science for people". In the second case, the authors propose a methodological framework for SSF extension projects, based on their experience in southeastern Brazil. Critiquing the conventional approach of the Brazilian extensionism that originated in the 60's and 70's, they encourage extension appropriate to the complexity of SSF. This demands a review of the reciprocal relationship between theory and practice of action research, of instruments of participatory methodologies, and a focus on community-based management of SSF.

Another factor to promote stewardship in SSF is appropriate institutional arrangements for management. Pomeroy and colleagues discuss the implications and practical application of marine spatial planning (MSP) as an ocean and coastal resource management paradigm in Asia and the Caribbean. Their focus on where MSP fits in the range of management paradigms, and its impacts on SSF stewardship. Their main conclusion was that while MSP with zoning is increasingly recognized as an important management approach for ocean resources, countries in the regions are still challenged by capacity, technical, legal, and institutional constraints in the implementation process.

Such deficiency could also affect the ability to deal with socio-ecological changes in the local/regional context. Inappropriate institutional arrangements increase vulnerability of local SSF communities and impair their ability to respond to changes. Prudencio and colleagues demonstrated that changes in a watershed landscape in southern Brazil triggered by many sources, including problems with a sector-based governance and lack of co-management process, resulted in local/regional socio-ecological crisis.

Co-management in SSF facilitates ecosystem stewardship. The success of this kind of management arrangement is strongly affected by the economic dynamics. Caldeira and Pierri analyze the opportunities for co-management in a local context of southern Brazil.
They highlight that focusing on the economic dimension of SSF will be important to foster a favorable atmosphere for co-management, balancing the transaction costs.

**Conclusions**

Climate impacts on SSF will increase fishers’ vulnerability if there are no appropriate institutional arrangement to deal with them (Defeo et al.). However, institutions must be effective at achieving the broad dimensions of SFF sustainability and not just short-time social welfare (Azevedo and Pierri). They must be robust enough to guarantee real decision-making rights for fishers in co-management (Spinola et al.). Transition from conventional fishery management to co-management can be facilitated by considering the economics of SSF, and balancing transaction costs (Caldeira and Pierri).

Emerging management approaches, such as MSP, can contribute to stewardship of SSF if appropriate institutional and technical conditions are strengthened (Pomeroy et al.). Otherwise, the socio-ecological changes forced by bio-physical and socio-economic sources could generate a socio-ecological crisis, trapping SSF communities in eroding traditional practices (Prudencio et al.).

Partnership from local or external institutions to support SSF stewardship must achieve real measurable results, and not remain purely at the level of discourse (Hellebrandt et al.). This demands, for example, reframing the role of extension by external agents (universities, government, etc.), considering the complexity of SSF (Carneiro et al.) and the opportunities for knowledge sharing (Trimble et al.). Developing collaborative processes for resource system data generation may enhance stewardship, but its effectiveness will depend on continuous trust building among stakeholders (Malafaia et al.).

**References**


**Critiquing socio-economic monitoring in fisheries via the global socio-economic monitoring initiative for coastal management (SOCMON/SEM-PASIFIKA): Opportunities for bridging gaps in socio-economic information**

Maria Pena, Centre for Resource Management and Environmental Studies, University of the West Indies, Barbados. maria.pena@cavehill.uwi.edu

Patrick McConney, Centre for Resource Management and Environmental Studies, University of the West Indies, Barbados. patrick.mcconney@cavehill.uwi.edu
Peter Edwards, US National Oceanic and Atmospheric Administration, Washington DC, USA. peter.edwards@noaa.gov

Vineeta Hoon, Centre for Action Research on Environment Science and Society (CARESS), Chennai, India. vineetahoon@gmail.com

Brigd Mibei, Coastal Oceans Research and Development in the Indian Ocean East Africa (CORDIO EA), Mombasa, Kenya

Michael Pido, Palawan State University, Puerto Princesa, Philippines, mpido@yahoo.com

Brooke Nevitt, Pacific Marine Resources Institute (PMRI), Saipan, Commonwealth of the Northern Mariana Islands. brookenevitt@gmail.com

Arie Sanders, University of Zamorano, Zamorono, Honduras. asanders@zamorano.edu

Supin Wongbusarakum, National Oceanic and Atmospheric Administration, Honolulu, Hawaii. supin.wongbusarakum@noaa.gov

Abstract
For the past ten years, the Global Socio-economic Monitoring Initiative for Coastal Management (SocMon/SEM-Pasifika) has been actively collecting socio-economic data at coastal management sites and communities in tropical coastal regions. SocMon is a simple, flexible participatory monitoring methodology developed specifically for coral reef and coastal management to enhance understanding of communities and their relationship to coastal and marine resources. Socio-economic information can help fisheries and coastal managers identify potential problems and shocks, mitigate negative impacts and focus management priorities accordingly to achieve management objectives.

SocMon/SEM-Pasifika is therefore a means of promoting the use of social and economic data in fisheries and coastal management decision-making and its uptake provides the opportunity for improved fisheries and coastal management capacity and therefore conservation of coastal and marine resources. Due to the fairly recent establishment of several regional coral reef conservation initiatives aimed at preserving and protecting marine and coastal habitats, funding support for socio-economic monitoring at marine protected areas or locally managed marine areas and coastal fishing villages across SocMon/SEM-Pasifika regions has been high. As such a significant amount of socio-economic data on small-scale and subsistence fisheries exist. This paper aims to synthesise the information that has been collected; report on how it has been used for management or if not, how it can be useful in fisheries management and informing data needs for, particularly Small Scale Fisheries (SSFs). This paper will evaluate the Global SocMon Initiative and its associated monitoring methodology with respect to its ability to fill socio-economic information gaps in knowledge. In particular the paper discusses the efficacy of SocMon for adequately monitoring socio-economic characteristics of small-scale fisheries in order to inform and adapt management, increase adaptive capacity and resilience, and reduce vulnerabilities to certain shocks and impacts.

Socio-economic monitoring for coastal management (SocMon/SEM-Pasifika)
Socio-economic Monitoring for Coastal Management (SocMon) is a global initiative being implemented at the global and regional levels with the goal of establishing socio-economic coastal and marine monitoring programmes at the site level (Bunce et al. 2000; Bunce and Pomeroy 2003).
SocMon/SEM-Pasifika is a globally networked, regionally adapted, practical methodology of socio-economic monitoring for coastal management. Six regions are successfully conducting SocMon/SEM-Pasifika – the Caribbean, Central America, South Asia, South East Asia, Western Indian Ocean and the Pacific Islands. Brazil is soon to be the seventh region. SocMon works through regional and local partners to facilitate community-based socio-economic monitoring. SocMon/SEM-Pasifika is a set of guidelines for establishing a socio-economic monitoring program at a coastal management site. Each of the regions conducting SocMon/SEM-Pasifika have a set of region-specific guidelines for socio-economic monitoring used with a companion manual that details field methods and techniques. The guidelines are not rigid and can be tailored to each site’s need (Bunce and Pomeroy 2003). There are 60 to 67 socio-economic variables that may be used in assessment or monitoring across SocMon/SEM-Pasifika regions. While the majority of variables are shared across all regions, there is slight variation with additional variables used and sometimes shared by regions.

The variables are presented in the regional guidelines (except the Pacific) according to the means of data collection – key informant interviews and/or secondary sources, and surveys. The variables are further categorised according to type. Generally (for all regions except the Pacific), key informant and secondary sources variables are categorised according to community-level demographics, community infrastructure and business development, coastal and marine activities and governance. Survey variables are categorised according to household demographics, coastal and marine activities, attitudes and perceptions and, material style of life. Nomenclature of SEM-Pasifika variables is based on type of data (demographics, coastal and marine resources, threats, management and governance, stakeholders) and not means of data collection (Wongbusarakum and Pomeroy 2008). In 2011, an addendum to the regional SocMon and SEM-Pasifika guidelines was published (Wongbusarakum and Loper 2011). These guidelines provide an additional set of ten socio-economic indicators related to climate change.

Due to the flexibility of the methodology, new variables for assessment and monitoring may be designed according to site need. This has been done in Micronesia and the Caribbean as a result of recent coral reef conservation initiatives - the Micronesia Challenge and Caribbean Challenge (Nevitt and Wongbusarakum 2013; Pena, McConney and Blackman 2013). Both sets of variables are in the experimental phase and require field testing.

Goals and objectives for site assessments or monitoring are usually tailored to each site’s needs and have focused on a variety of socio-economic aspects including inter alia baseline data gathering on coastal communities against which to measure changes and trends; informing fisheries and marine protected area (MPA) management plans; promoting the use of socio-economic data in fisheries management; developing socio-economic profiles for fisheries; determining the adaptive capacity of coastal communities to climate changes; enhancing the management capacity of stakeholders; and using socio-economic data to complement biophysical monitoring (Pena and McConney In press).
Due to the fairly recent establishment of several regional coral reef conservation initiatives aimed at preserving and protecting marine and coastal habitats, funding support for socio-economic monitoring at marine protected areas (MPA) or locally managed marine areas (LMMA) and coastal fishing villages across SocMon/SEM-Pasifika regions has been high. Of the 72 study sites, half have been conducted at MPA/National Park/protected dive sites or at sites in which there are plans for conservation; and the other half at coastal community sites, particularly fishing villages. As such a significant amount of socio-economic data on small-scale and subsistence fisheries exist. SocMon/SEM-Pasifika assessments or monitoring studies have included socio-economic information on fisheries such as demographic data on primary occupation; coastal and marine activities; types of use; household market orientation; attitudes and perceptions of resource conditions; and perceived threats. Additionally, governance data on awareness of rules and regulations, compliance, enforcement and participation in decision-making, among others, have been collected during site assessment/monitoring. Socio-economic data collected so far indicate inter alia a high level of livelihood dependency on subsistence and SSF; declining resource conditions and accompanying reduction in catch at some sites; reluctance to change to alternative livelihoods due to a number of factors; and threats such as restricted access, overfishing, pollution, sedimentation etc. (Pena and McConney, In press).

Our analysis is based on socio-economic assessment or monitoring that has been implemented by the six regions conducting SocMon/SEM-Pasifika in 36 countries globally at 72 study sites. We examine socio-economic monitoring conducted between 2003 and 2013 with emphasis on variables commonly monitored across all regions that have applicability to small-scale fisheries (SSF).

Variable analysis
Site assessment/monitoring reports and research papers were downloaded from the database on the SocMon/SEM-Pasifika website (www.socmon.org/database.aspx) for analysis. Project and research profiles were compiled in an Excel spreadsheet according to project/research title, year of initiation, country, study site(s), partners, goals and objectives for monitoring, methods of data collection, sample sizes and SocMon/SEM-Pasifika variables monitored (key informant/secondary sources and survey) to effectively build a preliminary meta-database for all SocMon/SEM-Pasifika regions.

<table>
<thead>
<tr>
<th>Key informant/secondary sources variable</th>
<th>Popularity rating</th>
<th>Survey variable</th>
<th>Popularity rating</th>
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</thead>
<tbody>
<tr>
<td>Community-level demographics</td>
<td></td>
<td>Household-level demographics</td>
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</tr>
<tr>
<td>K2</td>
<td>Population 33</td>
<td>S1</td>
<td>Age 53</td>
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</tr>
</tbody>
</table>

*Community infrastructure, business development and ownership*

| K13 | Community infrastructure and business development (and ownership) 26 | S2   | Gender 54 |

| K14 | Activities 41 | S7   | Occupation 53 |
| K15 | Goods and services 32 | S8   | Household size 42 |

| K16 | Types of use 33 |

| K18 | Goods and services market orientation/target markets for goods and services 26 |
| K20/SE A KS 20 & 21 | Levels and types of impacts 31 |
| K23 | Stakeholders 25 |
| K25 | Management body 26 |

*Coastal and marine activities*

| S11 | Household goods and services |

| S4   | Education 52 |

| S7   | Occupation 53 |
| S8   | Household size 42 |

| S9   | Household income (sources) 57 |

| S10  | Household activities 45 |
| S11  | Household goods and services 35 |
| S12  | Types of household uses 35 |

*Attitudes and perceptions*

| S16  | Perceptions of resource conditions 56 |
| S17  | Perceived threats 53 |

| S18  | Awareness of rules and regulations 42 |
| S19  | Compliance 37 |
| S21  | Participation in decision-making 41 |
| S28  | Material style of life 39 |

In two additional spreadsheets, key informant/secondary source and survey variables were inventoried according to study site for all regions to determine the variables most commonly shared among sites and regions. Variables chosen for site assessment/monitoring had to be identified for most sites by reviewing the relevant data.
collection instruments used (key informant interview guides and surveys) and linking questions for primary data collection or information provided by secondary sources to relevant variables. Where data collection instruments were provided, variables were identified based on results and discussions in site assessment/monitoring reports.

Each SocMon/SEM-Pasifika variable was assigned a score or “popularity” rating based on the number of sites monitoring the specific variable. Of the 72 study sites at which SocMon/SEM-Pasifika has been conducted, key informant/secondary sources variables and survey variables have been assessed or monitored at 50 and 67 sites, respectively. In order to determine common variables utilised across regions, any key informant/secondary sources variable with a “popularity” rating of 25 or more (i.e. assessed/monitored at 25 sites or more), and any survey variable with a “popularity” rating of 33 or more (i.e. monitored at 33 or more sites) have been the focus of this study. Based on a “popularity” rating applied to these types of variables, 10 key informant/secondary sources variables and 15 survey variables were identified as being commonly assessed/monitored across all SocMon/SEM-Pasifika regions (Table 1).

Simultaneously while inventorying the variables, spreadsheets were developed to record additional questions asked in data collection instruments, or secondary source information, relevant to SSF that could not be effectively measured by original SocMon/SEM-Pasifika variables with the purpose of identifying the need for revising or adopting original variables, or developing new variables to measure socio-economic characteristics of these fisheries. While an extensive list of these questions or information cannot be provided here, common data captured among regions related to catch characteristics (volume of catch, fish size, target species, catch price); details on fishing practices (methods used, number of persons involved, gender-based division of labour, time of day, seasonality); post-harvest preparation and value-added products; fish handling practices; livelihood resilience and alternative livelihood options; alternative livelihood options and supplemental income; skill requirements; and capital investment requirements, among others.

Table 1 Commonly assessed or monitored SocMon/SEM-Pasifika variables across all regions by “popularity” rating

All of variables (Table 1) are applicable to the collection of data on SSF and could comprise a core set of variables that could be used in monitoring of these SES. It however is clear based on our analysis of primary data collection questions and secondary source data, that in order to effectively monitor SSF globally, the revision or adoption of original SocMon/SEM-Pasifika variables, and the development of new ones, is necessary. A core set of highly recommended variables that should be included in any SSF socio-economic monitoring programme or framework would ensure the collection of standardised data at the regional level (details in a forthcoming paper). These should lead to an improved understanding of the socio-economic context of these SES, which is critically needed for their sustainable development, effective management and governance, especially in
In recommending a core set of SSF-specific variables we note that incorporating the Sustainable Livelihoods Approach (SLA) (DFID 2000) into variable selection, and therefore into the monitoring process, is important in capturing the characteristics of these SES. SocMon has been successfully combined with the SLA in SocMon Central America; for examples see Bonilla (2007); Brune and Sanders (2007), (2008); Ramírez and Morazán (2007); Sanders and Bonilla (2009), and could be adopted in all regions.

Conclusion
Although socio-economic information from SocMon/SEM-Pasifika, or any other approach, is seldom used in coastal and marine resource management decision-making anywhere in the world (Pena, McConney and Edwards 2014), the methodology described in this paper is one that can assist in providing a better understanding of the contribution of SSFs to food security, sustainable and alternative livelihoods, poverty alleviation etc. as well as impacts and implications of global processes such as climate change on these social-ecological systems. Based on the suite of tools the SocMon/SEM-Pasifika methodology utilises and approaches such as the SLA, as well as our experience implementing the methodology globally, we highly recommend this participatory methodology for monitoring the socio-economic characteristics of SSFs in order to inform and adapt management, increase adaptive capacity and resilience, and reduce vulnerabilities to certain shocks and impacts.

References


**Fisheries participatory monitoring at a southern Brazilian coastal community, Tarituba: reconciling conservation and livelihoods**

Dias, Ana Carolina Esteves, University of Campinas, Brazil, dias.ac09@gmail.com
Seixas, Cristiana Simão, University of Campinas, Brazil, csseixas@unicamp.br

**Abstract**
Participatory monitoring of artisanal fisheries in Brazil is still incipient. The development of this approach requires negotiation between fishers, managers and other stakeholders about management and monitoring issues. In Tarituba Community, an opportunity for participatory monitoring has emerged lately. Tarituba fishing grounds are located inside a no-take protected area established over the last 10 years, which has created conflicts
between fishers and Protected Area managers. In order to mitigate these conflicts, a Term of Reference has been developed between the two parties to allow artisanal fishing in the area. The Term of Reference requires the monitoring of fishing activities. In this context, the present work aims to develop a participatory monitoring of artisanal fisheries at Tarituba based on ecological and socioeconomic criteria within an Ecosystem Approach to Fisheries. This study is a pilot project in Brazil of the Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon). The SocMon methodology has 4 major steps: (i) Preparatory Activities, including defining goals of monitoring, identify and consult stakeholders, define study area and identify parameters and indicators; (ii) Planning Activities, which includes assess secondary data, conduct a reconnaissance survey and plan the field data collection; (iii) Field data collection; (iv) Data analysis. At the moment, we have performed the preparatory and most of the planning activities. Field data collection will start in May 2014, and preliminary results will be presented at the Second World Small-Scale Fisheries Congress.

**Introduction**
Participatory monitoring of artisanal fisheries in Brazil is still incipient. This process can be developed based on Ecosystem Based Management approach, which considers the human population as an integrated ecosystem (McLEOD et al. 2005), including its social and economic aspects (FANNING et al. 2011). This approach requires negotiation between fishers, managers and other stakeholders about management and monitoring concerns, considering the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions. When the Ecosystem Based Management paradigm is joined with the one of the Fisheries Management, the result is a perspective whose primary purpose is to manage fisheries to encompass the multiple needs and desires of society without harming the elements and interactions present in marine ecosystems. This perspective is called the Ecosystem Approach to Fisheries Management (FAO 2003).

Management practices based on the Ecosystem Approach to Fisheries that involves socio-ecological monitoring contribute to the maintenance of livelihoods of local communities, adjusting their practices to sustainable ones according to the natural resources stocks. In the study area of this project, the community Tarituba, located in the municipality of Paraty, southern Brazil, artisanal fishing is among the main activities (BEGOSSI et al. 2010). However, the main fishing spots are located inside a no-take protected area, which has created conflicts between fishers and Protected Area managers. In order to mitigate these conflicts, a Term of Reference has been developed between the two parties to allow artisanal fishing in the area. The Term of Reference requires monitoring fishing activities. In this context, the present work aims to develop a participatory monitoring of artisanal fisheries at Tarituba based on ecological and socioeconomic criteria within an Ecosystem Approach to Fisheries.

**Methods**
**Study area**
Tarituba is located at Paraty municipality in Southern Brazil. This is an important environmental area, housing a Brazilian biodiversity hotspot, the Atlantic Forest. Many Protected Areas (PA) were implemented in Paraty. Some of them are no-take zones, like Tamoios Ecological Station (Figure 1). This PA was created as environmental compensation of a nuclear power plant established in the region. However, its delimitation was established without taking into account the social impact to surrounding traditional communities. The main fishing spots of Tarituba fisherman are located inside those zones. This fact causes conflicts between fisherman and PA managers. The Term of Reference is an attempt to mitigate that situation.

Figure 1. Tarituba Community location and its surrounding marine area used as fishing grounds inside a no-take zone, Tamoios Ecological Station (dark blue). Source: IBAMA 2000 (Adapted).

Methodology
The development of the monitoring program was based on the methodology used by the Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon) (Bunsen 2000). This methodological proposal is guided by a participatory approach and is divided into four major steps: (i) Preparatory Activities, including defining goals of monitoring, identify and consult stakeholders, define study area and identify parameters and indicators; (ii) Planning Activities, which includes assess secondary data, conduct a reconnaissance survey and plan the field data collection; (iii) Field data collection; (iv) Data analysis.

For the, Preparatory Activities, the recognition of the area of study and consultation on the interest of key players took place in October 2013, when another researcher was finishing his PhD project in the same community. After defining the study area – which area was established by the Term of Reference, we organized a two-day workshop in April 2014 with fishermen and government staff to define goals of monitoring.

Indicators emerged from interviews with stakeholders (23 interviews with fishermen and 8 with government staff) by asking them the main ecological and socioeconomic aspects
of Tarituba fisheries socioecological system they considered most important to follow at monitoring program to achieve monitoring goals. Besides, fishermen traditional and local ecological knowledge were accessed through interviews with key informants (22 recognized knowledgeable fishermen) to better understand ecological aspects of this system and to propose ecological indicators. Fishermen were questioned about the main species caught, its biology and ecology and environmental factors that influence fisheries and species availability.

Data on potential indicators will be presented and discussed with stakeholders during the next planning activity.

The next step, Planning Activities is to implement the participatory monitoring per se and requires defining methods of data collection and logistics. This step will take place in late August, 2014. Both steps were supported by participatory techniques (participative workshops, interviews and participatory mapping of fishing grounds). The other two steps (Collection of indicators and Data analysis) will be held jointly by the local community and PA managers.

Results
At a workshop with stakeholders, four objectives were set to this monitoring program: (i) to contribute for the strengthening the union of fishermen; (ii) to prove the importance of fishing spots located inside PA to local fisheries; (iii) to reduce conflicts between fishermen and managers; and (iv) to contribute to Tarituba fisheries sustainability. In order to achieve those objectives, 16 ecological and 15 socioeconomic indicators were suggested by interviewees. Two of the ecological indicators, species caught and quantity in kg by species, are required by the Term of Reference. Tables 1 and 2 shows the indicators related with their parameters to be monitored.

Table 1. Ecological parameters and their respective indicators.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Subparameters</th>
<th>Indicators</th>
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<tbody>
<tr>
<td>Fishing Effort</td>
<td>Fishing gear</td>
<td>Description of the fishing gear and its specifications It depends on fishing gear</td>
</tr>
<tr>
<td></td>
<td>Effort (duration of fishing trip/number of fishers/number of time nets are thrown in the same fishing trip, or number of hours gillnets are set)</td>
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</tr>
<tr>
<td>Species</td>
<td>Species caught</td>
<td>List of caught species Total amount caught per specie/amount inside PA specie</td>
</tr>
<tr>
<td></td>
<td>The amount of individuals caught inside PA per specie</td>
<td>Size of individuals per specie (cm) (average/maximum/minimum*)</td>
</tr>
<tr>
<td></td>
<td>Size of individuals per species (average/maximum/minimum*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presence of ovate/ pregnant female *</td>
<td>Number of ovate pregnant female/total caught – per specie</td>
</tr>
<tr>
<td>Environmental Factors</td>
<td>Rain</td>
<td>Presence / absence of rain</td>
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<tr>
<td>-----------------------</td>
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<tr>
<td></td>
<td>Water color</td>
<td>Turbidity of the water on the day of capture</td>
</tr>
<tr>
<td></td>
<td>Marine current</td>
<td>Major Marine current at catch moment</td>
</tr>
<tr>
<td></td>
<td>Moon phase</td>
<td>Moon phase on the day of capture</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>Water Temperature</td>
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<tr>
<td></td>
<td>Wind</td>
<td>Prevaling wind direction</td>
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<tr>
<td>Unexpected factors</td>
<td>Environmental or Anthropogenic</td>
<td>Description of the factor</td>
</tr>
<tr>
<td>Fishing ground</td>
<td>Location of Fishing grounds</td>
<td>Fishing gorunds</td>
</tr>
</tbody>
</table>

* Some species only.

Table 2. Socioeconomic parameters and their respective indicators.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling capacity of vessels</td>
<td>Number of vessels with capacity to go fishing (equivalent to that performed inside PA) beyond the areas belonging to PA / fisherman</td>
</tr>
<tr>
<td>Social welfare income as complement of fishing activities</td>
<td>% Of income from fisheries / retired fisherman</td>
</tr>
<tr>
<td>Local Economy: Trade and Tourism</td>
<td>% Of fish sold to restaurants or focusing on tourism service</td>
</tr>
<tr>
<td></td>
<td>Listing of destinations and corresponding %</td>
</tr>
<tr>
<td>Runoff of fisheries production</td>
<td>Number of job vacancies for the education level of fishermen in the community and surroundings</td>
</tr>
<tr>
<td>Lack of employment in the region</td>
<td>% Of fishermen whose parents and grandparents used to fish</td>
</tr>
<tr>
<td>Cultural and Traditional Aspect</td>
<td>% Of protein coming from fisheries within the PA to feed the fisherman family</td>
</tr>
<tr>
<td>Food supply</td>
<td>Perception of fishermen on the benefits of fishing to their welfare.</td>
</tr>
<tr>
<td>Well-being and pleasure</td>
<td>% Of income from fisheries / Fisherman family unit</td>
</tr>
<tr>
<td>Total Income</td>
<td>% Of income from fisheries from fishing grounds within the PA / Fisherman family unit</td>
</tr>
<tr>
<td>Income from PA Surveillance approach</td>
<td>Perception of fishermen on surveillance approach hours/week</td>
</tr>
<tr>
<td>Frequency fisherman goes fishing</td>
<td>Average of Fisherman Education Level</td>
</tr>
<tr>
<td>Education Level</td>
<td>Safe anchoring grounds inside PA</td>
</tr>
<tr>
<td>Safety in cases of adverse conditions at sea</td>
<td></td>
</tr>
</tbody>
</table>
### Discussion
There are two different concerns in place, the protection of local marine environment and the maintenance of fisheries at main spots, which are located inside a no-take zone. Managers want to make sure Tarituba artisanal fisheries do not degrade the natural environment and fishermen want to continue the main activity that is part of their livelihood since ever. The objectives of the monitoring program contemplate these two issues. The indicators that emerged from the parameters pointed out provide information that address all objectives collectively established for monitoring. The second objective, to prove the importance of fishing spots located inside PA to local fisheries, can be achieved by interpreting the data generated by indicators that compare aspects of fisheries inside the no-take zone with that for Tarituba total caught. Several indicators of the tables 1 and 2 can generate relevant information in this direction. Examples are the amount in kilogram each species is captured at the PA and the total for Tarituba; and the percentage of income from fisheries within the PA per fisherman.

To achieve the fourth objective, to contribute to Tarituba fisheries sustainability, indicators such as the size (maximum, medium, minimum) of the captured relevant species and the percentage of ovate individuals captured can generate important clues in this regard.

Regarding the first and third goals, to contribute to strengthening the union of fishermen and to reduce conflicts between fishermen and managers, are linked to the way in which collection, analysis and use of data will occur. These steps should be done transparently and jointly, involving fishermen and managers.

Interviewers stated that many environmental factors are related to the capture of some species, like water room temperature, presence of rain and wind direction. In this sense, the indicators related to environmental factors and changes in the local marine environment are an important category to establish a baseline for comparison of data collected with regard to the conditions that could affect the results, avoiding erroneous interpretations of data.

In addition, it should be given special attention to those species whose breeding seasons coincide with its local harvest, such as snook. Sedentary species as grouper can give important clues on local environmental changes related to fisheries or other impacts as pollution and habitat destruction. It is important to have in mind when analyzing monitoring data that migratory species, such as mackerel, may be influenced by impacts outside Tarituba fishing areas, reflecting it at the indicators collected. All those information mentioned above should be incorporated at the criteria to choose the final indicators.
Conclusion
Fish is not affected by fisheries only, but also by many other factors, related or not to human activities. Thus, an integrative approach relating the elements of the local coastal environment and their interactions is more appropriate for the effective understanding of this system and to better guide decision making regarding management and conservation strategies.

According to our findings, for the monitoring program to reveal more reliable information, it is important to relate the capture of species with environmental factors that influence on the fishing activities. In addition, it is necessary to take into account unforeseen environmental change.

Considering the fishing system of Tarituba as a social-ecological system in which the human population is part and directly influences the other elements of the system, it is essential to include in the monitoring program socioeconomic aspects related to local fisheries. This will make it possible to integrate the welfare of both human and ecosystem, one of the principles of the EAF.

Regarding the participatory approach, our experience shows that it was very important to consider both fisheries and managers concerns. The approach has created a discussion arena between both parties, which still needs to be improved and operating in other conflicting situations.

References

Factors influencing the harvest strategies in the Punta Allen spiny lobster fishery and management implications.

Abstract

Co-management and community rights-based approaches are being increasingly accepted as appropriate strategies for achieving sustainable small-scale fisheries. However, in addition to these, a robust understanding of the contexts under which fishers make decisions regarding harvest strategies as well as their perceptions on resource abundance and management effectiveness is also necessary. The Punta Allen spiny lobster fishery operates in Quintana Roo, Mexico. The fishery is based on a co-management, territorial user rights approach, where fishers have exclusive rights to harvest spiny lobsters using artificial shelters within individual areas, known as “campos.” However, fishing effort and the amount of lobster which can be landed are not controlled. As a result, the development and implementation of well-defined harvest control rules that are consistent with the harvest strategy and which take into account the impact on habitat quality have been recommended. This paper seeks to identify which factors are most influential in determining the harvest strategies of fishers, and will examine the implications for management. The reported results will be based on interviews conducted with campo owners of the Vigia Chico Cooperative using a survey instrument designed to capture information on i) the factors which influence the number of artificial shelters deployed; ii) the factors which fishers consider to be most influential on the productivity of their campo, the abundance of the spiny lobster resource, and the profitability of the spiny lobster fishery; and iii) fishers’ perceptions on the effectiveness of current and future management measures in the spiny lobster fishery.

Regular session 2.4: Climate change and adaptation

Adapting to maintain viable fisheries livelihoods in the face of multiple interacting bio-physical and socio-political stressors

Nathan Bennett (University of British Columbia)

Change is a constant for small-scale fishers. Fisheries change annually and seasonally and, in many places, are in decline. Globally, the health and productivity of the ocean is threatened by coastal development, overfishing, habitat destruction and global
environmental changes. Climate change has serious impacts on the environment and the livelihoods of fishers. At global, regional and national scales, demographics, politics, markets, technology and social factors impact fishers’ livelihoods. These extra-local stressors also drive internal changes in the livelihood portfolios, social organization, governance structures and cultural spheres of coastal fishing communities. Vulnerabilities to stressors are experienced differently between communities and groups, producing winners and losers at local and regional scales. This paper will draw on fieldwork with coastal fishing communities in Thailand and elsewhere to explore: 1) the variety of biophysical and socio-political stressors being experienced by fishers from the local perspective; 2) how these stressors interact to produce differential vulnerabilities between communities and groups; 3) factors that increase the adaptive capacity of communities to multiple interacting stressors; and, 4) adaptations that support both viable fisheries and livelihoods. Two frameworks for examining the adaptive capacity and vulnerability of coastal fishing communities will be presented.

Evidences of climate change effects on fish stocks in the Campeche Bank and the challenge for management

Francisco Arreguín-Sánchez, Pablo del Monte Luna, Manuel J. Zetina-Rejón
Instituto Politécnico Nacional, Centro Interdisciplinario de Ciencias Marinas
Apartado Postal 592, La Paz, 23090, Baja California Sur, México.

Abstract
The scientific basis underpinning the conventional management of exploited stocks assume stability in ecosystems, and that the main driver of variation of stock abundance is fishing. The long-term trends of environmental variables, such as temperature, suggest that this notion was reasonably acceptable for several decades (approx. 1930-1980), but not for the last 2-3 decades. Recognition of environmental effects is of great importance for the sustainability of fish resources and the ecosystem. For example, if a fully exploited stock declines by an environmental effect, and if fishing intensity is not adjusted accordingly, the result will be an overfishing state that cannot be reversed through conventional management (control of fishing mortality), inducing to a potential degradation of the stock and the ecosystem. In this paper evidences of the effect of climate change are documented based on several environmental variables such as temperature, mean sea level, AMO, salinity and primary production; and the effects on various fish resources of the Bank of Campeche are shown, including red grouper (Epinephelus morio), red snapper (Lutjanus campechanus), octopus (Octopus maya, O. vulgaris) jacks (Caranx spp.), shrimps (Farfantepenaeus duorarum, F. brasiliensis), snook (Centropomus undecimalis), sharks (several species), lobster (mainly Panulirus argus), among others. Several of these resources have been diagnosed as overexploited following the scientific conventional approach, despite the fishing control applied; while others have increased their abundances, outlining trophic cascade effects.
effect on the ecosystem, we highlight the need to integrate the ecosystem approach to improve probability of success of the management goals.

The scientific basis underpinning the conventional management of exploited stocks assume stability in ecosystems, and that the main driver of variation of stock abundance is fishing. The long-term trends of environmental variables, such as temperature, suggest that this notion was reasonably acceptable for several decades (approx. 1930-1980), but not for the last 2-3 decades. Recognition of environmental effects on stocks is of great importance and related to the sustainability of fish resources and the ecosystem. For example, if a fully exploited stock declines by an environmental effect, and if fishing intensity is not adapted accordingly, the result will be an overfishing state that cannot be reversed through conventional management (control of fishing mortality), inducing degradation on both, the stock and the ecosystem.

In this contribution we show evidences of how changes over time of several stocks of the Campeche Bank are related to climate change effects, and discuss their implications on efficiency of fisheries management and, based on information on ecosystem evolution, we show the concept of "ecosystem limit reference level" as an alternative strategy to define limits of fishing on fish stocks from holistic ecosystem attributes to maintain ecosystem sustainability.

For this purpose we used information of some key stocks in the region, including red grouper (*Epinephelus morio*), red snapper (*Lutjanus campechanus*), octopus (*Octopus maya, O. vulgaris*) jacks (*Caranx spp.*), shrimps (*Farfantepenaeus duorarum, F. brasiliensis*), snook (*Centropomus undecimalis*), sharks (several species), lobster (mainly *Panulirus argus*), hawksbill turtle (*Eretmochelis imbricata*). Some of them has been declared as deteriorated in the National Fishing Act (DOF 2012) because of overfishing, such as red grouper and the pink shrimp; while others show growing yields in the last years (e.g. octopus), even when the fishery existed for several decades. Firstly we associated information on catch and/or stock size time series and related them to several time series of anomalies of environmental variables used as climate change indicators as sea surface temperature (SST), salinity (SAL), mean sea leve (MSL), North Atlantic Oscilation (NAO), Atlantic Multidecadal Oscilation (AMO), and Primary Production (PP). Figure 1 represents the long-term relationship between changes in fish stocks and environmental variables. The change of phase in all the variables demonstrates a clear effect of climate change over the last six decades, as well as an also clear response of the stocks. Then, for example, based on the AMO index (which expresses changes of SST at regional basis) we can explain changes in several fish stocks such as red grouper, pink shrimp and octopus due to the effect of temperature in stocks'so growth performance, affecting inversely red grouper and pink shrimp, and proportionally to octopus. In all these cases the effect of temperature is related to the reproductive performances or reproductive success. In other cases like the hawksbill, the evidence is clear and related to the nesting frequency but we can not arrive to a fully biological interpretation yet. For others we can show by now the association without fully interpretations, with some exception where we hypothesized on trophic cascade effects, like for the case of lobsters.
Figure 1. Anomalies of several environmental variables expressing climate change, and their association with time series of catch of several fish stocks in the Campeche Bank. Effects on yields can be observed as change of catch tendencies associated to the effect of regime shift indicated by the vertical shadow band (taken from Arreguín-Sánchez 2012).

The above evidences demonstrate that the present state of some stocks should not been associated with overfishing, at least initially, and that management measures, as stated in the NFA will probably not result in the expected success of recovery. Even more, simulation experiments based on a trophic dynamic model (Ecosim, Walters et al. 1999, Arreguin-Sanchez et al. 2014) that incorporates climate changes indices forcing primary production, resulted in a representation of ecosystem evolution expressed as relative changes in biological production, that also explains stocks changes over time (figure 2) as experienced. Following such evolution we can understand the need of ecosystem based criteria to guide fisheries management on an adaptability basis; being a strong and essential complement to the NFA in Mexico. Following Arreguin-Sanchez et al. (2014), we suggest the use of the concept of "ecosystem limit reference level, ELRL" to deal with
these problems in addition to the conventional management based on the population concept.

Figure 2. Simulated evolution of the Campeche Sound ecosystem over the last six decades. Yellow-red denotes low-high transition in biological production. Grey area in the upper panel represents carrying capacity while line represents the anomaly of the AMO index. Note that about mid 1970’s regime shift occurred after which global ecosystem production decreases.

Figure 3 represents the basis of the ELRL concept using as example the north continental shelf of Yucatan, NCSY, as example, where we represent the degree of ecosystem degradation (based on the gain in entropy) as a function of the harvesting rate, HR (representing the loss of biomass for each tropic level or species), and the tropic level (representing species and/or fish stocks). In such diagram we can identify the ELRL based on ecosystem resilience and/or the auto-organization capacity, where the rational is that conserving such attributes, the ecosystem can reverse effects of fishing maintaining its organization; in other words, the ELRL is the limit of catch or loss of biomass that ecosystem can support to maintain a sustainability and the auto-organization capacity. To deal with changes over time as shown in figure 2, the corresponding HR for a given fish stock can be maintained as constant over time since HR represents the proportion of biomass existing in a given year or fishing season. For this, monitoring fish stock comes to be essential for the management policy. In our essay for the NCSY (figure 3), assuming an acceptable ecosystem degradation risk of 30% we could advise that harvesting rates for the main fish stocks must be between 35% to 45% of the existing biomass, which in a gross sense coincides with the balanced catch concept expressed by García et al. (2012). In our opinion this approach is a good alternative for small-scale fisheries where a multispecies resource is exploited.
Figure 3. Conceptualization of the “ecosystem limit reference level” for the North Continental shelf of Yucatan. Diagram refers changes in gain of entropy (degradation) as a function of the trophic level (=species) and harvesting rate. Black line represents 30% of degradation risk, while dashed line on the left (towards the blue color) represents 20% of risk; e.g., for a species of a trophic level 3, the harvesting rate advised should be about 40%, while for TL=4.8, about 35%.

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Panarchy: Exploring resilience and well-being among fishing dependent households

Marta C. F. Leite. Natural Resource Institute, University of Manitoba, Canada. E-mail: martaleite20@gmail.com
Fikret Berkes. Natural Resources Institute, University of Manitoba, Canada. E-mail: Fikret.Berkes@ad.umanitoba.ca

Abstract

Resilience theory and the concept of “panarchy” emphasize the importance of scales. However, the household level and its importance as the link between the individual and the community level have been overlooked. Resilience at a larger systems level does not necessarily translate into resilience at lower levels, such as the individual, community and household levels. At the individual level, literatures from psychology of development and mental health provide relevant insights for studying the social component in human-nature systems, with focus on the strengths needed for individuals to recover from adversities. The social well-being approach brings a broader understanding of human well-being, as it emphasizes relational processes in addition to the material and subjective dimensions of well-being. It explicitly aims to understand how relationships, and the social structures in which they are embedded, shape peoples’ agency to improve quality of life. This paper aims to explore how the integration of different strands of literature contribute to a greater understanding of fishing-dependent household resilience.

1. Introduction

In this paper we argue that integrating different strands of literature help us to better understand fishing-dependent household resilience processes and well-being. Resilience concepts, approached from both from social-ecological systems resilience and individual resilience literatures and the social well-being approach will be used as the theoretical background to develop the argument.

2. Contributions from Social-Ecological Systems (SESs) literature

Resilience is a concept that has been much in vogue and recognized as a lens to the study of change, adaptation, and transformation in complex systems (Gunderson and Holling 2001; Nelson et al. 2007). However, resilience theory (Holling 1973) describes properties of systems, and does not necessarily endow a desirable state (Béné 2012). Resilience can be defined as the capacity of a system to withstand shock and to rebuild itself in order to maintain the same basic identity, structures, functioning and feedbacks (Folke 2006; Gunderson and Holling 2002).

Since the 1990s resilience thinking has broadened its scope to include social systems and the interactions between people and nature (Carpenter et al. 2001; Gunderson and Holling 2002; Nelson et al. 2007; Ross and Berkes 2014). The perception of humans in nature can be represented by the concept of social-ecological systems (SESs) (Berkes and Folke 1998; Chapin et al. 2009). Coastal small-scale fisheries are a good example of SESs, where human livelihoods present a direct dependence on fishing resources and on marine ecosystems. This dependence often results in human activities modifying in meaningful ways the structure and functioning of the ecological components of the system. Likewise,
these modifications will affect people’s livelihoods, which will respond and adapt, affecting the natural system again, and so on.

As resilience aims to explore how change and persistency can coexist together, both adaptability and transformability are key concepts to be considered (Folke et al. 2010) in systems’ resilience studies. Here, we agree that the same applies for studying household resilience, especially if we are to consider the multi-scale and multi-level nature of the SESs they are part of (Gunderson and Holling 2002).

3. Panarchy and multi-level resilience

Panarchy is a key concept in resilience thinking; it describes SESs as composed by nested levels and cross-scale interactions (Gunderson and Holling 2002). These nested levels operate over a range of scales (e.g. time and space) and are influenced by process occurring at other levels of the panarchy, as well as processes originating within a level itself. The panarchy concept helps with analyzing how changes originating at different levels influence other(s) level(s) within a SES.

Folke et al. (2010:20) claim, “transformational change at smaller scales enables resilience at larger scales.” However, the opposite may also apply: “increasing resilience of particular parts of a system to specific disturbances may cause the system to lose resilience in other ways” (Folke et al. 2010:23). Resilience at the larger systems level (e.g. coastal systems) does not necessarily translate into resilience at lower levels, such as the community, household and individual levels. SESs resilience literature has conventionally focused on the system level (Gunderson and Holling 2002). In order to evaluate resilience of the social component of coastal SESs, there is a need of directing efforts to comprehend the dynamics, behaviors, and complexities of lower levels, and how they related to and influence each other.

Moreover, we need to consider how forces originating at higher levels enable or constrain household resilience, as for example environmental policies. This understanding poses the question of “resilience of what to what” (Carpenter et al. 2001), referring to the distinction between specified resilience (resilience of some specific aspect of the system, such as household’s livelihoods) and general resilience (resilience of the system as a whole, such as coastal ecosystem). From a social perspective, the question may also be framed as “resilience of what for whom?” (Leach 2008).

4. Resilience at the individual level

The concept of resilience in the field of psychology and mental health was introduced in the 1960s and 1970s (Masten and Obradovic 2008). Luthar (2006:742) defines individual resilience as “a phenomenon or process reflecting relatively positive adaptation despite experiences of significant adversity or trauma”. Contrary to SESs resilience, where a system can be maintained in either a desirable or undesirable state, here resilience is always a positive characteristic of individuals. Another important difference is that while
many of the research on SESs resilience does not consider vulnerability (Gallopín 2006; Béné 2012), in developmental studies researchers have identified vulnerabilities and protective factors as being central to understanding adaptation processes (Luthar 2006). Here vulnerabilities relate to factors that magnify conditions of risk (e.g. poverty) and protective factors, on the other hand, are those that minimize the effects of risk (e.g. family and social support) (Luthar 2006; Masten and Obradovic 2006).

The process of individual resilience encompasses interactions and adjustments of the individual with both social and physical environments (Berkes and Ross 2013; Brown and Westaway 2011; Buikstra et al. 2011). Creativity, competence, social charisma, the ability to experience a range of emotions, affectional ties with the family, informal support systems outside the home, belief in oneself, and sociability are some of the characteristics identified for individual resilience (Luthar 2006). Many of these refer to supports found in particular levels of the panarchy, such as the household (e.g. ties with family) and the community (support systems outside the home and sociability).

Finally, two concepts are fundamentally important to individual resilience: 1) resilience varies over time: “positive adaptation despite adversity is never permanent; rather there is a developmental progression, with new vulnerabilities and strengths emerging with changing life circumstances” (Luthar 2006:741), and 2) resilience is normally domain-specific, an individual can be very resilient in one area and still vulnerable to other stressors (Luthar 2006; Masten and Obradovic 2006). As stated by Berkes and Ross (2013:10) “resilience is seen as a continual personal development process in facing adversity and adaptation, rather than a stable outcome that is reached and maintained”.

Both ideas can be related to concepts of resilience at the system’s level: scalar interactions (time-dependence), and specified resilience (resilience “of what to what”?). However, there are other factors to be considered, such as the role of human agency and the social structures enabling adaptation to take place, both approached by the concept of social well-being.

5. The social well-being approach: an essential piece in the puzzle

Human agency is “the capacity of individuals to act independently to make their own free choices” (Brown and Westaway 2011:322), and can also be related to a group of people’s abilities to negotiate and make decisions impacting their lives, including those related to adaptation strategies in response to change (Coulthard 2012). Berkes and Ross (2013:15) consider “adaptive capacity as a latent property, which can be achieved when people exercise their agency”. Human agency allows individuals, or groups of individuals, to be “autonomous, purposive and creative actors, capable of a degree of choice” (Lister 2004:125). These choices are greatly informed by what people perceive is important for their well-being (Gough and McGregor 2007).

Although there is no singular definition for wellbeing, the term is frequently related to quality of life, or the important features needed for pursuing a fulfilling life (Gough and McGregor 2007). Well-being is experiential, and its definition depends on what people
value in terms of being and doing, and on how they relate to the environment to which they belong (Gough and McGregor 2007; Millennium Ecosystem Assessment 2005). Essential to the concept is the acknowledgement of plurality and that what wellbeing means for one specific individual or group, will often be fundamentally different from the perceptions of other individuals/groups, including our own as researchers (Gough and McGregor 2007; White 2008).

The social well-being approach brings a broader understanding of human well-being as it emphasizes relational processes in addition to the material and subjective dimensions of well-being (Armitage et al. 2012; Gough and McGregor 2007; White 2008). The approach contributes to the study of the choices people have, and/or prioritize in order to respond to change, as it emphasizes people’s own understandings, purposes, cultures and worldviews, and moreover, it genuinely commits to actor-oriented approaches (Coulthard 2008; Gough and McGregor 2007; White 2008). Moreover, it explicitly aims to understand how relationships, and the social structures in which they are embedded, shape peoples’ agency to improve their quality of life (White 2008).

Coulthard (2012:2) argues that “adaptation choices can include compromises and trade-offs between the pursuit of well-being on the one hand, and on the other, the necessity for adaptation strategies that reduce vulnerability and risk”. The social well-being approach considers social structures that enable, or constrain, the exercise of human agency and the flourishing of place-specific livelihoods (Idrobo 2014). For example, in many contexts the social and cultural dimensions of societal structures have a role in defining access to material and social benefits, such as the cast systems in India (Gough et al. 2007).

The social wellbeing approach has demonstrated great potential to improve SESs resilience understanding (Armitage et al. 2012; Coulthard 2012; Weerantunge et al. 2012). In the context of small-scale fisheries, the literature on social wellbeing can provide an improved understanding of household’s adaptations in response to changes, by bringing to light important aspects, such as agency and social/institutional structures (Armitage et al. 2012). “Fisheries are multiobjective and multiscale in nature […] all three dimensions of wellbeing – the material, relational and subjective – need to be taken into account, both in seeking a better understanding of small-scale fisheries and in developing appropriate policy” (Weeratunge et al. 2013:4).

6. Conclusions

Many of the factors enabling, or constraining, household resilience originate at other levels of the panarchy, rather than at the household level itself. The literatures on both individual resilience and social well-being provide important inputs to the study of household resilience. This integration allows us to explore strengths, behaviors and motivations, as well as the role of agency, relationships, power dynamics and social structures (e.g. class, age, social status, gender) that allow or constrain households to adapt to change (Armitage et al., 2012; Béné, 2012; Coulthard, 2008; Leach 2008).
A focus solely on well-being could prioritize short term human interests, and overlook important features of the ecological component of the system of essential importance for long term well-being of fishing dependent households (Armitage et al., 2012: 11). As well, resilience thinking is not a panacea, and has being broadly criticized for overlooking important social concepts. In order to allow positive adaptation, resilience and well-being to fishing-dependent households, it is necessary to adopt policies that enhance fishers’ freedom of choice and room for maneuver, and for such, it is necessary to first understand what fishers and their households value as important for their own well-being while they face change (whether political, social, economical, or environmental).

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Climate change, gendered adaptive capacity and agency among coastal people in Zanzibar, Tanzania

Lindström, Lars (Department of Political Science, Stockholm University, Sweden) de la Torre-Castro, Maricela (Department of Physical Geography and Quaternary Geography, Stockholm University, Sweden)

Coastal populations in developing countries largely depend on small scale fisheries and aquaculture for food and income. Climate change (CC) threatens survival and complicates efforts at poverty alleviation. At the same time there has been a shift from mitigation to adaptation. However, what adaptation means to people living in poverty is not well understood and even less is known how the capacity to adapt is distributed. It is also not known how coastal people themselves perceive climate change and the consequences for their agency. We address these issues by analyzing how adaptive capacity and agency are gendered by comparing women and men in small-scale fisheries and seaweed farming in Unguja Island, Zanzibar, Tanzania.

The results are based on data collected through semi-structured interviews (n=226) with 96 fishermen and 132 women, mainly seaweed farmers, in 6 villages. Very few had an understanding of the expression “climate change” although well aware of the changes in...
the marine environment. Less than 5% link the changes to CC at a broader scale; instead local issues such as deforestation were given as explanations. About two thirds engage in additional activities, but only with a marginal contribution to livelihoods. Women show a high dependence (70%) on microcredits and are more willing to change to another activity while more reluctant to migrate. Overall, coastal men and more so women live in poverty, they have very low adaptive capacity and agency is very limited, while bearing the effects of climate change.

Fisheries and climate change in Western and Central Africa: A review of stresses and adaptive capacity

George Freduah, PhD Candidate, Sustainability Research Centre, University of the Sunshine Coast, Queensland, Australia, gfreduah@usc.edu.au
Dr Pedro Fidelman, CRN Research Fellow, Sustainability Research Centre, University of the Sunshine Coast, Queensland, Australia, pfidelma@usc.edu.au
Professor Tim Smith, Director, Sustainability Research Centre, University of the Sunshine Coast, Queensland, Australia, tim.smith@usc.edu.au

Abstract
Climate change and other stressors (e.g., social-economic, cultural and political) are predicted to severely affect fisheries, particularly in Western and Central Africa. The development and implementation of effective responses to these stressors will depend in part on an improved understanding of how they affect small-scale fisheries in the region, and which response strategies are available. In this paper, we use a systematic review method to explore these stressors and available responses. The review of forty one peer-reviewed articles reveals a significant gap in knowledge, which includes lack of specific information on (1) the effects of important climate stressors such as sea-level rise, increased sea surface water temperature and ocean acidification; (2) how climate and non-climate stressors may interact to influence small-scale fisheries; (3) the range of response strategies that may be available; and, (4) factors that may enable or hinder the development and implementation of these strategies.

1 Introduction
Climate change is one of the most critical stressors predicted to severely affect fisheries (Allison et al., 2009), particularly as a result of increased sea surface temperature, decreased pH levels of surface seawater, and sea level rise. For example, increase in sea surface temperature will lead to changes in species distribution (Pauly, 2010), and ocean acidification will impact shell-borne organisms (Orr et al., 2005; Feely et al., 2004). Sea level rise also poses serious threats to coastal communities, including fisheries infrastructure (Barange and Perry, 2009).

Africa’s climate is more prone to severe changes in climate than other continents. For example, a temperature increase of 1°C has been observed in Ghana over the past 30 years and temperatures are expected to change by 0.6°C, 2.0°C and 3.9°C in 2020, 2050 and 2080 respectively. Sea levels in Ghana are predicted to rise every decade by an
average of 0.3 cm from 3.6 cm by 2010 to 34.5 cm by 2080 (MoEST, 2011). The effects of such change have already been observed, particularly on important marine fisheries. For example, increase in sea surface temperature by 1°C has been linked to reduced catch rates of round sardinella in Ghana (MoEST, 2011). In addition, the Ghanaian coastal strip contains about 25% of the entire country’s population (Collier et al, 2008), and even a relatively small rise in sea level could have a dire effect on the coastal livelihoods and the economy.

In Africa, climate change is exacerbated by over dependence of its economy on primary production, such as fishing (Collier et al., 2008). In Ghana, for instance, fish is identified as the most important non-traditional export commodity (Koranteng et al., 2006). West and Central African constitute the majority of countries whose economies are most vulnerable to climate impacts on fisheries (Allison et al., 2009).

In sum, responding to climate is an emerging critical issue in the context of fisheries in Western and Central Africa. It is exacerbated by the need to respond to a number of non-climate stressors (e.g., social-economic, cultural and political). The development and implementation of effective responses will depend in part on an improved understanding of how climate and non-climate stressors affect small-scale fisheries in the region, and which response strategies are available. In this paper we undertake a systematic review of the peer-reviewed literature to explore how climate change and other stressors affect small-scale fisheries in Western and Central Africa, and the strategies available in response to these stressors.

2 Methods

We systematically reviewed existing peer-reviewed literature to understand how climate change and other stressors affect small-scale coastal fisheries in Western and Central Africa, and the strategies available to respond to these stressors. Systematic review is a standard method to search, group and analyse relevant literature from corpus of documents identified by the review process (McGowan and Sampson, 2005).

We used Web of Science (Web of Knowledge) as the data source for published peer-reviewed articles and book chapters on climate change and fisheries with geographical focus on Western and Central Africa. The search included a combination of terms (see Table 1) and resulted in 195 articles. Titles and abstracts of all articles were reviewed to select documents based on inclusion and exclusion criteria (see Table 2). In instances where titles and abstracts were not sufficient to inform if the article should be included or excluded, the full article was reviewed. As a result, 41 articles were selected and analysed.

Table 1. Search terms used in the review

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Hits</th>
<th>Included</th>
<th>Excluded</th>
</tr>
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<tbody>
<tr>
<td>(Fish*) AND (&quot;climat* change&quot; OR &quot;global warming&quot; OR &quot;stress*&quot;) AND (&quot;Ghana&quot; OR &quot;Nigeria&quot; OR &quot;Cote d'Ivoire&quot; OR &quot;Ivory Coast&quot; OR &quot;Senegal&quot; OR &quot;Sierra Leone&quot; OR &quot;Cape Verde&quot; OR &quot;Guinea-Bissau&quot; OR &quot;Guinea&quot; OR &quot;Liberia&quot; OR &quot;Gambia&quot; OR &quot;Benin&quot; OR &quot;Niger&quot; OR &quot;Burkina Faso&quot; OR &quot;Mali&quot; OR &quot;Mauritania&quot; OR &quot;West Africa&quot;)</td>
<td>169</td>
<td>31</td>
<td>138</td>
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</tbody>
</table>
(Fish*) AND ("climat* change" OR "global warming" OR "stress") AND ("Burundi" or "Central African Republic" or "Democratic Republic of the Congo" or "Rwanda" or "Angola" or "Cameroon" or "Republic of the Congo" or "Chad" or "Gabon" or "Equatorial Guinea" or "São Tomé and Príncipe" or "Central Africa")

Table 2. Inclusion and exclusion criteria used in the systematic literature review

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
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<tbody>
<tr>
<td>• Written in English only</td>
<td>• Geographical focus outside of Western or Central Africa Adaptation strategies with no explicit focus on fisheries</td>
</tr>
<tr>
<td>• Available on Web of Science database</td>
<td>• Focused on large-scale fisheries</td>
</tr>
<tr>
<td>• Focus on any of the countries of Western or Central Africa</td>
<td>• Solely based on climate science</td>
</tr>
<tr>
<td>• Published between 1985-2014</td>
<td>• Exclusively based on fisheries science</td>
</tr>
<tr>
<td>• Articles, reviews and book chapters</td>
<td></td>
</tr>
<tr>
<td>• Climate change adaptation for the purpose of fisheries</td>
<td></td>
</tr>
<tr>
<td>• Impacts of climate change on small-scale fisheries (both inland and marine)</td>
<td></td>
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<tr>
<td>• Vulnerability of small scale fisheries</td>
<td></td>
</tr>
<tr>
<td>• Adaptive strategies of small scale fisheries</td>
<td></td>
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<tr>
<td>• Social and ecological aspects of fisheries</td>
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</table>

3 Stressors and Response Strategies in Western and Central Africa small-scale fisheries

3.1 Stressors

Reporting on stressors confronting small-scale fisheries, with exception of changes in weather conditions (i.e., rainfall and flooding), included mostly non-climate stressors such as overfishing, intense illegal fishing, population growth and dietary needs, and limited access to funds. These stressors are detailed, as follows:

Changes in weather conditions – Unparalleled Changes in weather conditions marked by heavy rainfalls and flooding are expected to affect small-scale fishing, in particular its productivity (e.g., Adebo et al., 2011).

Drought – Small-scale fisheries are expected to be affected by high incidences of drought. Fishers are already experiencing the effects of drought. Fishers suffer low catches during periods of drought because of high drop in water levels in lakes, which drives fishes into deep waters (e.g., Codjoe et al., 2012).

Overfishing – Overfishing in west African lagoons is a result of intensive fishing pressure; and the use of effective fishing gear (e.g., beach seines), which result in a considerably higher fishing effort. Overfishing is also driven by high dependence on fisheries for food and livelihood (e.g., Albaret and Lae, 2003; Allison et al., 2009).

Intensive illegal fishing – The presence foreign vessels illegally operating in West African coastal waters is a common phenomenon. As a result, many countries like Senegal suffer from over-exploitation of its fisheries resources (Belhabib et al., 2014).

Population growth and dietary needs – Human population is expected to increase in Western and Central African countries, where fish provide greater proportions of non-
grain protein needs. This will increase global, regional and local demand for fish which will finally threaten sustainability of fisheries (e.g., Barange et al., 2014).

Limited access to funds – Small-scale fishers are unable to access funds from financial institutions because fishing is perceived as relatively risky activity. As a result, personal savings and money borrowed from friends and relatives remain important source of funds for small-scale fishers (e.g., Adebo et al., 2011).

3.2 Response strategies

The literature reports on strategies that may be developed/implemented in response to some of the stressors identified above (namely, changes in weather conditions [flood and drought] and overfishing). Livelihood diversification and flood control measures were noted as strategies in response to flood. The former is considered as a key strategy for increasing wealth and for safeguarding against decrease in fish stock and income. It may include, for example, a combination of backyard fish pond and farming (e.g., Bene et al., 2011). The later, i.e., flood control measures, include building strong barriers around fish farms (Adebo et al., 2011).

Responses to drought include: (1) access to seasonal weather forecast information, which helps fishers to better plan their activities, e.g., when to go fishing; (2) post-harvest technology, which includes smoking, salting and the sale, providing a variety of full-time and seasonal livelihood and employment opportunities; and (3) the use of fish pond, including controlled pond, artificial lake, or reservoir to stock fish. These ponds are used in aquaculture for fish farming, and can support livelihood, food and income during periods of drought (Codjoe et al., 2012).

Migration was the only response noted for overfishing. It is a strategy that small-scale fishers may adopt to meet their need for fish amid rapid fishery depletion (Belhabib et al., 2014).

4 Discussion

This paper used a systematic review method to highlight the stressors confronting small-scale fisheries and corresponding response strategies in Western and Central Africa. The literature reviewed concentrates mostly on non-climate stressors (i.e., overfishing, intense illegal fishing, population growth and dietary needs, and limited access to funds); and reports on response strategies associated with only a couple of the stressors identified (i.e., change in weather conditions and overfishing).

There is a significant gap in knowledge that may constrain the development and implementation of effective strategies in response to climate and other stressors in Western and Central Africa. This includes lack of specific information on (1) the effects of important climate stressors such as sea-level rise, increased sea surface water temperature and ocean acidification; (2) how climate and non-climate stressors may interact to influence small-scale fisheries; (3) the range of response strategies that may be available; and, (4) factors that may enable or hinder the development and implementation of such strategies. Future studies addressing these issues would be highly beneficial.

References


Allison H. (2010). The Economics of Adapting Fisheries to Climate Change. OECD.


Governance of adaptation or adaptation of governance? Towards resilience in small scale fisheries

Ahmed Khan (Saint Mary's University)*
Anthony Charles (Saint Mary’s University)
Derek Armitage (University of Waterloo)

Improvements to governance processes and adaptation mechanisms are increasingly viewed as crucial ingredients to address rapid environmental and economic change. They are often used in relation to specific ecosystems (e.g., climate change adaptation in coastal zones) and specific sectoral approaches (such as for fisheries or water governance). Adaptation is useful in dealing with uncertainty and shocks, and incorporating change to build societal wellbeing and resilience. Governance is equally essential in handling institutional innovation, science-policy interface, cross-scale linkages, partnerships, and financial mechanisms. Indeed, there is an overarching need for greater recognition of the interactions between governance and adaptation. Climate change impacts through warming oceans and sea level rise, for instance, will not only affect the distribution and composition of fish catches, it will also have ramifications on the spatial scale of governance, and new decision making frameworks on seasonality and access, and coastal planning. We argue that adaptation thinking can and must be applied to governance in a holistic manner, as much as governance can and must be applied to adaptation. In this presentation, we focus on small scale fishing communities that are highly vulnerable and often marginalised in decision-making. We use case studies from the Partnership for Canada-Caribbean Community Climate Change Adaptation and others around the world to understand how the complementarity of governance and adaptation in small-scale fisheries is relevant to building community resilience. Emphasis is placed on local participation and shared learning, integrated management, multi-sectoral coordination, marine spatial planning, and governing networks.

Impacts of climate variability on Latin American small-scale fisheries

Omar Defeo, UNDECIMAR, Facultad de Ciencias, Iguá 4225, 11400 Montevideo, Uruguay; DINARA, Constituyente 1497, 11200 Montevideo, Uruguay
Mauricio Castrejón, Interdisciplinary PhD program, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4R2
Leonardo Ortega, DINARA, Constituyente 1497, 11200 Montevideo, Uruguay
Angela M. Kuhn, Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4R2
Nicolás L. Gutiérrez, Marine Stewardship Council, 1 Snow Hill, London EC1A 2DH, United Kingdom
Small-scale fisheries (SSFs) are social-ecological systems that play a critical role in terms of food security and poverty alleviation in Latin America. These fisheries are increasingly threatened by anthropogenic and climatic drivers acting at multiple scales. We review the effects of climate variability on Latin American SSFs, and discuss the combined effects of two additional human drivers: globalization of markets and governance. We show drastic long-term and large-scale effects of climate variability (e.g., sea surface temperature anomalies, wind intensity, sea level and climatic indices) on SSFs. These variables, acting in concert with economic drivers, have exacerbated stock depletion rates in Latin American SSFs. The impact of these drivers varied according to the life cycle and latitudinal distribution of the target species, the characteristics of the oceanographic systems, and the inherent features of the social systems. Our review highlights the urgent need to improve management and governance systems to promote resilience as a way to cope with the increasing uncertainty about the impacts of climate and globalization of markets on Latin American SSFs.

Scenarios for coastal fisheries under climate change: impacts, resilience and adaptation potential

William Cheung, Lauren Weatherdon, Yoshitaka Ota
Fisheries Centre, The University of British Columbia

Marine ecosystems and fisheries are being affected by changes in ocean properties, particularly warming, acidification and deoxygenation, resulting from climate change. Previous studies largely focus on assessing the impacts to commercial fisheries. However, few efforts have been made to assess the impacts of climate change to small-scale fisheries. This presentation firstly summarizes the key projected impacts of climate change on fish stocks and fisheries by 2050. These impacts include projected decrease in catches in the tropics, changes in composition of fish stocks, and degradation of vulnerable habitats that are important to fisheries such as coral reefs. The implications of these impacts for coastal small-scale fisheries are then highlighted through a case study that applies quantitative scenario projections to assess the effects of climate change on the commercially and culturally important fisheries to First Nations in coastal British Columbia, Canada. The case study provides insight into the use of joint-management frameworks incorporating traditional ecological knowledge to aid in offsetting climate change impacts and developing site-specific mitigation and adaptation strategies. It also highlights the importance of the use of interdisciplinary framework to facilitate proactive discussions of potential mitigation and adaptation strategies deriving from local fishers’ knowledge that could be used to respond to a range of climate change scenarios.
Sense of place and adaptive capacity: How are fishing communities in Nova Scotia dealing with the impacts of climate change?

Shandel Brown, Department of Environment and Resource Studies, University of Waterloo (s38brown@uwaterloo.ca)

Fishing communities in Nova Scotia are currently experiencing high levels of socio-economic, ecological, and political change—all of which impact the ability of a community to adapt to the effects of climate change. The research uses a Community-Based Vulnerability Assessment (CBVA) to understand perceptions of climate change vulnerability and adaptation in fifteen fishing harbours on the South Shore of Nova Scotia. Thirty-nine semi-structured interviews were conducted to assess: 1) perceptions of current and future vulnerabilities and adaptive strategies; 2) how sense of place might facilitate and/or inhibit adaptive capacity; and 3) insights for governance and adaptation planning. The assessment highlights the importance of sense of place to how individuals and communities cope with challenges to fishery-based livelihoods. Sense of place theory provides a lens to understand some of the social attributes of adaptation specific to coastal communities such as identity derived from family heritage, values-based challenges for group decision-making, and the importance of wharves for community cohesion.

What can indicators tell us about how vulnerable the fisheries sector is to climate change in Small Island Developing States?

Iris Monnereau (CERMES, University of the West Indies)*
Robin Mahon (CERMES, University of the West Indies)
Patrick McConney (CERMES, University of the West Indies)
Leonard Nurse (CERMES, University of the West Indies)

Climate change vulnerability assessments in fisheries have been gaining increased prominence in both policy as well as the academic literature over the past decade. The impacts of climate change are believed to be highest in Least Developed Countries (LDCs) and Small Island Developing States (SIDS). SIDS are often, however, considered to be ‘data-deficient’ and thus seldom included in global vulnerability analyses of fisheries, even though highly dependent on the fisheries sector. This underrepresentation masks the vulnerability of the small scale fisheries sector in SIDS. To address this we have developed a national-level fisheries sector vulnerability framework incorporating over 100 indicators across the components of exposure, sensitivity, adaptive capacity that includes data on the majority of SIDS. We have used principal component analysis to assess the value and strength of these different components and the different vulnerability characteristics of the fisheries sectors of Caribbean, Pacific and other SIDS, and LDCs. This assessment may help to inform policy for small-scale fisheries in the face of climate change. Coherent and equitable global policy requires us to assess and evaluate the
vulnerability of the fisheries sectors of all nations regardless of size and development status.

Regular Session 2.5: Holistic perspective

Historical changes and shifting baselines in an artisanal fishery in the metropolitan region of Rio de Janeiro, Brazil

Rafael de Almeida Tubino (Laboratório ECOPESCA - Universidade Federal Fluminense, Instituto de Biologia, Departamento de Biologia Marinha; Outeiro de São João Batista s/n., Valonguinho, Caixa Postal 100644, Niterói, RJ, 24001-970)
Aguinaldo Nepomuceno Marques Junior (Universidade Federal Fluminense, Instituto de Biologia, Departamento de Biologia Marinha; Outeiro de São João Batista s/n., Valonguinho, Caixa Postal 100644, Niterói, RJ, 24001-970)
Edson Pereira Silva (Universidade Federal Fluminense, Instituto de Biologia, Departamento de Biologia Marinha; Outeiro de São João Batista s/n., Valonguinho, Caixa Postal 100644, Niterói, RJ, 24001-970)
Ronaldo Joaquim da Silveira Lobão (Universidade Federal Fluminense, Instituto de Estudos Comparados em Administração Institucional de Conflitos, Departamento de Direito Público; Gragoatá, Niterói, RJ, 24210-350)
Cassiano Monteiro-Neto (Laboratório ECOPESCA - Universidade Federal Fluminense, Instituto de Biologia, Departamento de Biologia Marinha; Outeiro de São João Batista s/n., Valonguinho, Caixa Postal 100644, Niterói, RJ, 24001-970)

Artisanal fisheries play an important regional role by supplying local markets, even in large cities such as Rio de Janeiro. Nevertheless, strong pressure in large urban centers promote major structural changes in these fisheries systems over time. Knowledge of traditional fishing practices is necessary for the establishment of baselines and for comparisons with current standards. In order to test the shifting baseline hypothesis in the fishing community in Itaipu, Niterói (RJ), four investigative approaches were adopted: a) analysis of recent changes in fisheries production based on literature data and monitored landings (2001 to 2003); b) assessment of fisheries changes and shifting baselines based on interviews carried out with fishers from different generations; c) comparative analysis of historical time series data on mullet landings in southern and southeastern Brazil and its production in Itaipu and in Guanabara Bay; and, d) analyses of environmental data on water quality issued by monitoring programs in Guanabara Bay, of variations in local physical and chemical parameters and of the simulation of the current sewage system discharge. The main observable features were the extinction of the most traditional fishery (mullet) and changes in the catch composition. The evaluation of the hypotheses related to the decline of mullet catches showed that its main cause is the increased use of gill nets in the fisheries, rather than industrial overfishing and organic pollution. The
overall physical changes caused by urban development since the 70’s have represented the baseline in which changes in the fisheries have occurred along the years.

**Towards an Ecosystem-based management of the Seabob shrimp (Xiphopenaeus kroyeri Heller 1862) fishery from the littoral of Campeche, Southern Gulf of Mexico**

Domingo C, Flores-Hernández (Universidad Autónoma de Campeche-EPOMEX)
Patricia Cariilo-Alejandro (Instituto Nacional de Pesca, INAPESCA)
Julia Ramos-Miranda (Universidad Autónoma de Campeche-EPOMEX) Atahualpa Sosa-López (Universidad Autónoma de Campeche-EPOMEX)
Laura Vidal-Hernández (Universidad Nacional Autónoma de México, UMDI Sisal)
Gabriel Núñez-Márquez (Instituto Nacional de Pesca, INAPESCA)
Isaac Rojas-González (Instituto Nacional de Pesca, INAPESCA)
Armando WAKIDA-KUSONOKI (Instituto Nacional de Pesca, INAPESCA)
Francisco Arreguín-Sánchez (IPN-CICIMAR, La Paz)
Carmen Pedroza (Unidad Académica de Estudios Regionales de la Coordinación de Humanidades de la UNAM)
Pablo Navarro-Pérez (Universidad Nacional Autónoma de México, UMDI Sisal)
Edson F. Flores-Ramos (Universidad Autónoma de Campeche)

Since its establishment as a legal fishery in 1997, the seabob shrimp (Xiphopenaeus kroyeri Heller 1862) artisanal fishery became important in southern Campeche State, generating social and economic benefits to fishermen. Nevertheless, recently landings have shown a decreasing tendency. Capture per unit effort, incomes and fishers life quality had also diminished. Furthermore, the Mexican General Law of Sustainable Fishing and Aquaculture established the Fisheries Management Plan (FMP) as a multidisciplinary tool that will help to achieve sustainability of fisheries. This is based on the ecosystem management approach. The aim of this work is to analyze the information available and with the participation of stakeholders (Government, fishers, traders and researchers) develop a FMP for the seabob shrimp fishery. The main results show that the fishery effort was at the maximum sustainable yield (MSY) level; this species inhabits partially the Protected Natural Area Laguna de Términos (PNALT) where it grows until its reproductive stage is reached. Despite that shrimp fishing is prohibited in the PNALT, its illegal captures there remain as one of the main management problems. Even though, seabob fishing could affect associated fish assemblages (more than 90 fish species), its impacts do not represent high threat for diversity. During four workshops using the Logical Framework method, the main components of the fishery system were determined: conservation of a healthy ecosystem, adapted management of the resource, and socio-economic welfare of the fishers. These components involved 14 action-lines with 51 specific actions.
Reinforcing the management of artisanal fisheries in Chile

Moreno A\textsuperscript{1}, L. Osman \textsuperscript{1}, F. Ghersi \textsuperscript{1}, C. Revenga\textsuperscript{2}, M. Caillaux \textsuperscript{1}
\textsuperscript{1}The Nature Conservancy, Peru and Chile. amoreno@tnc.org
\textsuperscript{2} The Nature Conservancy, Arlington, VA, US. crevenga@tnc.org

Abstract

For the past four years, the Conservancy has been working closely with fishing associations, academic institutions, and fisheries government agencies in the region of Los Rios in Southern Chile, to improve and refine the system of Territorial Use Rights in Fisheries (TURF) and improve the market access of products targeted by artisanal fishermen. Our fisheries work in Chile represents a unique opportunity to learn from the successes and challenges of implementing the Chilean TURF system for wider application to coastal fisheries around the world. Our work centers on establishing close working relationships with local fishing associations that have claimed and manage TURFs to help them improve their management, set aside No Take Zones (NTZ) to assess and recover the productivity of the benthic ecosystem, as well as to develop bio-economic models that will allow the evaluation of diverse management scenarios aimed at achieving conservation goals and increasing the economic performance of TURFs. In addition, the Conservancy and its partner, Shellcatch Inc., are implementing a traceability system—paired with sustainability criteria—aimed at increasing the value and market access of fishery products targeted by TURF owners.

Extended abstract

Chile is one of the world’s leading fishing nations, ranking 8\textsuperscript{th} in terms of landings. Much of Chile’s production is harvested by the artisanal sector, which is comprised of 86,132 small-scale fishermen. Chile is also a pioneer in fisheries reform; in the early 1990s, Chile enacted a Territorial Use Rights in Fisheries (TURF) program, which now encompasses more than 700 separate TURFs managed by local fishing associations via community-based catch-share agreements. The Chilean TURF model is seen by many as the example to follow to move small-scale coastal fisheries from the current open access regime to a rights-based management regime. While the Chilean TURF model certainly conveys rights to fishers and gives them more say over the long-term management of the resource, there is room for improvement, particularly towards increasing the sustainability of fishing practices, the environmental considerations for the design and management of the TURFs, the reduction in illegal harvests, among other things. Limited market access and the almost non-existent capacity for the production of value-added products are two additional limitations in the country for achieving sustainability in the fisheries sector. For the past four years, the Conservancy has been working closely with fishing associations in the province of Valdivia, located in the region of Los Rios in Southern Chile, as well as with fisheries government agencies, and academic institutions in Chile and the U.S. to improve and refine the TURF model so that artisanal fisheries are better managed. In an effort to show the importance of establishing NTZ to promote the
recovery of the benthic ecosystem and increase the productivity of fishing grounds the Conservancy has partnered with two local fishing associations in the towns of Chaihuín and Huiro, to set aside highly-exploited neighboring TURFs as No Take Zones (NTZ). Together with scientists from the Universidad Austral in Chile, we are monitoring the behavior and the ecological dynamics of the benthic ecosystem within the NTZ and comparing it to the dynamics we see in exploited TURFs. Early findings from the monitoring efforts do not yet show clear recovery of key commercial species within the NTZs; however, recent observations show a population increase in sea urchin within the NTZ and within neighboring areas. It is presumed that the small response to the reduction in fishing effort with the NTZ is hampered by the continued illegal fishing, which is the main threat affecting the TURFs’ performance.

In addition, and in collaboration with the University of California in Santa Barbara, we developed a fisheries bio-economic model that allows us to evaluate diverse management scenarios aimed at increasing conservation goals and economic performance of TURFs in the Region. Thus far, collaborative management between fishing associations that own TURFs show the most potential in terms of biomass production. Additionally, results clearly show that TURFs with surrounding open-access areas reduce the performance of the TURF under any management scenario.

We have identified that the economic viability of TURFs is not only related to the appropriate management of the fisheries themselves, but to the fisher’s understanding of and active participation in, the value chain. For this reason, the Conservancy in partnership with Shellcatch Inc., is working with artisanal fishers from Chaihuín and Huiro to implement a traceability system aimed at helping the fishers gain access to premium markets, optimize their value chain, and increase their income. The demand for sustainably caught seafood is consistently growing in Chile and internationally; buyers and consumers increasingly want to know where their seafood comes from and how and by whom it has been harvested. Through the implementation of a traceability system for the top selling resources, fishers can guarantee the origin of the product and provide information to the consumer with regard to their fishing practices. In addition to the market access benefits, we are using the traceability system to collect data that will allow us to track the successful implementation of sustainable principles within TURFs (i.e., benthic resources are harvested within the TURF boundaries, the harvest follow the basic regulations of minimum size and seasonal closures, etc.). Thus far, the two fishing communities are very committed to the project, with the first purchase trials providing an increase of 25% in the purchase price of key products. As we proceed with the project we believe that we are demonstrating that combining spatial design of TURFs with NTZs, combined with developing sustainability criteria and using market incentives and traceability technology we can improve both the economic and ecological performance of the TURFs in Chile.

Sustainability of exploited marine ecosystems: the case of fisheries in Sinaloa, Mexico
Hernández-Padilla and Juan Carlos, Centro Interdisciplinario de Ciencias Marines – Instituto Politécnico Nacional, Av. Instituto Politécnico Nacional S/N Col. Playa Palo de Sta. Rita, La Paz, BCS, Mexico CP:23096; email:jchpadilla@gmail.com
Salas-Márquez, Silvia, CINVESTAV-IPN, km 6 antigua carretera a Progreso. C.P. 97310
Seijo-Gutiérrez, Juan Carlos Universidad Marista de Mérida, Periférico Norte Tablaje Catastral 13941 Carretera Mérida-Progreso. C.P. 97300

Abstract
Ecosystem approach for fisheries management has been promoted in recent time before the challenge of collapsing fisheries worldwide. The aim of this study is to accomplish a bioeconomic analysis of fisheries by maximizing net income and conserving ecosystem stability, in order to explore if there is a relationship between the ecosystem and bioeconomic indicators. We use as a case study the fisheries of the continental shelf of southern Sinaloa. Simulation of different scenarios are proposed to evaluate these indicators. Ecopath models with a dynamic Ecosim interface will be the base to explore and identify ecosystem indicators focused, in this case, on self-organization capacity. The trajectory of change respect to sustainability of the current state of the ecosystem shows a trend towards the origin indicating a loss of self-organization capacity; which is interpreted as a tendency to degradation. In order to know how far of sustainability the system is, the limits of natural variation of sustainability were calculated within the historical trajectory based on variability of a stable system condition given by stability of climate variables. Sustainability loss suggests that the ecosystem is likely to be more vulnerable. In order to address this condition the measures of management and control of fishing mortality should be more efficient to maintain sustainability.

Job description
Management of exploited aquatic resources is not easy (González-Laxe 2002). This is a very complex issue especially if we consider the different interactions between the exploited resources such as trophic relationships, environmental changes and social pressures. The ecosystem is subject to different pressures such as overfishing (Fogarty and Murawski 1998; Hobson and Lenarz 1977). This aspect can accelerate the loss of marine biodiversity in the long term. Most fishery models were developed between 1950 and 1980 where the environmental conditions were relatively stable, and therefore, we assumed that fishing was the main source of variations in the abundance of exploited populations. Currently the environmental conditions are not stable thus this assumption is not valid, emerging the need for adaptable strategies for sustainable fisheries management. The ecosystem responds to these pressures in different ways according with
its capacity of self-organization (Ulanowicz et al. 2009). These processes refer to the sustainability of the resources exploited in the medium and long term.

The aim of this paper is to contribute comprehensive information and evaluate scenarios to support management of sustainable use of the resources in the ecosystem. We use as a case study the fisheries of the continental shelf of southern Sinaloa, Mexico. Simulations such as climate change are proposed to evaluate the sustainability indicator (self-organization) and adaptability of fisheries management. The baseline to compare these simulations was the trophic model representing ecosystem’s conditions in the period 2006/07 (Hernández-Padilla 2012). The projection of 100 years of the trend of climate change IPCC A1B model was used. Ecopath and Ecosim models were the base for exploration and identification of ecosystem indicators.

Preliminary results suggest that the trajectory of change with respect to the values of sustainability indicator (0.90 to 0.82) of the current state of the ecosystem (period 2006-2011), shows a certain trend to gain in entropy, indicating a loss of self-organization capacity. However, this does not necessarily mean ecosystem degradation. Conversely, considering the effect of environmental variability particularly the effect of climate change, the values of sustainability indicator (0.90 to 0.58) also trend toward the gain in entropy, representing the origin of the self-organization curve in Figure 1. The loss ecosystem’s organization suggests a vulnerable ecosystem to external perturbations. This could be interpreted as evidence of the effect of climate change on the ecosystem sustainability. In order to address this condition, the measures of management and control of fishing mortality should be more efficient to maintain sustainability.

With the series of sustainability indicator or potential self-organization (to 2100), ecosystem evolution is shown under the scope of this indicator. The trend suggest a decrease on ecosystem’s self-organization capacity and a greater variability between period 2006-2038 as a result of climate change considered in the simulation experiment (IPCC’s model). Following on from these series, we identify four alternative ecosystem states (2006-2018, 2019-28, 2029-2037 and 2038-2100; Figure 2) given by similar values of sustainability indicator which can adopt different management strategies.

Finally, the concept of adaptability as a management strategy is a key concept linked to the ecosystem’s sustainability. We should be able to adjust catch rates of exploited resources to the different alternative states of ecosystem for sustainability of exploited marine resources.

List of figures

Figure 1. Trajectory of change sustainability indicator as the effect of climate change.

Figure 2. Sustainability indicator or potential self-organization series 2006-2100 as change.
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References


Integrating environmental justice, human security, resilience and vulnerability scholarships: a pathway to enhance small-scale fishing communities preparedness to environmental changes

Beatrice Frank (Oklahoma State University, USA)

Marine and costal socio-ecological systems are vulnerable to global changes, especially the one repeatedly subjected to extreme weather and climate events. Hurricane and tsunami, among other environmental disasters, expose coastal areas and small-scale fishing communities’ sensitivity to changes. To enable fishing communities to survive by coping with such changes, there is a need to enhance fisheries ability to be prepared and respond to environmental stressors and impacts. Environmental justice, human security, resilience and vulnerability scholarships can provide to small-scale fisheries the tools necessary to better understand their vulnerabilities to hazard and risks and to plan anticipatory actions that strengthen their capacity to withstand changes. In this presentation, I emphasize critical points of divergence and synergy between these literatures to pinpoint how different fields have approached and addressed the exposure of individuals and communities, especially small-scale fisheries, to environmental risks and hazards. Together these literatures highlight ways that leaders, managers and decision-makers can plan for the impacts of environmental changes by learning from past experiences, taking action in the present and plan preventive measure for the future. Through the integration of environmental justice, human security, resilience and vulnerability literature in small-scale fisheries discourses, it will be possible to better understand how to increase small-scale fisheries preparedness to disaster and to suggest actions that strengthen the ability of individuals, groups and communities to anticipate, mitigate and/or adapt to global environmental changes.

The existing institutional and legal framework in Latin American and Caribbean countries and its implications for small-scale fisheries development

Sérgio M. G. Mattos, Fishery Engineer, D.Sc., Ministry of Planning, Budget and Management – Brazil sergio_mattos@terra.com.br
Michelly de Mattos, Lawyer – Brazil michellydemattos07@gmail.com

Abstract

A weak and ineffective public policy for small-scale fisheries seems to be related to the existing institutional and legal frameworks. Such complex system probably affects the existing social, technological and ecological sustainability found at small-scale fishing communities in developing countries, such as those found at Latin American and Caribbean (LAC) Region, with economic implications. The existing institutional and legal frameworks seems to obstruct the enforcement of management measures, and the objective of the present study is a proposal for the establishment of criteria and indicator of analysis
to assess those found in Brazil – as a case study – for small-scale fisheries development, considering the implications of implementing: (i) International legal instruments and initiatives linked to fisheries; and (ii) A fishery management system, their instruments and regulations. Issues related to international legal instruments will be analysed considering: responsible and sustainable small-scale fisheries; food security and poverty eradication; rights for a decent work; and territorial rights and conservation units. Issues that must be assessed and analysed related to the existing management system and their instruments and regulations are: fishermen behaviour; the market system; the fishing resources and the environment; and fisheries governance and governability. Assessment of the existing fishing regulations and institutional and legal framework for small-scale fisheries in these countries shall be a way to move forward on how future fishing rules and management measures at local, national and regional areas can be developed, controlled, monitored and supervised, aiming at implementing public policies for responsible and sustainable small-scale fisheries.

Introduction

A weak and ineffective public policy for small-scale fisheries seems to be related to the existing institutional and legal frameworks, both from a social standpoint and from the economic and productive point of view, because the status of the small-scale fishing activity was never properly recognised, being considered since long as additional to the fishing industry sector. Hence, it seems that such institutional and legal framework complexity and entanglement affect the existing social, technological and ecological sustainability found at small-scale fishing communities in developing countries, such as those found in Latin American and Caribbean, with economic implications.

Such situations do not contribute to enforce the existing management measures, as well the implications of these measures, if it is implemented in some way. The assessment of such issues may help for the understanding of the small-scale fisheries management system in these countries and shall be a way to move forward on how future fishing rules and management measures at local, national and regional level can be constructed, controlled, monitored and supervised, aiming at implementing public policies for a responsible and sustainable fishery.

Also taking into consideration a belief that there is a weak established fishing policy, the objective of the present analysis is to propose criteria and indicators on how to assess and evaluate the existing institutional and legal framework found in Brazil, as a case study, considering issues related to: (i) International legal instruments and initiatives linked to fisheries, considering: responsible and sustainable small-scale fisheries; food security and poverty eradication; rights for a decent work; and territorial rights and conservation units.; and (ii) A fishery management system, their instruments and regulations, considering: fishermen behaviour; the market system; the fishing resources and the environment; and fisheries governance and governability.
Elements and definitions for the analysis

I) Issues related with International legal instruments and initiatives linked to fisheries

Issues related to international legal instruments with direct implications to small-scale fisheries in such region shall be analysed regarding issues considered in the United Nations Convention on the Law of the Sea (UNCLOS) and those under the Food and Agriculture Organization of the United Nations (FAO) for a responsible and sustainable small-scale fisheries and food security and poverty eradication; those under the International Labour Organization – ILO in support of rights for a decent work; and instruments meant for territorial rights and conservation units.

I.1) Responsible and sustainable fisheries.

The United Nations Convention on the Law of the Sea (LoS Convention) establishes a comprehensive legal regime covering all aspects of the seas and oceans. These include limits on various areas, navigation, a framework for conservation and utilization of the living marine resources, a regime for the deep seabed beyond national jurisdiction, rules for protection and preservation of the marine environment from pollution and rules on scientific research. In a fisheries context, the most relevant areas are the territorial sea and the continental shelf, the exclusive economic zone (EEZ) and the high seas (Lobach, 2014).

The FAO Code of Conduct for Responsible Fisheries – The Code – provides a framework for national and international efforts to ensure sustainable exploration of aquatic living resources in harmony with the environment. The Code contains principles and standards applicable to the conservation, management and development of all fisheries. It covers capture, processing and trade of fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries into coastal management. The overall objective is to promote a framework for sustainable development, foster protection of the aquatic environment and the maintenance of biodiversity while making a contribution to the safety of fishing operations (FAO, 1995; Lobach, 2014).

I.2) Food security and poverty eradication

The FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (FAO, 2014), have been developed as a complement to The Code and provide complementary guidance with respect to small-scale fisheries in support of the overall principles and provisions of The Code. The Guidelines address both inland and marine small-scale fisheries and are intended to support the visibility, recognition and enhancement of the already important role of small-scale fisheries and to contribute to global and national efforts towards the eradication of hunger and poverty. The Guidelines support responsible fisheries and sustainable social and economic development for the benefit of current and future generations, with an
emphasis on small-scale fishers and fish workers and related activities and including vulnerable and marginalized people promoting a human rights-based approach.

I.3) Rights for a decent work

Protection and right of workers for a decent work in the region may give a view on how the fishing groups are formed, how they develop their activities, and how they can work together in the nearby areas and with neighbours fishing communities. According to International Labour Organization – ILO Declaration on Fundamental Principles and Rights at Work, the concept of decent work is “to promote opportunities for women and men to obtain decent and productive work in conditions of freedom, security and human rights”. Thus, decent work is broadly based on four components and strategic objectives: employment generation, social security, rights at the workplace and social dialogue.

I.4) Territorial Rights and Conservation Units

Extractive reserves, marine protected areas (MPA) and non take fishing zones, known in Brazilian legislation as “conservation units”, shall be considered for the understanding of the importance to strengthen the dialog between fishers rights and environmental issues.

Territorial rights, such as extractive reserves, is a partnership model that attempts to reconcile the protection and conservation of natural resources alongside their sustainable economic use for the benefit and empowerment of local communities. These reserves were frequently cited as institutions that protect territorial rights, and in this context, there is a need to provide better access to information on existing rights that protect coastal communities. Access rights to resources and collective territories greatly depend on knowledge and on being able to use the relevant legal instruments (Ruffino, 2012).

II) Issues related with a fishery management system, their instruments and regulations, for small-scale fisheries in Brazil.

Issues that must be assessed and analysed related to the existing management system and their instruments and regulations for small-scale fisheries are: fishermen behaviour; the market system; the fishing resources and the environment; and fisheries governance and governability.

New trends in fisheries sciences focused on integrating various intrinsic relationships within and between the different components of the fisheries, i.e. the resources and the fishers, whose relationships should be biological, economic or social (Ulrich et al., 2002).

The Brazilian small-scale fishery model is based on multi-gear, multi-fleet and multi-species fisheries that enlarge challenges do discuss and implement tools to analyse the consequences and risks of different management measures applied to particular stocks (Mattos, 2004).
II.1) Fishermen Behaviour

Relationship between fishers, others workers of the fishing activity and stakeholders, the organisational system and cultural aspects are issues that govern the fishing activity in each country, with influences for fisheries governance, considering the existence of a multi-stakeholders structure and others possible mechanisms.

Fishermen decision and / or behaviour can be simulated according to four procedures (Mattos, 2004): production depends on the effort and the catchability applied; the revenues at the end of one period are used to cover the different costs of the fishing activity for the next period; fishing effort limited by the administration; and the fisherman intends to go fishing for the maximum number of days that the law and revenues allow, enforced only by effective institutional controls (provided by the administration or by the fishers’ organisations).

II.2) The Market System

The economics of the fisheries, with interferes and influences the market, the characteristics of the fisheries and the value chain, must be emphasised. According to Anderson (1977), fishery economics can be defined as the study of the optimal allocation of a fishing stock to a fishery, because proper use of a fish stock requires that resources be utilised to exploit it such that the present value of future net returns is maximised. Such maximisation is not an end in itself; rather, its achievement means that society’s resources have been properly allocated.

Nevertheless, a target stock is generally chosen by the value it has in a specific market, to best satisfy fishermen wants and the desire of society. As well, to optimally allocate a fishing stock to a fishery, and so for a specific market, it’s important to know the characteristics of the fisheries: how fishing, including the natural resources (ex. estuaries and coastal areas), is legally treated.

II.3) The Fishing Resources and the environment

In natural ecosystems there is a non-linear relationship between resource exploitation and population growth with respect to many other natural resources, notably fisheries (Myers, 1995).

That is why biological and bioeconomic fishing models were developed aiming at studying the dynamics of an exploited fish population and the structure of the fishery where they have to be developed. It is possible to take into account some useful ideas of these models and adapt them to a specific region and fishery where a bioeconomic analysis is to be applied, because the cost is proportional to effort and well satisfy the needed understanding of the bioeconomic tools for fisheries management (Mattos, 2004).

II.4) Fisheries governance and governability
Political issues that have influences and may have implications for the implementation of public policies, taking into account: plans and policies for fisheries management and regulation; conflicts for the sustainable use of fisheries resources and a particular stock; and institutional arrangement and competencies.

Knowledge and recognition of the institutional arrangements and the existing legal framework, aiming at the identification and fulfillment of institutional responsibilities must be a key issue, together with the identification of the necessary adjustments to improve the system of governance and the empowerment and participation of stakeholders directly and indirectly involved with small-scale fisheries.

**Proposed analysis to establish criteria and indicators**

Legitimacy and representativeness of the Brazilian context at a national level lead for an agreement that small-scale fisheries represents a productive economic activity with positive results in relation to costs and revenues; produces positive outcomes with regard to employment and income generation, with relatively minor environmental impacts; and there is a close relationship between biodiversity and ecosystem conservation and the health and livelihoods of small-scale fishing communities (Ruffino, 2012).

Taking into account all the above mentioned and an everlasting existence small-scale fisheries undevelopment and food insecurity and poverty along with fishing communities, the effort to establish criteria and indicators for the analysis of the institutional and legal framework aiming at assessing their implications to small-scale fisheries development shall consider issues such as:

- Evaluation and description of the institutional and legal framework;
- Strengthen mechanisms for stakeholder participation in management through the operationalization of existing mechanisms and / or development of alternative mechanisms;
- Knowledge, recognition and description of conflicts between fisheries and other economic sectors in order to identify necessary adjustments in institutional arrangements to improve the ability to manage conflict;
- Develop and / or enhance communication strategy between government and the fisheries sectors; and
- Identify opportunities and demands for adequate funding / institutional apparatus to carry out the functions of planning and control.

It is important to recognise, finally, the development of an ecosystem approach to fisheries – EAF management plan, for the identification of fishery(ies) and geographic area(s) to be addressed for the proposed analysis.

**Final considerations**
Aiming at managing small-scale fishing activities, sounds reasonable for many countries to establish legal instruments that could avoid uncertainties, whilst make very difficult to enforce any management measures, and that could allow that such public policies can be implemented at a consistent basis with local, national and regional realities.

Factors beyond human control, such as varying climate can exert dramatic influence on fish population dynamics, obscuring the effects of fishing pressure, because the links between fishing pressure, environmental changes and fish behaviour are not sufficiently understood.

In some extend, identification of externalities is crucial, if there is a decision to move forward, considering that it could be positive, elements that can contribute to the interaction and to overcome uncertainties and bottlenecks within the three dimensions of sustainability (social, economic and environmental); and negative, elements that may contribute to enlarge the challenges and difficulties in facing uncertainties and implementing public policies.

References


Speed Session 2.6
Fishermen to providers of services: option to improve their economic income into ten towns on the Costa of Guerrero, Mexico

Salvador Villerías Salinas. svilleriass@gmail.com
Pedro Vidal Tello Almaguer. pvidalt@hotmail.com
Centro de Investigación y Posgrado en Estudios Socioterritoriales Universidad Autónoma de Guerrero, México.

Abstract
The state of Guerrero has 500 km of coastline and 42 locations dedicated to coastal fisheries, their main activity. Fishermen have activities in other economic sectors, to improve their income as selling food and recreational boat rides. In the present investigation, into ten fishing activity communities and its link to tourism the services was analyzed to assess their impact and the economic level of families and local development. The fishery products are offered in rustic local, where visitors get to eat seafood, businesses is administrated by the family. Tourists are the center of the country and the interior of state of Guerrero; they travel mainly on Easter holidays, summer, December and other. The revenue generated by the fishing activity and the services are insufficient to meet the basic needs of families of fishermen due to the precarious infrastructure for fishing and the goods with providing the service. Fishing activities and services give "high" income over short periods of time. Fishing is not a profitable business, the number of fishermen has increased, while species do not reproduce at the pace of catches and demand is high. Migration of young people, mainly men, cities, coastal resorts outside the state and country is generated.

Introduction
Results of the study on the coast of Guerrero, Mexico, on fishing communities in ten are shown; its link to tourism and impact on the socioeconomic status of families. In Guerrero, fisheries operate in 56 towns by 6500 people. The studies associated with this activity are scarce but coincident.
As in Cambodia, in Guerrero, fishing generates economic resources and allows the family support. Fishing is important for the income it provides and helps create direct and indirect jobs in the fishing places (Hap et al. 2006; Villerías and Sánchez (2010).
The declining trend in the fishery resource and low prices of capture; has caused youth fishing villages in Guerrero; migrate in search of better job opportunities (Villerías et al. 2012). A similar situation is presented in two places in Mexico; Arriaga, Chiapas and La Barra, San Pedro in Tabasco, the residents of these localities combine fishing and migration. The intention is that fishing will endure; according to the migration needs (Muñoz and Cruz 2013).
On the coast of Guerrero, Acapulco and Zihuatanejo are important cities for their economic activities linked to the national and international tourism. In addition, there are fishing villages that visitors receive state and country; giving the fishery resource value added, and becomes livelihood; to generate income to allow the food security of the families of fishermen.
Methodology
Primary and secondary sources of information were used. As semi-structured questionnaires applied to fishing families. A review of studies on socioeconomic aspects of fisheries in Mexico and the coast of Guerrero was performed. This made it possible to establish the relation between fishing and tourism services offered to visitors in the fishing villages, it also enabled the selection of places to study. Capture fisheries was analyzed in ten locations, using information provided by the Cooperative Societies of Fishery Production (SCPP); species and its market further sale to include tourism.
Selected households, related to fisheries and sale of tourist services were surveyed. A semi-structured questionnaire was applied; this allowed to know the different activities developed to survive.
Fieldwork was conducted in ten locations (Fig. 1). Selected as being representative for the field study, to be related to visitor services. To determine the sample of households participatory evaluation in each of the communities was performed. This provided information on fishing activities and services; and the problems they have to solve order to survive.

![Guerrero Coast: Location of the study area](image)

Figure 1. Guerrero Coast: Location of the study area

Resulted
The economic activities
In 2010, among the ten localities studied, there was a total population of 4504 inhabitants (Fig.2.) and an economically active population (EAP) of 1712 people (INEGI, 2011). Of the total workforce, 33% participated in fishing activities. The distribution of the EAP by sector was 52% in primary activated; 6% were secondary sector; and 42% was related to tertiary activities. Between the years 2000 and 2010, it was noted that the primary activity descended 10% in 2010, and tertiary was increased by 5% compared to 2000. Primary activities have lost their importance in these communities. Mainly agriculture crops like corn, beans, sesame, among others. The services in the communities studied increases, the demand for tourism; visitors on weekends or holiday season.

Figure 2. Total and economically active population, 2010

The places with the highest percentage of population related to tertiary activities are Barra de Coyuca with 40%, located 20 km west of Acapulco; and Barra de Potosi with 15% and is located only 20 km south-east of Zihuatanejo. The remaining eight villages are farther away from the tourist centers (Acapulco and Zihuatanejo), except La Saladita and Mahajua located approximately 30 km from Zihuatanejo.

Characteristics of fisheries
Fishing practiced in these places is, strictly multiple-species artisanal or small scale, and low volumes of catch reported by species. The fishermen are organized into cooperative societies and permittees; fishing in public areas, at sea and in coastal lagoons. In the ten towns there are 566 inhabitants engaged in fishing. The fishing gears are suitable for inland capture on the coast: The longline for red snapper and snapper; falsework for the shark; trammels different mesh sizes and diving “lung” in rocky sites oyster is extracted,
among others. The boats used are fiberglass and with an average of 6 m in length with a capacity of 1.5 tm and outboard 50 hp. Canoes in inland waters are used, also called pangas.

**Income from fishing**
The catch in ten villages in 2013 was 160.7 tonnes, with a value of 522.801 dollars. These figures include 42 species, the five leading are: "red snapper" (*Lutjanus peru*), "pacific crevalle jack" (*Caranx caninus*), "snook" (*Centropomus* sp), mackerel (*Scomberomorus* sp) and mullet (*Mugil* sp); the objective is the red snapper species and fishing throughout the year and the price that is paid to fishermen is low at the rate of two dollars per kilogram. The locality of Mount Pico is the most important because of the volume of the registered catch was 51.6 tm. However, Tecoanapa bar, with 23.8 tm reaches a value of 309 thousand U.S. dollars (Fig. 3) and represented 59% of income from fishing.

The most important market is Acapulco and Zihuatanejo. Marketing is carried through intermediaries that operate in all localities, they regulate prices and fishermen cannot shirk this marketing system. The income derived from fishing in ten communities studied is an important sources of income for 90% its population who works in the fishing. If the value of the catch was divided evenly among 566 fishermen to each it would behoove the amount of 924 US dollars; in the best case, each fisherman Barra de Tecoanapa and Majahua would perceive annually 4,176 and 2.049 U.S. dollars; respectively. These amounts reflect the social condition of poverty and marginalization experienced by fishermen in this area of Mexico; because their income is insufficient to have a decent standard of living.
The life strategy and prospects
Some fishermen along with their families and for other income to support his family ramadas were constructed for the purpose of sell the products of fishing and recreational travel offer. On the study area a total of 191 establishments were located. The Costa Chica region has 101 local and account for 53%; in Costa Grande ramadas are 90 and comprise 47%; of the total.
Fishing is their way of life. Income generated from fishing is not enough to support his family. They have learned to take advantage of the landscape of the coast of Guerrero and the opportunity to sell fish products; important source of income on a temporary basis on holiday and weekends, with a variable number of tourists. Visitors who come to these places to buy local food prepared by the families of the fishermen: the Fish "a talla", fresh oysters, fish fillets, ceviche, shrimps, etc. Prices are accessible for those with higher incomes to six minimum wages by day (USD 4.7 salary).
The fisherman and his family are selling seafood products armadas. It allows to obtain money to mitigate needs for clothing, education, food and service payment; among others. However, it was observed in these towns that emigration is present; young people those moving in or out of the country in search of better job opportunities.
It is necessary to strengthen the fishing villages, improving the delivery of services to visitors and thereby entrench the population. Should be considered a local development strategy; enabling a participatory planning and local actors make their decisions, for better planning of its territory: The purpose is to avoid that sell their land to real estate companies, to build tourist developments in national and international impact.

**Conclusions**
In the study areas, fishing is artisanal or small scale. The fishing gears are suitable for catching species. The objective is the red snapper species for their commercial value. Revenue from the fishing locations are limited and depend on the fishing season and the prices are set by intermediaries, as well as tourism. Being fishermen and service providers, allows greater income fishery products; to solve needs and in some cases to send their children to college. It is recognized that the family and especially women, play an important role in fishing related activities and services. The condition of poverty and marginalization in these localities little organization and limiting government support to boost its activity; day to day tries to overcome the conditions in which they live and continue with fishing activities in the uncertainty of capture and prices; fishing is an important livelihood; not only for the ten localities studied.

**References**


**Socioeconomic Aspects of Organized Coastal Fishermen at Magdalena- Almejas Bay, BCS Mexico**
Despite the important role of small scale fisheries in world economy and rural development in coastal areas, this are still poorly understood. In Baja California Sur (BCS) where fishing is important for their economic, environmental and social impacts, outstands Magdalena-Almejas Bay (MAB) region, widely recognized and valued for its extensive mangrove communities and the impact of charismatic species, and coastal geographical conditions which generate high biological productivity that allows the development of 16 small-scale fisheries and other industrial fisheries contributing over 56% of BCS capture. While MAB vocation focuses on fishing, the confluence of conservation interests and development of other economic activities demand fundamental solutions that consider the opinion and review the status of the communities living there. Among other issues to address, there is insufficient information to support the social component management measures within the ecosystem. Therefore a study supported by official statistics published by government agencies, enriched with local knowledge from surveys and fisheries operation is performed. The results allow to characterize user groups, meet their income, identify alternative livelihoods, valuing provision services given by the ecosystems, and relationships of marketing fisheries products in the first link of the chain, in order to provide useful information for the construction of public policies that promote sustainable development according to the existing legal framework in Mexico.

Institutional analysis in monitoring the artisanal fishery and Marine Protected Areas in Pernambuco, Brazil – preliminary results

Beatriz Mesquita Ferreira (Universidade Federal Rural de Pernambuco/ Fundação Joaquim Nabuco/ ICSF)
Rosângela Paula Teixeira Lessa (Universidade Federal Rural de Pernambuco)

The coastal region in northeast Brazil is characterized by the strong presence of artisanal fisheries (72.4% of artisanal fishers in Brazil are distributed in the North and northeast regions), because of economic as well as cultural and environmental features. Marine Protected Areas (MPAs) have been implemented worldwide in the last decade with the aim of conserving biodiversity, preserving a strong relationship with artisanal fisheries actors. An institutional analysis was done in order to compare two contiguous MPAs, which are managed differently in southern Pernambuco state-Brazil. While one is managed by the federal government and has specific management tools as a no take zone; the other is managed by state government and lacks differentiated management than unprotected areas. A total of 40 semi-structured interviews were conducted with fishers of the localities seeking information about their knowledge in relation to protected areas,
possible changes over time in relation to fishing activity and quality of life: management, resources used, productivity and mobility of resources, resource users, social capital, collective-choice rules, and leadership, among others. The results indicate that in the area with effective management the knowledge about fish stocks management is better, despite the historical conflicts in MPA implementation. In this same area we also observed a greater range of income-generating opportunities not only related to fishing, but also to tourism.

Fishing characterization of two communities inside a biosphere reserve in the Upper Gulf of California, Mexico

Ismael Mascarenas-Osorio, Centro para la Biodiversidad Marina y la Conservación A.C. La Paz, B.C.S. 23090. México
Catalina López-Sagástegui, UC MEXUS, University of California Riverside, CA 92521
Brad Erisman, Marine Biology Research Division, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, CA. 92093-0202 USA
Marcia Moreno-Báez, Marine Biology Research Division, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, CA. 92093-0202 USA
Victoria Jimenez-Esquivel, Centro para la Biodiversidad Marina y la Conservación A.C. La Paz, B.C.S. 23090. México
Octavio Aburto-Oropeza, Marine Biology Research Division, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, CA. 92093-0202 USA.

Abstract

Communities in the Upper Gulf of California depend on fishing for their livelihoods, and the region’s marine resources are valuable in national and international seafood markets. Through a collaborative research we aim to contribute to fisheries management in the Upper Gulf of California Biosphere Reserve by characterizing fishing activities for Santa Clara, Sonora, and San Felipe, Baja California in México. We describe and compare their most important small-scale fisheries with respect to species composition, effort, revenues, seasonal patterns in fishing activities in relation to the reproductive seasons, and spatial patterns of fishing within the Biosphere Reserve. In both communities, only four species (blue shrimp, Gulf corvina, bigeye croaker, and Spanish mackerel) ranked highest with respect to landings and revenues, but their relative importance to overall fisheries production varied by community. Peaks monthly landings and revenues match with the beginning of species’ spawning periods. Santa Clara has a sequential fishery season pattern, while San Felipe’s seasons overlap and landings of target species occurred throughout year. Differences on area use by fishing were also identified. Santa Clara uses a wider area compared to San Felipe. Our findings help to understand specific fishing dynamics for each community, prompting us to wonder whether these differences should be integrated into regional fisheries management in order to meet economic needs and reach management and conservation goals.
Introduction

Commercial fisheries are essential to the livelihood, welfare, and food security of coastal communities (FAO, 2012). However, small-scale fisheries can be more difficult to manage, because they often lack sufficient or reliable data necessary to assess stocks and set regulations accordingly (Salas et al., 2007). Understanding spatial and temporal patterns of small-scale fisheries is important for the management of marine protected areas. Such information is crucial to assess possible impacts of fishing on species and coastal ecosystems as well as to identify and mitigate socio-economic impacts of regulations on fishing communities (Horta e Costa et al., 2013).

The Gulf of California specifically the Upper Gulf of California zone (Fig. 1), is the most important fishing area in Mexico, in terms of small-scale fisheries production, as more than 2,000 small boats using gill nets to harvest blue shrimp (*Litopenaeus stylirostris*), Gulf corvina (*Cynoscion othonopterus*), bigeye croaker (*Micropogonias megalops*), Spanish mackerel (*Scomberomorus concolor*), and small volumes of other groups (Cisneros-Mata, 2010). Fishing activities in this zone have long interacted with the conservation of two endangered species, vaquita porpoise (*Phocoena sinus*) and the totoaba (*Totoaba macdonaldi*) (Ávila-Forcada et al., 2012). This constant conflicts between fishing communities and conservation agenda did not show plausible results in terms of conservation, because do not consider the possibility that the communities may differ in their fishing activities with respect to catch composition or spatio-temporal patterns in landings.

For that reason we describe and compare their most important small-scale fisheries with respect to species composition, revenues, effort, seasonal fishing activities in relation to the reproductive seasons of target species, and spatial patterns of fishing within the Biosphere Reserve.

Materials and methods

Species composition of catch; annual effort, landings, and revenues

We acquired commercial fisheries data from the Mexican National Commission for Fisheries and Aquaculture (CONAPESCA), for Santa Clara and San Felipe for the period of 2001 to 2011 for the four most important fisheries: *L. stylirostris*, *C. othonopterus*, *M. megalops*, and *S. concolor*. Database contain records of landings (kg) and ex-vessel prices (pesos/kg).

We engaged in collaborative fisheries research with commercial fishers of both communities from 2012-2013 to acquire fine-scale information on catch composition (kg), revenues (pesos/kg), and spatial patterns from each boat trip. We also interview informally several fishers to estimate effort for most important fisheries. We obtained information for 1,687 fishing trips (Table 1).

We compared mean annual CPUE data from fisheries and from our collaborative research to determine whether the results were similar.
Reproductive seasonality

We conducted biological surveys in both communities throughout 2012 to determine the reproductive season of the three most common fishes captured by commercial fisheries in the region. We recorded information on total length to the nearest mm, total body weight and gonad to the nearest g.

The sex and reproductive condition of each fish female sampled was first determined by macroscopic inspections and later verified by microscopic evaluations of gonads using standard histological procedures (Erisman et al., 2012). Classification of gonadal development stages followed Brown-Peterson et al. (2011). Monthly patterns in the percentage of Actively Spawning and Spawning Capable females were combined with GSI data to define the spawning season for each species. Our estimates of reproductive seasonality were then compared to published and unpublished technical reports to corroborate our conclusions (see Table 4).

Seasonal patterns in effort landings, and revenues

We compared the monthly patterns in catch for *C. othonopterus*, *M. megalops*, and *S. concolor* from the fisheries database with their reproductive seasons to estimate the contribution of the reproductive season to fisheries in terms of landings and ex-vessel revenues production in each community. We then estimated the relative importance of the reproductive season (Erisman et al., 2011).

Spatial patterns of fishing activities

Fishing areas for *L. stylirostris*, *C. othonopterus*, *M. megalops*, and *S. concolor* were identified for both communities using GPS data loggers that use a Global Positioning System (GPS) to record a boat’s position at regular intervals of time (Erisman et al., 2012). The fishing grounds (observations) were represented as points and we estimated the fishing area used by each community for each fishery by simultaneously plotting all marked points creating a polygon for all fishing observations. The percentage of marked points located within these areas were used to estimate the general distribution of fishing grounds in relation to the two restricted zones.

Results

Species composition of catch; annual patterns of effort, landings, and revenues

Mean total landings and revenues were higher in Santa Clara than San Felipe (Table 2). In Santa Clara only four species represented more than 90% of landings. Conversely, San Felipe recorded 9 species represented more than 90% of landings. In both communities, same four species (Table 1) ranked highest with respect to annual landings and revenues, but their relative importance to overall fisheries production varied by community. Blue shrimp was the most important in terms of revenue in both communities. Respect to mean
annual landings and ex-vessel revenues were higher in Santa Clara for Gulf corvina and Spanish mackerel than in San Felipe (Fig. 2). Overall fishing effort was similar for both communities in terms of the number of trips per boat per season (Table 3). In both communities, effort was highest for blue shrimp with more than 100 trips per boat per season.

Reproductive seasonality

The three species was best categorized as spring spawners, the onset and duration of the reproductive season differed among three species (Fig. 3). Gulf corvina reproduce from late February through early June, with a peak in activity during March-April. Bigeye croaker females have a protracted reproductive season for bigeye croaker beginning in March and running through early October, with a peak in spawning activity from March-July. Female Spanish mackerel indicated that reproductive season began in April, peaked from April-July.

Seasonal interactions between fishing and spawning

Seasonal interactions between fishing activities and the reproductive seasons of three main target species differed between communities (Fig. 4). Blue shrimp showed no relationship between their reproductive season in both communities. Fishing season in Santa Clara began each year with the blue shrimp season (September-March), followed by Gulf corvina, bigeye croaker, and Spanish mackerel in coincidence with their respective reproductive seasons (Fig. 4).

In San Felipe the seasonal patterns of fishing looked a little different (Fig. 4). Fishing begins with blue shrimp season. However, landings and revenues for Gulf corvina and Spanish mackerel were relatively consistent across all year.

Overall, the contribution of the reproductive season to total landings and revenues was significantly higher for Santa Clara than for San Felipe (Table 4), whereas San Felipe only the bigeye croaker was harvested during their peak spawning season.

Spatial patterns of fishing

We found noticeable differences in spatial patterns of fishing between communities (Fig. 5). Fishers from Santa Clara used larger areas (blue shrimp=2,307.8 km²; Gulf corvina=1,291.1 km²; bigeye croaker=1,452.4 km²; Spanish mackerel=1809.7 km²; Fig. 5 a-h), compared with San Felipe (blue shrimp=597.9 km²; Gulf corvina=938 km²; bigeye croaker=1,682.4 km²; Spanish mackerel=1,094.8 km²; Fig. 5 a-h).

Fishing activities of both communities interacted partially with the vaquita refuge and the no-take zone. For Santa Clara, the percentages of observations that occurred inside the no-take zone was considerably higher only for Gulf corvina (61.1%). The percentage of observations of Santa Clara inside the vaquita refuge was highest for Spanish mackerel (15.5%), and blue shrimp fishery (11.9%). For San Felipe, the percentages recorded inside the vaquita refuge were higher (corvinas= 39%; blue shrimp= 30.3%; bigeye...
croaker= 16.5%), for some species. Respect to the no-take zone the percentage was lower for all species.

Discussion

Our results show that blue shrimp, Gulf corvina, bigeye croaker, and Spanish mackerel represent the most important fisheries for both communities within the Biosphere Reserve. These results are congruent with previous studies that have examined dynamics of small-scale fisheries in this region (Aragón-Noriega et al., 2010), and breeding grounds for the most important commercial species in the Upper Gulf of California (Román-Rodríguez, 2000; Castro-González, 2004; Valdovinos-Jacobo, 2006; Aragon-Noriega, 2007).

Finfish fisheries in Santa Clara are best characterized by sequential changes in catch composition that coincide with seasonal reproductive migrations of target species, beginning with shrimp fishing season (September, throughout March), due to the high market prices this fishery (Rodríguez-Quiroz et al., 2009) and then followed by Gulf corvina, which coincides with a high domestic demand for fish in Mexico during Easter (Erisman et al., 2012). However, after Easter the market prices drop and fishing activities then replaced by the reproductive season of bigeye croaker and the Spanish mackerel that begin to form aggregations in April and May respectively. In San Felipe the small-scale fisheries tend to be less seasonal and less dependent on the reproductive periods of fishes. Fisheries are also more diversified in terms of catch composition such that they tend to catch lower volumes but across a wider range of species and some of them throughout all the year.

Differences in catch composition between Santa Clara and San Felipe, including the diversity of catch and the relative volumes landed per species are likely reflections of differences in the spatial patterns of their fishing activities (Moreno-Báez et al., 2012), and the nearshore habitats by community (Santa Clara=sandy or mud bottoms, San Felipe=rocky and sandy bottoms), which tend to hold a higher diversity of fishes due to increased habitat complexity (Hastings and Findley, 2010).

Comparing our study with previous studies in the area (Rodríguez-Quiroz et al., 2010) that used some fisher interviews to described the size and location of fishing grounds in relation to the Biosphere Reserve, we found that the fishing activities inside the two restricted areas were much lower for both communities in comparison with the previous study. Conversely, the use of GPS data loggers has its limitations. Most fisheries utilize drift gill nets as their main gear type. These nets vary in length, soak times, the strength of surface currents, spatial orientation once deployed, so the locations of gear deployment and retrieval do not specifically reflect the exact locations where fish were captured.

Our results suggest that regulations of regional fisheries and the reserve itself should be adjusted in order to account for such important fine-scale heterogeneity in use and the impact of regulations on the livelihoods of the communities.

In case of Santa Clara the effects on the most important finfish species populations are higher than in San Felipe, due to high dependency of catch to reproductive migrations of species. Different studies recognize that several fish species that aggregate to reproduce in certain sites and periods and were harvested for fisheries, can remove significant
proportions of assembled individuals and have negative implications for reproductive stocks outputs and economic benefits for the communities (Sadovy et al., 2008). Understand the potentially effects that each community have in the species populations will help to explore adaptive management of fisheries.

References


Fig. 1. Map of the Upper Gulf of California and Colorado River Delta Biosphere Reserve.
Fig. 2. Annual trends in landings for the four most important fisheries in Santa Clara (solid line) and San Felipe (dashed line) from 2001 to 2011.

Fig. 3. Reproductive seasons for the most important species in the Upper Gulf of California from changes in the monthly percentage of Spawning Capable females (%SC) and Actively Spawning Females (%AS) and the mean gonadosomatic index (meanGSI) of adult females.
Fig. 4. Mean monthly landings trends of four species by community from 2001 to 2011 in relation to their spawning season (hatched box). Dark gray bars indicate months of peak landings significantly different.
Fig. 5. Fishing zones of the most important species to small-scale fisheries in Santa Clara (a-d) and San Felipe (e-h) from 2012-2013. a and b) *L. stylirostris*; c and d) *C. othonopterus*; e and f) *M. megalops*; g and h) *S. concolor*.
Table 1. Number of fishing trips monitored with GPS data loggers from February 2012 to October 2013 by community, species, and year.

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</tr>
</thead>
<tbody>
<tr>
<td>GSC</td>
<td>50</td>
<td>86</td>
<td>198</td>
<td>5</td>
<td>55</td>
<td>--</td>
<td>611</td>
<td>197</td>
<td>1202</td>
</tr>
<tr>
<td>SF</td>
<td>22</td>
<td>--</td>
<td>265</td>
<td>79</td>
<td>40</td>
<td>31</td>
<td>63</td>
<td>16</td>
<td>485</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>86</td>
<td>463</td>
<td>84</td>
<td>95</td>
<td>31</td>
<td>674</td>
<td>213</td>
<td>1687</td>
</tr>
</tbody>
</table>

C. othonopterus (Gulf corvina)  M. megalops (Bigeye croaker)  S. concolor (Spanish mackerel)  L. stylirostris (Blue shrimp)
Table 2. Catch composition of small-scale fisheries from Santa Clara (GSC) and San Felipe (SF) from 2001 to 2011. Dotted line indicates 90% of total commercial landings and ex-vessel revenues.
Table 3. Comparison of annual values in effort, landings, CPUE, and ex-vessel revenues of the four most important small-scale fisheries data in both communities from the official fisheries database and our GPS trackers program.

<table>
<thead>
<tr>
<th>Community</th>
<th>Species</th>
<th>No. Permits</th>
<th>Mean annual landings (tons)</th>
<th>Mean annual revenue (USD)</th>
<th>Mean CPUE (tons/permits/year)</th>
<th>Mean effort (trips/season/boat)</th>
<th>Mean CPUE (kg/trip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSC</td>
<td><em>C. othonopterus</em></td>
<td>405</td>
<td>2,566.2</td>
<td>2,189,047</td>
<td>6.33</td>
<td>23</td>
<td>749.26</td>
</tr>
<tr>
<td></td>
<td><em>(Gulf corvina)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>M. megalops</em></td>
<td>405</td>
<td>1,249.8</td>
<td>889,329</td>
<td>3.08</td>
<td>45</td>
<td>300.67</td>
</tr>
<tr>
<td></td>
<td><em>(Bigeye croaker)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>S. concolor</em></td>
<td>405</td>
<td>1,129.8</td>
<td>1,157,461</td>
<td>2.78</td>
<td>30</td>
<td>275.33</td>
</tr>
<tr>
<td></td>
<td><em>(Spanish mackerel)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>L. stylirostris</em></td>
<td>423</td>
<td>501.2</td>
<td>5,553,193</td>
<td>1.1</td>
<td>100</td>
<td>27.35</td>
</tr>
<tr>
<td></td>
<td><em>(Blue shrimp)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td><em>C. othonopterus</em></td>
<td>239</td>
<td>195.0</td>
<td>170,290</td>
<td>0.81</td>
<td>30</td>
<td>437.83</td>
</tr>
<tr>
<td></td>
<td><em>(Gulf corvina)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>M. megalops</em></td>
<td>239</td>
<td>1,055.1</td>
<td>670,055</td>
<td>3</td>
<td>50</td>
<td>328.94</td>
</tr>
<tr>
<td></td>
<td><em>(Bigeye croaker)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>S. concolor</em></td>
<td>239</td>
<td>687.3</td>
<td>711,346</td>
<td>2.8</td>
<td>40</td>
<td>254.81</td>
</tr>
<tr>
<td></td>
<td><em>(Spanish mackerel)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><em>L. stylirostris</em></td>
<td>220</td>
<td>437.1</td>
<td>4,153,042</td>
<td>1.9</td>
<td>110</td>
<td>24.09</td>
</tr>
<tr>
<td></td>
<td><em>(Blue shrimp)</em></td>
<td></td>
<td></td>
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</tbody>
</table>

Table 3. Comparison of annual values in effort, landings, CPUE, and ex-vessel revenues of the four most important small-scale fisheries data in both communities from the official fisheries database and our GPS trackers program.
Table 4. Summary of the contribution of the spawning season of the three most commercially important fish species in the Upper Gulf of California to landings (tons) and ex-vessel revenues in both communities from 2001 to 2011.

<table>
<thead>
<tr>
<th>Community</th>
<th>Species</th>
<th>References</th>
<th>Spawning season</th>
<th>Avg annual landings from aggregations (tons)</th>
<th>% of annual landings from aggregations</th>
<th>Avg annual revenue from aggregations (USD)</th>
<th>% of annual revenue from aggregations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSC</td>
<td>C. othonopterus (Gulf corvina)</td>
<td>Erisman et al., 2012; This study</td>
<td>Feb-Jun</td>
<td>2,546.9</td>
<td>99.2</td>
<td>2,178,466</td>
<td>99.5</td>
</tr>
<tr>
<td></td>
<td>M. megalops (Bigeye croaker)</td>
<td>Roman-Rodriguez, 2000; Castro, 2004; This study</td>
<td>Mar-Oct</td>
<td>1,190.9</td>
<td>95.2</td>
<td>845,469</td>
<td>95.1</td>
</tr>
<tr>
<td></td>
<td>S. concolor (Spanish mackerel)</td>
<td>Valdovinos, 2010; This study</td>
<td>Apr-Sep</td>
<td>1,066.7</td>
<td>94.4</td>
<td>1,095,301</td>
<td>94.6</td>
</tr>
<tr>
<td>SF</td>
<td>C. othonopterus (Gulf corvina)</td>
<td>Erisman et al., 2012; This study</td>
<td>Feb-Jun</td>
<td>94.3</td>
<td>48.3</td>
<td>82,535</td>
<td>48.5</td>
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<tr>
<td></td>
<td>M. megalops (Bigeye croaker)</td>
<td>Roman-Rodriguez, 2000; Castro, 2004; This study</td>
<td>Mar-Oct</td>
<td>953.2</td>
<td>90.3</td>
<td>616,082</td>
<td>91.9</td>
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<td></td>
<td>S. concolor (Spanish mackerel)</td>
<td>Valdovinos, 2010; This study</td>
<td>Apr-Sep</td>
<td>354.6</td>
<td>51.5</td>
<td>358,743</td>
<td>50.4</td>
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</table>
Engaging fishing communities in seaweed aquaculture: Facilitating diffusion of innovation and microenterprise development

Holly T. Cronin (PhD Candidate in Geography & Neotropical Environment, McGill University, Canada)

In recent years, several well-documented projects have demonstrated the viability of seaweed cultivation as an avenue for economic diversification in coastal areas traditionally reliant on wild fisheries. Despite favorable market dynamics and readily accessible technology, commercial development of smaller-scale production of seaweeds as food products has proven slow to gain traction in fishing communities worldwide. Literature on the subject calls for better understanding of the institutional and socioeconomic factors involved. This paper outlines an organizational framework to support the development of regional seaweed aquaculture hubs and consequently lower the barrier to entry for surrounding communities to engage in cultivation and processing. The strategy is designed to facilitate diffusion of innovation and the positive socioeconomic and environmental impacts associated with establishment of community-based seaweed aquaculture enterprises. Specifically, elements of the emerging industry in the US state of Maine are highlighted to shed light on policy, legal, training, business, and extension services fostering sustainable growth in the sector. Drawing on recorded oral histories that explore the system dynamics of a fishing community across the border in the Canadian province of New Brunswick, avenues are outlined to recontextualize Maine’s successes for a different commercial and political environment within the same bioregion. The early results of implementation research conducted in New Brunswick identify key challenges and opportunities in translating and reapplying place-specific seaweed industry lessons. This project contributes new insights on generalizable core organizational elements that facilitate engagement of fishing communities to establish small-scale seaweed aquaculture enterprises.

Livelihood diversification in fishing communities: Lessons and experiences from a coastal village in Brazil

Deborah Santos Prado (Commons Management and Conservation Research Group, State University of Campinas, Brazil) deborah.stprado@yahoo.com.br

Cristiana Simão Seixas (Environmental Studies and Research Center, State University of Campinas, Brazil) Campinas, Brazil (csseixas@unicamp.br)

Abstract
In Brazil, as in many other countries, fishing communities are dealing with complex changes; mostly related to the degradation of ecosystems, growing tourism, and environmental management policies. In this research we investigate how a Caiçara
community has dealt with social-ecological changes over the last 50 years, analyzing how livelihoods change over time and in response to various drivers. The Aventureiro village is located on Ilha Grande, an island in the south of Rio de Janeiro state, where fisheries and tourism are the main economic activities. We used livelihoods surveys, participant observation, semi-structured interviews and fishing landings to understand the main changes in livelihoods and its diversification process; and also to carry out an assessment of small-scale fisheries (SSF) over a 15-year period. Even though they have been configured differently among households, no livelihood activity common in the 1960’s has disappeared, and new ones have been added. Over the years, SSFs have maintained the catch returns, diversity of fishing gears and fishing spots. Increased financial resources, due to community-based tourism development, have allowed for incremental investments in gear and vessels. SSF remains an important activity for all households, particularly with regards to food security, but also as a way of life that contributes to cultural identity and wellbeing. In the face of challenges and disturbances, the coping and adaptive strategies used by this community have helped to maintain the diversity of livelihood options and ecosystem services, including the fisheries.

**Introduction**

In Brazil, as in many other countries, fishing communities are dealing with complex changes, mostly related to declining fishery returns, degradation of ecosystems, growing tourism, and environmental management policies. Given the vulnerability of small-scale fishing communities to a broad number of challenges, researchers have highlighted the importance of understanding how fishers are adapting to contemporary coastal changes (Marschke and Berkes 2006; Blythe et al. 2014).

Fishing livelihoods are known to be complex, dynamic, and reactive to multiple drivers of change (Allison and Ellis 2001). In this research we investigate how a Caiçara community has dealt with social-ecological changes over the last 50 years, analyzing how livelihoods have changed over time and in response to various stressors. The Caiçaras are a mixed heritage traditional group (Brazilian Indigenous people, Portuguese colonizers and African descendents), who combine small-scale fishing with small-scale agriculture and plant resource extraction for their livelihood.

According to some authors, households and communities require the skills, assets and other resources necessary to adapt to changes (Ellis and Allison 2004). Livelihood diversification has been defined as the process by which households construct a diverse portfolio of activities and social support capabilities, for survival and in order to improve their standard of living (Scoones, 1998). It has also been considered important for reducing the vulnerability that comes with the dependence on a single set of resources (Marschke and Berkes 2006). In the context of fisheries, diversification should not be interpreted as a job substitution and a transition away from fishing, but as coherent ways to diversify both within and outside of fishing activities, linking both poverty reduction and responsible fisheries (Brugere et al. 2008).
The diversification of livelihoods is directly related to the basis of capitals or assets available within each household (human, social, physical, financial and natural capital), as well as the choices taken by them (Goulden et al. 2013). Limited assets may reduce fisher’s adaptive options. Based on the Sustainable Livelihoods Approach the greater and more varied the asset base, the more sustainable and secure the livelihood, in other words, the greater the capacity to manage risk and cope with shocks (Scoones 1998).

The obvious economic metaphor “capital” in Sustainable Livelihood Approach (SLA) seems to suggest that livelihood resources could be viewed as “production factors” in the production of livelihoods (Knutson and Ostwald 2006), as well as an attempt to quantify qualitative elements of life or to value non-tangible assets. We agree with Knutson and Ostwald (2006, p.4) that “according to a relative understanding of sustainable livelihoods, capitals do not have intrinsic values of their own, but are valued only according to their contribution to the total production, or in our case, livelihood”. As a graphic tool and also to observe the configuration and dynamics of assets available over time, we quantified livelihood assets and described it according to the cycles of change in the livelihood trajectory at Aventureiro village, Rio de Janeiro state, Brazil.

**Study Area and Methods**

This research used qualitative and quantitative methods in form of livelihood surveys, participant observation, semi-structured interviews, fish landings and documentary analysis, which contributed for a better comprehension of the livelihoods pathway and for the identification of key drivers of change. Fieldwork took place between September 2011 and July 2012. Fish landings were documented for seven consecutive days, bimonthly over one year during 1995-1996 by Seixas (1997) and again from 2011-2012. Fish landing data provided information on key social-ecological changes in a time frame of 15 years. For more information on complete data see Prado (2013).

Livelihood assets were quantified using key criteria, each one divided into sub-criteria listed in the livelihood matrix (Table 1). The criteria were chosen based on case-studies in livelihoods resilience (Noralene et al. 2011; Ferreira, 2011) and adapted to the specific context. The results were depicted through livelihood asset pentagons. The scores for each asset were given according to the scales 5 (very high), 4 (high 1), 3 (moderate), 2 (low) and 1 (very low). It is important to mention that information on livelihood assets are based on the comparison of data collected, and not from scores chosen directed by the households participants, which could not be verified objectively.

Aventureiro is located on Ilha Grande, an island in the municipality of Angra dos Reis, Rio de Janeiro State, southeastern coast of Brazil. It is one of the smallest and most isolated villages on the island, composed by approximately 90 residents and 20 households, far from the city, approximately two and half hours by motor boat. There is only an elementary school located in the community, and youth who wish to study beyond the elementary level must go to the neighboring village or to Angra dos Reis to complete their studies. There are no grocery stores or medical services, or any municipal regulated electric grid. The community is surrounded by a diverse and well preserved
environment (sandbanks, lagoons, mangroves, forest, rocky shores and the sea). The whole area is situated within the Atlantic Forest Region, one of the most biologically diverse areas in Brazil.

The Livelihood Trajectory
The Livelihood Trajectory of Aventureiro village in the last 50 years was identified based on secondary data and on the historical survey. The cycles of change were triggered mainly by public policies regarding environmental conservation and development. Below we present four cycles we identified:

Before the 1960’s: Agriculture and Local artisanal fishing
The livelihood system consisted mainly of shifting agriculture and artisanal fishing until the 1960’s, which ensured subsistence for all households. Other natural resource-related activities included the extraction of forest products, marine invertebrates gathering, rearing small domesticated animals and hunting. Community isolation was compounded by the lack of motorized vessels and the trade of agriculture products was carried out mainly with neighboring villages. Collective work was typical for constructing houses, beach seining and manioc flour production in communal mills. There was a strong cultural sense of reciprocity this time, as well as exchange or sharing networks, which strengthened social capital within the community.

From 1960 to 1994: Operating Large purse-seiners
With the national government incentives for industrial fisheries in the late 1960’s, the possibility of employment as crew on purse-seine boats became an opportunity for a new income source and was considered a new phase on the livelihood trajectory. This new activity increased the financial capital of households, and at the same time brought an economic rationality different from the subsistence economy based just on agriculture and local fishing.

Furthermore, two no-take PAs were created, overlapping with the village territory: A terrestrial no-take Biological Reserve (in 1981) and a no–take Marine Park (in 1990), which became a source of stress for community members. At the beginning of the 1990’s, sardine overfishing coupled with the closure of Ilha Grande’s prison in 1994 (which had prevented tourism development for security reasons), promoted the emergence of another source of income to Ilha Grande and to Aventureiro households: Tourism-related activities.

Table 1. Livelihood Matrix. The assets were quantified over time, according to the cycles of change in Aventureiro village, Brazil. The scores for each asset are given in the scales 5 (very high), 4 (high), 3 (moderate), 2 (low) and 1 (very low).

<table>
<thead>
<tr>
<th>Assets</th>
<th>Key Criteria</th>
<th>Sub-Criteria</th>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Capital</td>
<td>Capacity for collective action and local organization</td>
<td>Low social stratification</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Collective actions being carried out in the community</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Representative leadership acting locally aggregating the community</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The community is formally represented in decision making processes related to the system</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total (maximum sum = 20)</td>
<td>19</td>
<td>17</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Score (0-10)</td>
<td>9,5</td>
<td>8,5</td>
<td>5,5</td>
<td>8,0</td>
</tr>
<tr>
<td>Human Capital</td>
<td>Potential for social-ecological learning</td>
<td>People between 18 and 35 years old involved in at least 3 livelihoods activities</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge about livelihood strategies are passed through generations</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Capacity for innovation</td>
<td>Livelihoods diversification</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Well-being</td>
<td>Locals have access to health services</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total (maximum sum = 20)</td>
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<td>Backyards cultivation</td>
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<td>Scenic beauty as a tourist attraction</td>
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### Physical Capital

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<td>3</td>
<td>4</td>
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<tr>
<td>Material and consumption goods acquisition</td>
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<td>4</td>
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<td>Total (maximum sum = 10)</td>
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<td>4</td>
<td>6</td>
<td>8</td>
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| Score (0-10) | 2,0 | 4,0 | 6,0 | 8,0 | 9,0 |

**From 1994 to 2000: Tourism Development**

Over time, households have been improving the tourism related services which consist primarily of “camping areas” in the backyards of community members’ houses, food sales (in small restaurants) and boat trips. Initially such tourism activities generated little income and lacked supporting infrastructure, relying on adventure travelers looking for camping, hiking and surfing. Overtime tourism generated more financial capital and therefore physical capital (e.g. vessels, electric power generators, furniture and household appliances, such as TVs). At the same time, the ongoing increase of tourists in the village caused a conflict with the state environmental agency in charge of the two PAs during this period. This conflict intensified over the years, leading up to a crisis point in 2000. Threats and a lawsuit to displace the residents to areas outside the Biological Reserve came as shocking news to local households, bringing for the trajectory a new context of community organization.

**From 2000 to 2010: Community self-organization fighting for rights**

Facing the threat of eviction since 2000 and the prohibition of tourism camping sites in 2006, the residents created the community-based organization (CBO), an association that
claimed land rights in an organized way. Supporting the CBO in this period of crisis, local NGO’s and university groups acted as mediators and capacity builders, helping to write documents and generating publicity through the media. The community won the right to receive tourists and the process of community organization strengthened the social capital among the community.

*From 2010 to 2014:*
Conflicts associated with the no-take PAs on the community land are a complicated problem. The CBO has been attempting to reclassify part of them into a Sustainable Development Reserve (RDS) since 2008. RDS are a type of PA that allow for the maintenance of human populations, such as Caïcaras, while protecting livelihoods and culture, as well as the natural environment. This reclassification is likely to bring changes regarding whom and how resources will be used and how tourism will be managed. In 2014/05/29 the RDS of Aventureiro was created, which will no doubt bring another cycle of change to the system.

**The dynamic of assets and options**
Over the years, the assets available at Aventureiro have also undergone various changes (Table 1, Figure 1), allowing the adoption of common livelihood strategies by most households. Physical and Financial capital has gradually increased in the community, first with the fishermen employment as crew in large-scale fisheries and now with community-based tourism. We understand that tourism in this fishing village also brings management capabilities, personal attributes as attitude to work and entrepreneurship to perceive opportunities, therefore increasing the human capital. The only exception is related to the new economic rationality that comes with tourism, which may enhance community dependence on money and potentially diminish the social capital by disrupting the cultural sense of identity and reciprocity within the community.

Natural capital, as well as ecosystem services, have remained stable over time primarily because of the low impact activities they conduct, with no dependence of a specific resource, and due to the conservation policies historically in place. The assessment of fisheries in the last 15 years has shown an increase on the average production for each catch; fishing spots have remained the same, and a diversification in fishing gears and vessels was observed.
Figure 1. The pentagon of assets over time. The assets were quantified according to the phases or the cycles of change in Aventureiro Village, Brazil, since 1960.

In each household six livelihood activities, on the average, were carried out in 2011-12. These include the following, tourism-related activities, home garden cultivation and agriculture, non-timber forest product extraction, small-scale fishing, crewing in larger-scale fishing, construction, handicrafts, wage labor, marine invertebrates harvest, and rearing chickens and other domestic animals. Except for construction, tourism, handicrafts, wage employment and pensions, the other activities consisting of livelihood strategies are mostly for subsistence and are an important component of food security and wellbeing, generating knowledge and options of choice in times of adversity.

**Literature Cited**


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**Diagnose, distribution and a SWOT analysis of the economic benefits generated by sea cucumber fisheries in a fishing cooperative in the Yucatán, Mexico**

Luis Alfonso Rodríguez Gil, Laboratorio Aprovechamiento Recursos Marinos,
In the beginning of 2013, the very first commercial fishing permissions were granted for the sea cucumber exploitation, *Isostichopus badionatus* and *Holothuria floridana*, in the Yucatan State, taking as a scientific basis a traditional fishing approach. During the 2006-2007 season, 6 permissions were granted for protection fisheries and the commercial interest by the fishing sector allowed the expedition of 176 permits with a total of 557 fishing units in 2013, establishing an initial quota of 556 T which grew up to 1671 T respectively. Permissions granted during 2013 have a 2 year duration, with a fishing period of 12 days and a 250 kg/fishing unit, applying a non-fishing precautionary measure of indefinite time for the species, taking in consideration the biomass estimates. Fishing permission/concessions establish that fishermen and divers must be from the same communities of the established fishing zones. This approach has generated as a result: illegal fishing, clandestine processing, conflict of interests between the fishing sector and authorities. Facing this situation, an Ecosystemic Approach is proposed procuring marine protected areas, involving superposition of the population productivity, biodiversity conservation and socioeconomical aspects. By proposing No-Fishing Zones and/or enclosed rotational fishing areas, drying process standardization’s and touristic diving services, will create an immediate income increase and quality of life in conjunction with the fishing communities involved in the protected areas, adjacent communities and authorities.

**Keywords**: sea cucumber, *Isostichopus badionatus*, ecosystemic approach, SWOT analysis.

**Introduction**

The importance of sea cucumber started over a thousand years ago in the Far East. During the XXI century this fishery has expanded, being China the main world importer and consumer. During the present century other international markets have been opened such as Japan, Korea, Singapore and Taiwan (Conan and Sloam 1988).

In Mexico, the national demand for the sea cucumber ignited the commercial fishery throughout the Mexican Pacific and the California Gulf since 1988, mainly in the two littorals of the Baja California peninsula (Castro-Salgado 1994).

Considering the reached common interest of producers and commercializers and with the purpose of motivating their participation in gathering basic information from this ocean
resource, through informative projects that can be technically comparable and trustable, the Instituto Nacional de la Pesca (INP) created the Sea Cucumber Promotion Fishing Institutional Program (PIPF), in order to obtain such information in all regions in Mexico where sea cucumber bank are being exploited or used. In the Yucatan peninsula, promotional fisheries were developed during the 2006-2012 period utilizing the afore national program.

The purpose of the INP has always been the generation of basic knowledge with two main objectives: to gather up all sufficient data in order to evaluate the generative capacity of wild populations and to conclude in the possibility of initiating or discarding a commercial capture.

A promotional sea cucumber fishery started in 2006-2007 along the Yucatan coast; which focus mainly in three species Astichopus multifidus, Isostichopus badionotus and Holothuria floridana; and it was set and initiated along 6 set regions in the litoral and given to 6 social organizations as a concession (Rodríguez et al. 2007; Rodríguez. 2007). From 2013 onward, commercial fisheries have been granted in the Yucatecan coast. Therefore, the main focus of this investigation is to make a diagnose of the capture and dehydration process in a fishermen cooperative; utilizing a SWOT analysis and contemplating how the economic impact is distributed along the income and life quality of the fishermen involved in this activity.

**Methods**

A statistic revision was performed along with a deep fisheries diagnose since its beginnings and through its evolution until the granting of the commercial exploiting permission in 2013. An Ecosystemic approach was contemplated. A fishery diagnose was used by applying the SWOT approach analysis: Strengths, Weaknesses, Opportunities and Threats; specifically on the fishing effort and the dehydration process for the sea cucumber.

**Results**

**Fishery diagnosis**

The sea cucumber production in live bulk was 1 Ton for the 2006 and of 113 Tons for the 2007 as a promotional fishery, with 6 granted permissions; being a total of 114 Tons (Anuarios estadísticos de pesca, 2006-2007). The next 2 years from 2008-2009 there were no permissions granted for promotional fisheries due to the red tide affectations and impact which diminished populations of this specie but these were finally recuperated by the year 2010.

From the 2010-2012 year new permissions were granted for a new promotional fishery, but with a ridiculous increase of 61 permissions and 200 boats and clearly by fishermen pushing and creating a social pressure over authorities, creating thereby an enormous pressure over the resource too. The live bulk production for sea cucumber reached the 2062 Tons by the 2010, 1083 T by 2011 and only 861 T for the 2012; gathering a total of 4006 T on this three years from 2010-2012 (Anuarios estadísticos de pesca 2010-2012).

For the 2013 year, the first 176 commercial permissions were granted, distributed along 4 capture zones and on which 557 boats are actively fishing. The commercial permissions granted on 2013 have the following characteristics: they are valid for 2 years; from the
27th of April 2013 until the 14th of May 2013, but with a fishing lapse of 12 days. And close season starting from the 15th of May 2013 until when initiated the next year. It is clearly shown that the number of fishing permissions have increased from 6 promotional fishery in 2006-2007 up to 176 commercial fishing permissions by the 2013; this is 171 more permissions. The captured biomass has increased from 556 T allowed in the 2006-2007 up to 1671 T for the 2013 (preliminary numbers, obtained from the captured fishing arrivals in SIPESCA up to July 2013). Captured biomass tripled from when the commercial fishery was established.

These data shows an increased problem presented by the fact that it is extremely difficult for fishing authorities to control 557 small boats in applying the assigned quota for live bulk weight. Regardless of the fishing measures and management rules for the conservancy of the sea cucumber species such as; minimal capture size, assigned per/boat quotas, permission numbers, temporal close season and assigned fishing zones (Carta Nacional Pesquera 2012). All of the above mentioned have contributed to the illegal fishery, specifically when fishermen don’t respect management rules for the resource and for a lack of vigilance from fishing authorities when there is an excessive number of boats to control.

Besides, fishing permissions clearly demand and establish that fishermen and divers involved in the activity should locals from the communities of the fishing zones. This traditional approach has generated illegal fisheries, clandestine processing, and conflicts of interests from the fishing sector and authorities and corruption in all its levels. Facing this situation, an Ecosystemic Approach should be contemplated (Purcell, 2010) on which a wider participation from the fishermen in decision making should be taken into consideration, procuring marine protected areas within the allowed fishing grounds, and involving a superposition of the activity by the population, the conservancy of biodiversity and the socioeconomical aspects involved in the activity.

As an extra tool to the present sea cucumber conservation regulations in protected areas, it is extremely important to establish the use of NO FISHING ZONES within these protected natural areas and/or rotation of close fishing/harvesting areas, along with the fishermen communities within or around these areas and authorities.

Contemplating the creation of two state reserves and two federal reserves in the coast of the Yucatan state in order to establish (fishing exclusion zones) in combination with responsible fishing zones and/or community managed zones. In order to achieved this, a strong alliance should be created between the sea cucumber fishermen union of Yucatan and all communities within and around these reserves.

Currently there is work under way for the creation of alternative ways of subsistence and the reevaluation of Ecosystemic services; such as specie conservation by way of non-extraction zones in order to help fisheries and also by offering scuba diving touristic services for the investigation if the sea cucumber species in its natural habitat.

Measures taken on Zone Ruling:

1. Establish NO Extraction Zones (ZNE) in Natural Protected Areas within the permitted fishing areas, or 2. Rotational closed fishing-harvesting areas.
In both cases the following is contemplated: definition, use, limitations and implementation. Both measures must have the local fishermen and authorities mentioned before:

1. Unión de Pepineros del Estado de Yucatán (Yucatan Seacucumber Fishermen Union), 2. Secretaría de Desarrollo Urbano y Ecología “SEDUMA” (Yucatan Ecological and Urban Development Agency) of the Yucatan state government has under its supervisión 2 state reserves with a marine area which are; Palmar and Dzilam de Bravo Bocas. 3. The 2 federal Protected Natural Areas that contemplate a marine area: Ria de Celestun and Ria Lagartos. And 4. Small fishing communities within these natural protected areas and surrounding villages.

**Operation and income distribution per boat**

In relation of how income is distributed by boat and crew, the average beach price was taken and resulted in $30 pesos /Kg for sea cucumber for the 2014 year. Each boat can only fish 250 kgs/day of fresh sea cucumber, therefore its gross daily income per boat is of $7,500 mexican pesos, or roughly 650 usd.

There is several ways of distributing this income, as an example we have the model of the fishermen cooperative of the San Felipe port in the Yucatan state. In this cooperative, each boat works with 3 crew members and semi-autonomous hooka is used, the work is divided in the following form: a hose operator which basically holds and makes sure the air supply from the air compressor to the diver its always free and ready; then two divers that alternate the diving time and the outboard engine operation.

Income distribution after expenses its distributed fairly into 4 parts: the first part to the hose operator, two parts for the divers and the last one part for the owner of the boat. In the case for sea cucumber only gasoline is discounted from expenses, the fishing cooperative absorbs the chilled-ice expenses.

Total Income per/Boat $7,500.00 pesos - $ 600.00 pesos for gasoline = $6,900.00 pesos  
$6,900/4 parts = $1,725.00/part  
Therefore: the hose operator makes $1725.00, each diver makes $1725.00 and the owner of the boat makes $1725.00.

For the Chicxulub Port in Yucatan, each boat has as a crew: 1 engine operator, 2 divers and 1 hose operator.

Income distribution after expenses is distributed into 4 parts: the first part to the hose operator and the engine operator, two parts for the two divers and the last one part for the owner of the boat. In the case for sea cucumber gasoline and ice are discounted from expenses.

Total Income per/Boat $7,500.00 pesos - $ 2,600.00 pesos for gasolina - $300 pesos from ice = $4,600.00 pesos  
$4,600/4 parts = $1,150.00/part
Therefore; the hose operator and engine operator make $1,500 each, each diver makes $1,150 pesos and the boat owner makes $1,150.00 pesos. Resulting in a total of 3000 kgs of sea cucumber as an average captured biomass per boat in a period of 12 granted days (Carta Nacional Pesquera, 2012), this results in a boat income of $90,000 before expenses.

The Ecosystemic Approach also contemplates socioeconomical aspects, reason why, a focused diagnose was implemented to improve the capture volumes and the dehydration process of the sea cucumber, in order to increase incomes and elevate the life quality of all fishermen in the activity, by means of a SWOT analysis with the following results:

**Strengths:** The own valid fishing permissions, all divers are certificated, they possess navigational charts and have complied with certified survival courses.

**Opportunities:** they can improve their efficiency in the drying process, by increasing the dehydration process from the degutted process until the last stage of sea cucumber of 5% humidity: increasing the drying process will give them the opportunity for better or more jobs and giving its product added revenue value.

**Weaknesses:** They solely depend on price arrangements from the buyer price declaration before season per/Kg and for a determined part of the process; they don’t have a complete dehydration cycle and neither a standardized drying process. They do not posses a solid residue treatment procedure or system from the degutted process and from the gray waters derived from reception of product, degutted, washing and boiling.

**Threats:** Red Tide, Cold Weather Fronts, not complying with what is established in their fishing permissions, reason why they can get fined or even loose the permission for capturing ad processing of this marine resource.

**Conclusion**

The amount of permissions given and the elevated number of licensed fishing boats for the commercial fishing of sea cucumber have overpassed the authorities and it is extremely difficult to control and vigilate. Reason why, it is necessary that responsible fishing and the active support and participation of all fishermen involved in this activity should be focused on complying and vigilating their quotas and regulations.

The Ecosystemic approach should include the active role and participation of fishermen and its representatives in the decision making for fisheries in the most sustainable manner, repercuting in a major population productivity, biodiversity conservancy and socioeconomical aspects.

The SWOT diagnose showed that mainly fishermen hold a great opportunity to standardized their product by a set dehydration process of the sea cucumber and sell it not only as sea cucumber under the first boiling, but also to take it up to dehydration standard of 5% humidity as dry sea cucumber final product.

**Acknowledgments**

We thank the “Federacion Regional de Sociedades Cooperativas Pesqueras, Turisticas, Acuicolas y Artesanales del Estado de Yucatan” and also the “Cooperativa de Pescadores de San Felipe”, for the facilities and help during the data intake and recollection for the SWOT analysis.

**References**
Small Scale Fisheries Systems in Brazil: From sustainability to the collapse

Maíra Borgonha (Universidade Federal Fluminense, Instituto Meros do Brasil)
Cassiano Monteiro-Neto (Universidade Federal Fluminense)

Local Ecological Knowledge is an important source of information to create strategies to biodiversity maintenance and management of resources from local and regional fisheries. In Brazil, since de 90’s Local Ecological Knowledge studies have been shown its importance through the implementation of participatory management and sustainable use of fisheries resources. This study aims to investigate the multiple aspects, which contribute to the cause of fisheries depletion three distinct places along the Brazilian coast: São Francisco do Sul (South - 26°26’S); Armação de Búzios (Southeast - 22°44’S) and Caponga (Northeast - 4°2’S). In each place the fisheries is the main living source of local people, which has been suffering with some aspects like changing technology, increasing of capture, absence of adequate management laws. The data collection has been based in participatory research using an Etnoecological approach. The comparative analyses are using Rapid Rural Appraisal techniques and Sustainable Livelihoods Approach as well. It is expected to find relations between aspects that shape and/or influence the depletion of these important mall scale fisheries systems.

Governability and fisheries in Lake Chapala: a challenge for law enforcement
Along its history Lake Chapala has suffered major changes related to environmental and, most recently, anthropogenic factors. These have had different impacts on the variety of activities carried out in this lake. Fishing activities are among the most important economic activities in this region suffering from these changes. This work aims to identify the socioeconomic impacts that some of these changes, such as pollution or water level fluctuations, have had on fishers’ population. Field work was carried out in 2103 in the rural community of Venustiano Carranza, Michoacán. Interviews were applied to fishers, and key informants in the social and governmental sectors.

Some of the major findings consisted in identifying luck of regulations or law enforcement in the lake, because it is lucking agreement among stakeholders, and even though law making has been vertically, it has favored one side of the activity through subsidies to increase the fishing tools and has neglected environmental conservation. This has resulted in an imbalance among environmental conservation and fishers’ economy; and has caused loss of state legitimacy.

Sharks, Sails and Smugglers: Fishing for new livelihoods in Eastern Indonesia

Vanessa Jaiteh, Centre for Fish, Fisheries and Aquatic Ecosystems Research, Murdoch University, 90 South Street, Murdoch, Western Australia 6150 and Asia Research Centre, Murdoch University, 90 South Street, Murdoch, Western Australia 6150
Carol Warren, Asia Research Centre, Murdoch University, 90 South Street, Murdoch, Western Australia 6150
Neil Loneragan, Centre for Fish, Fisheries and Aquatic Ecosystems Research, Murdoch University, 90 South Street, Murdoch, Western Australia 6150

Shark fishing has provided important livelihoods for several remote communities in Eastern Indonesia for over three decades. While recent declines in catches and shark fin prices call for effective management interventions, a severe lack of data impedes timely assessments of the fishery. We examined shark fishing practices and changes in fin prices over the past 15 years in three case studies from the Halmahera, Arafura and Timor Seas. While fishers observed a decline in target species since the early 2000s, they were primarily concerned about the ongoing fall of shark fin prices that began in March 2012. High-value species such as guitarfish, pigeye and sandbar sharks were particularly affected, losing 25-40% of their pre-2012 value. This change, combined with rising fuel prices, loss of fishing grounds, few attractive options for alternative incomes and restrictive debt relationships with patrons, has led some fishers to engage in unsustainable or high-risk activities such as blast fishing and people smuggling. Probably the most
urgent challenge therefore is to provide incentives for fishers to leave the fishery and pursue alternative, economically viable activities that carry lower environmental and personal risks. We argue that traditional methodologies for assessing fisheries that do not involve fishers are unlikely to be timely or effective in this setting. In contrast, involving fishers in the assessment of a data-poor fishery generates a comprehensive understanding of the circumstances that shape fishers’ decision-making. This provides information on the ecological and social requirements that must be fulfilled for management initiatives to be successful.

The impact of the insurance fishing closure on artisanal fishing of the south coast of São Paulo state (Brazil)

Jocemar Tomasino Mendonça - Instituto de Pesca – APTA/SAA/SP, Brazil, jocemar.mendonca@gmail.com
Alineide Lucena Costa Pereira - Instituto de Biodiversidade Austral, Brazil, alineide30@gmail.com

Abstract
In Brazil the public policy of fishing closure insurance was institutionalized in 2003 by the federal government that grants a minimum income to artisanal fisherman during the period of prohibition on fishing. This study evaluates the impact of public policy on fishermen of the south coast of São Paulo state. Data were collected at the period of 2002-2012 at Cananéia, Iguape and Ilha Comprida cities. Information about benefits, official register of fisherman, and fish landing in the region were obtained through interviews with fishermen. The average income of fishermen in the region is 1.3 times the minimum wage, and 53.4% fishermen received the benefit of fishing closure insurance in 2012 in the region. This benefit contributes on the annual income of the fisherman average of 27.9%. Of fishing closures insurance laws used to receive the benefit the spawning (fishing closure of freshwater fish) was the primary with 74.8% of cases, although these products represent only 1.7% of production landed in the region. There is a large discrepancy between the legislations used to receive the benefit of fishing closure insurance and the product landing in each city. The major problem encountered in granting the benefit is not the grant itself, but the issue of official register of fisherman (RGP) for those who can't prove the professional exercise of the activity or when it allows the fisherman to receive the benefit of fishing closure insurance of products that are not captured or captured in small quantities. The possible solution for this fact would be a significant improvement on fishing monitoring system (fishery statistics) so state or federal agencies can demonstrate the professional exercise of the activity by means of fish landing.

Introduction
In Brazil the public policy of fishing closure insurance was institutionalized in 2003, and grants the benefit of a monthly minimum wage during the fishing prohibition period of
certain species for artisanal fisheries. These closed periods are not treated as a punitive measure, but rather preventive, because the measure meets the need for renewal of aquatic species, and is an attempt to contribute to maintaining the sustainability of the fishing activity in future times (Ruffino 2005). Although this instrument imposes on fishermen stoppage with loss of income and economic power for some of them. The subsidy policy in the various production sectors has always been controversial because it brings immediate benefits, but in many cases can cause socio and environmental problems. In fishing this fact is no different, and have generated many problems in the sector, once high number of people who have been benefited from the secure closure have not its main annual gain from the capture of the species for which it requests the insurance (Mendonça and Lucena 2013). This study evaluates the impact of this public policy on fishermen of south coast of São Paulo state, Brazil.

Methods
Data were collected at the period of 2002-2012, at Cananéia, Iguape and Ilha Comprida cities, south coast the state of São Paulo, Brazil (Figure 1). Information were obtained through interviews with fishermen in the period 2009-2011. Information on insurance closures benefits were obtained in 2012 from the site of the Federal Govern (http://www.portaltransparencia.gov.br/defeso) which recording the number of beneficiaries, amount received by fisherman, by total state and total municipality. The information on the number of fishermen was obtained through the list of official records of fishermen set out by the Ministry of Fisheries and Aquaculture (www.mpa.gov.br) in 2012. Regional fisheries landings were obtained through the state fisheries monitoring program performed by Instituto de Pesca/APTA/SAA/SP at the period 2002-2012 (Mendonça and Cordeiro 2010).
Figure 1. South coast off São Paulo state, showing Cananéia, Iguape and Ilha Comprida cities.

Results
The total of 1316 fishermen were interviewed in the cities of the south coast of São Paulo, with a mean age of 45 years (± 0.3 years), whose families consisting of 4 people including two person who has income in the family on average. The average income of fishermen in the region is 1.3 times the minimum wage (± 0.5 wage), 53.4% of these fishermen have received the benefit of fishing closure insurance in 2012. This benefit contributes on the annual income of the fisherman on average of 27.9%, to Iguape city it represents a contribution of 37.2%, 20.8% to Cananéia and 25.0% to Ilha Comprida. According to federal government data the amount disbursed in the cities of the south coast of São Paulo for insurance closures payout was R$ 4,893,242.00 (US$ 2,194,278,92).

Of fishing closures insurance laws used to receive the benefit the spawning (fishing closure of freshwater fish) was the primary with 74.8% of cases, followed by closure of the catfish (18.8%), oyster (2.7%), seabob shrimp (2.2%), mussels (0.8%) and crab (0.7%). In each municipality were differences on the choice of legislation used, as shown in Table 1.

In each municipality of the south coast of São Paulo state artisanal fisheries have different predominant products landing, to Cananéia Seabob shrimp (*Xiphopenaeus kroyeri*), Oyster (*Crassostrea brasiliana*) and Mullet (*Mugil liza*) totaling 63.4% of the average production for the period; to Iguape Broadband anchovy (*Anchoviella lepidentostole*) and Catfish (*Genidens barbus*) totaling 76.8%; to Ilha Comprida King weakfish (*Cynoscion atricauda*), Whitemouth croaker (*Micropogonias furnieri*), mullet and mixture amounted
52.2% of average production landed. The mixture is a category of landed product that brings together different types of fish of low commercial value.

Table 1. Percentage of fishing closures insurance laws used to receive the benefit at south coast of São Paulo state in 2012. (*Spawning is the set of species of freshwater fish that perform migration to reproduction).

<table>
<thead>
<tr>
<th>LAWS</th>
<th>CLOSURES PERIODS</th>
<th>South coast</th>
<th>Cananéia</th>
<th>Iguape</th>
<th>Ilha Comprida</th>
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<td>Portaria SUDEPE N-42, 18 de outubro de 1984 (Catfish)</td>
<td>January 1 to March 31</td>
<td>18.8</td>
<td>73.7</td>
<td>0.2</td>
<td>27.9</td>
</tr>
<tr>
<td>Portaria SUDEPE N-40, 16 de dezembro de 1986 (Oyster)</td>
<td>December 18 to February 18</td>
<td>2.7</td>
<td>11.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Portaria Nº 52, 30 de setembro de 2003 (Crab)</td>
<td>October 1 to November 30</td>
<td>0.7</td>
<td>3.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Instrução Normativa Nº 105, 20 de julho de 2006 (Mussels)</td>
<td>September 1 to December 31</td>
<td>0.8</td>
<td>3.4</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Instrução Normativa Nº 195, 2 de outubro de 2008 (Spawning *)</td>
<td>November 1 to February 28</td>
<td>74.8</td>
<td>0.5</td>
<td>99.8</td>
<td>67.2</td>
</tr>
<tr>
<td>Instrução Normativa Nº 189, 23 de setembro de 2008 (Shrimp)</td>
<td>March 1 to May 31</td>
<td>2.2</td>
<td>8.5</td>
<td>0.0</td>
<td>4.9</td>
</tr>
</tbody>
</table>

The products that are included in the fishing closures insurance laws are catfish (*Genidens barbus*), oyster (*Crassostrea brasiliana*), crab (*Ucides cordatus*), mussel (*Perna perna*), seabob (*Xiphopenaeus kroyeri*) and spawning (fish many fresh water). The table 2 shows the percentage contribution of these products in the average south coast landings and each municipality in the period 2002-2012. Observed that major legislation followed in the insurance-closed (Instrução Normativa No. 195, 2 de outubro de 2008, the spawning closure) represents only 1.7% of the landing average for the south coast of São Paulo.

Table 2. Percentage contribution of products that are included in the fishing closures insurance laws in the total of landed products for each municipality of the south coast of São Paulo in 2012.

<table>
<thead>
<tr>
<th>Landing Product</th>
<th>South Coast</th>
<th>Cananéia</th>
<th>Iguape</th>
<th>Ilha Comprida</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catfish</td>
<td>7.6</td>
<td>4.8</td>
<td>9.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Oyster</td>
<td>6.3</td>
<td>17.0</td>
<td>0.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Crab</td>
<td>2.5</td>
<td>3.1</td>
<td>2.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Discussion

Since the mid-1980s the fishing sector has entered into crisis forcing the artisanal fishermen to diversify their sources of income, with multiple activities or leaving the activity. In this context, the benefit of insurance closures has contributed to reduce the abandonment of activity because it guarantees a minimum income. Apart from decrease the exploitation of resources, it also acts as a buffer, delaying the definitive cessation of activity (Capellesso and Cazella 2011).

The amount of insurance-closures beneficiaries in the south coast of São Paulo state (53.4%) is lower compared to the number found in the country, 62% in 2011 (Mendonça and Lucena 2013). The insurance-closures legislation (Lei No. 10,779, 25/11/2003), encompasses not only the fisherman themselves, but their families, once the benefit is targeted to families living in the household economy so many women have the right to receive the benefit. This law is widely used in this region.

Since its implementation the insurance-closures benefits have been increasingly accessed by fishermen, and today is an important economic component in family income. In municipalities of São Paulo south coast the amounts received by insurance-closure contributes with 27.9% of family income on average, in Iguape city this contribution reaches 37.2%. This largest contribution in Iguape is due to the insurance-closures legislation most used in the city (Instrução Normativa No. 195, 2 de outubro de 2008), which performs four payments to a closures period of four months for fish spawning.

Studies in other regions of Brazil demonstrate that the insurance-closures benefits could reach 48.8% of the total annual income of the family as in the coast of Santa Catarina State (Capellesso and Cazella 2011) or 15-30% of household income of most fishermen families from the state of Paraíba (Mendonça and Lucena 2012).

Due to this increasing importance in the contribution of family income, a significant number of fishermen and non-fishermen seek to regularize themselves in order to obtain the benefit, generating an increase in the numbers of the official register of fisherman (RGP) every year. This has been observed since 1999, when the rules for obtaining the insurance have changed, facilitating the access (Teixeira and Abdallah 2005) one of the biggest motivators for performing this registry is the favorable rules for fishermen contribute to retirement (as special insured) fueled by the lack of government control over the fishing activity. This context leads many people to register in the colonies (non-governmental institutions that represent the fishermen), undertake the payment of the colonies fees some time, getting retirement as special insured, even not exercising the fishing. Although some colonies try to create more stringent criteria for accepting new members, but there is still a lot of pressure, including political pressure, so that new registrations are accepted (Marinho 2009).
Due to the lack of control in the issuance of documents for the fisherman registration and in the insurance-closure processes, there is a large discrepancy between the legislations used for obtain the insurance-closure benefits and the product landing in each city, resulting in obtaining insurance-closure benefits of products that are not captured by fisherman or fishing in small quantities. This problem is generated mainly by the lack of control of the production of each fisherman, making it almost impossible to prove precisely who actually practice fishing.

While it is legitimate to benefit artisanal fishermen, and a victory achieved over many years (Lourenço et al. 2006), many accusations of fraud arise throughout the process. One of the most common problems is the grant of the official register of fisherman - RGP (Maia 2009), which do not require proof of the exercise of the activity of fishing as the main livelihood of the fisherman. In 2012, the federal government attempted to prevent abuse in obtaining insurance-closure benefits with an annual and compulsory re-registration of fishermen (Instrução Normativa MPA No. 6, 29 de junho de 2012), but it has not been possible to visualize their effects yet.

The possible solution for this fact would be a significant improvement on fishing monitoring system (fishery statistics) so state or federal agencies can demonstrate the professional exercise of the activity by means of fish landing. The south coast of São Paulo state has a very accurate and wide monitoring system (Mendonça and Cordeiro 2010), with the possibility of issuing proof of fishing production and therefore of the exercise of the activity. Such a system could help contribute to the legitimacy of fishermen and reduce the problems of fraudulent information, a fact of great concern both for the fisheries sector and public institutions involved.

References
Proposal for use ecological indicators for the evaluation of the shrimp fishery in the south-central portion of the state of Veracruz

Angel Morán-Silva (Instituto de Ciencias Marinas y Pesquerías, Universidad Veracruzana)
Ma. de Lourdes Jiménez Badillo (ICIMP, Universidad Veracruzana)
Sergio Cházarro Olivera (FES Iztacala, UNAM)
César Gabriel Meiners Mandujano (ICIMP, Universidad Veracruzana)
Gabriela Galindo Cortes (ICIMP, Universidad Veracruzana)

Shrimp trawl generates an environmental impact on the ecosystem, as a multispecific trawl and nonselective, therefore, bycatch (FAC) is extracted. It has been estimated that for every kilo of shrimp caught, are caught and discarded between 10 and 25 kg of FAC. One aspect that has been poor studied is the shrimp fishery relationship to environment. As part of the impacts generated by this activity are habitat modification, the impact on the species considered as FAC, alteration of community structure and the alteration of the renewal rate and recruitment. The study of the fishery has been dominated by the technical-biological point of view, and would get aside having this fishery interactions with the environment and the problems it is derived. In this sense, it becomes essential to promote and initiate studies that integrate technical, fishery and ecological aspects, like social and economic through the generation of indicators to provide a comprehensive assessment of the shrimp fishery components. The overall objective of this study is to analyze which integrates the ecological, social and economic aspects of the shrimp fishery in the south-central portion of the state of Veracruz, through the use of indicators to propose a model evaluation of the fishery to assist decision making.

Variations in abundance and species composition of penaeid shrimp (Farfantepeaenaeus spp.) in the coastal lagoon of Celestun, Yucatan, Mexico

Jorge A. López-Rocha (Unidad Multidisciplinaria de Docencia e Investigación Sisal, UNAM)
Gaspar Poot-López (Universidad Autónoma de Yucatán)
Iván Velázquez-Abunader (Centro de Investigaciones y de Estudios Avanzados, Unidad Mérida)
Shrimp fishery in Celestun lagoon represents an important economic and subsistence food resource for its residents. The objective was to compare the abundance and species composition of the shrimp catch of the artisanal fishery of Celestun lagoon, the first which was recorded in 1997 with the other which was observed in 2011, as a key element in assessing the fishery development. The information of abundance and species composition of shrimp in 1997 was obtained from published studies. In 2011 a campaign of monthly sampling was performed using a similar scheme that was developed in 1997, comprising three hydrological zones of the lagoon (seaward, middle and inner) and using the same fishing gear. The results showed that the species composition in 2011 involve four species; Farfantepenaeus duorarum (57%), F. brasiliensis (40%), F. aztecus (1%) and F. notialis (2%). Such results represent a significant change with the species composition recorded in 1997 in which the composition was 31.5%, 25.1%, 22.4% and 9.3% respectively. Also, a notable change was observed in the abundance by zone, while in 1997 the seaward area contained 52% of the total abundance of the lagoon, in 2011 this area accounted for only 5% of the total abundance. It is suggested that major environmental changes that have occurred in the period of 14 years in this coastal lagoon are the main factors involved. Mainly a marked decrease in submerged aquatic vegetation was observed in the seaward zone. The knowledge generated is relevant to understand the development of the fishery.

Characterization of small-scale artisanal fisheries in Angra dos Reis (RJ), Brazil

Fausto Silvestri
Genaro Barbosa Cordeiro
Tiago Oliveira Menezes
Leide Daiana Carvalho Barbosa
Débora Oliveira Paula
Francyne Carolina dos Santos Vieira
Fundação Instituto de Pesca do Estado do Rio de Janeiro - FIPERJ
Angra dos Reis (RJ), Brazil

Small-scale artisanal fisheries in Brazil constitute an important source of food and employment for coastal communities. Despite this function, for many coastal areas such as, Angra dos Reis (Rio de Janeiro State), these fisheries have been overshadowed by industrial fisheries (e.g., those targeting sardines). Under this scenario, industrial fisheries have increasingly attracted government incentives while small-scale fisheries have been neglected for decades. Until 2011, only the landings of industrial fisheries were recorded and there was no reliable information available for the small-scale fisheries. Throughout
2013, direct and structured interviews were undertaken in the six main ports of Angra dos Reis with the aim of characterizing small-scale fisheries with respect the number of landings, captures, vessels and fishermen. The results showed that the small-scale fisheries represent 64.4% of total landings while contributed only 31.4% of total catches (industrial and artisanal). 153 different small vessels were registered, totaling 2,114 landings. Driftnets, double-rigged shrimp trawls, and trap-nets were the main fishing gears, representing 98.8% of total catches. Sardine (Sardinella spp.), mackerel (Scomber spp.), blue runner (Caranx spp.) and miscellaneous shrimp (genus Farfantepenaeus, Xiphopenaeus and Litopenaeus) were the main resources captured in 2013, representing 8,867, 1,111, 177 and 105 tons, respectively. The local representation hold 684 fishers and provide support to governmental registration and licenses. The results represent an important tool for stakeholders by demonstrating the need for equal distribution of governmental resources and the implementation of public polices to help manage the small-scale fishing sector.

Productivity and economic development of the Arapaima spp. management in the Amazon Basin

Ellen Amaral (Universidade Federal do Tocantins)  
Oriana Almeida (Universidade Federal de Pará)

Since its creation, the Sustainable Development Reserve of Mamirauá (RDSM) has worked as a laboratory of natural resources management experiments. Inserted into the flooded forest in the Brazilian Amazon basin, the Mamirauá is a protected area where is allowed for local populations to use natural resources following a management plan. One of the main focus of this conservation efforts is the Pirarucu (Arapaima spp.), one of the most important and overexploited fish in the Amazon. Pirarucu management project has been developed in Mamirauá and its neighbors Reserve, Amanã RDS, since 1999. This study had the objective to evaluate the development and economic performance of the pirarucu management as a viable economic alternative, since the involved population lives in poverty. A questionnaire with 104 questions was applied to 20% of the total fishermen. In 2008, all the regions presented positive results. Average costs of pirarucu per kilo was US$1.03. The main costs were labor (as costs of opportunity) and expenses regarding with fuel and association fees. In relation to returns per fishermen, there was a average of US$730.36±615.15 per 2 months of work in the year. Price of fish was US$2.08. The management increased the fisheries productivity per capita and the fishermen income. Moreover, the management promoted economic development that is contributing to increase the fishermen interest on this initiative.
Let’s put the “pisces” together: introducing the Information System on Small-scale Fisheries (ISSF)

Rodolphe Devillers, Randal Greene, Arnaud Vandecasteele and Ratana Chuenpagdee
Department of Geography, Memorial University of Newfoundland, Canada
(rdeville@mun.ca; rgreene@mun.ca; avandecasteele@mun.ca; ratanac@mun.ca)

Abstract
Despite their importance to most coastal societies, small-scale fisheries are relatively poorly understood compared to large-scale fisheries. While detailed studies exist locally, information on SSF is often scattered and fragmentary at national or international levels. Such lack of integrated view of SSF contributes to their marginalization in policies. This paper presents the Information System on Small-scale Fisheries (ISSF), a major international initiative led by the “Too Big to Ignore” (TBTI) project that aims to capture, manage and share small-scale fisheries knowledge from around the world in an unprecedented way. ISSF provides a Web platform supporting crowdsourcing of small-scale fisheries data, allowing relevant stakeholders to submit information and anyone to search and visualize information such as researchers and organizations, scientific literature and profiles of small-scale fisheries in different geographies.

Introduction
The majority of the world’s fisheries are small-scale. According to the Food and Agriculture Organization (FAO 2013), small-scale fisheries contribute about half of the global fish catches and employ more than 90% of the world’s capture fishers and fish workers. Their contribution to poverty alleviation, food security and sustainable livelihoods, particularly at a community level, is well recognized (Béné 2006; Pauly 2006; Chuenpagdee 2011). Despite their tremendous social, cultural, and economic importance, these fisheries have been largely marginalized, ignored or dismissed as relics of the past. In many countries, this marginalization is shown by inadequate financial, institutional, and scientific support for small-scale fisheries, and an under-representation of the concerns of people working in this sector in policy discussions (Jacquet and Pauly 2008; Teh et al. 2011). Nevertheless, for the most part, the small-scale fisheries sector is relatively poorly understood and information on small-scale fisheries tends to be scattered and fragmented geographically. This is partly due to the diversity and complexity of the sector, when compared to large-scale fisheries, but also results from the fact that most of the research and management focus on large-scale, industrialized fisheries. Only recently that small-scale fisheries receive greater attention, particularly at the international level (FAO 2014).
This paper presents the Information System on Small-scale Fisheries (ISSF), a major international initiative that aims to capture, manage and share small-scale fisheries knowledge from around the world in an unprecedented way. The ISSF is an initiative of the “Too Big to Ignore” (TBTI) project, an international network involving more than 60
scientists and 15 partner organizations from 30 countries that aims to globally elevate the profile of small-scale fisheries. TBTI argues against the marginalization of this sector in national and international policies, and develops research and governance capacity to address global fisheries challenges. ISSF was developed to help achieve this goal by providing information on SSF to policy and scientists.

Methods
The ISSF design results from two years of consultation with scientists and partner organizations that helped identify information that could support science and policy, as well as available data sources that could contribute to the system. A variety of design alternatives have been put forward using data models, use-case descriptions, mock-ups and prototypes. These have been discussed and debated at numerous forums by TBTI members and collaborators and by TBTI Working Group leaders. With such a broad constituency, the resulting information system could not possibly reflect all ideas and information requirements. However, ISSF includes a number of key datasets and functionalities, and is built on a flexible architecture that can allow its expansion if needed.

To populate the database, some of the preliminary data collection has been conducted using online surveys to capture information on different aspects of small-scale fisheries (e.g. “Who’s Who in Small-Scale Fisheries Research survey” capturing information on researchers around the world interested in SSF). Once in ISSF, data can be enriched through the ISSF crowdsourcing tools, allowing anyone that has information on small-scale fisheries to enter new data or edit data they have entered in the past.

An extensive consultation exercise has also been conducted over two years to identify key attributes describing characteristics of small-scale fisheries. This process combined an extensive review of existing descriptions with a Delphi-like process allowing experts to iteratively come to an agreement on a smaller list of key attributes. Those key attributes will be the core characteristics describing small-scale fisheries in geographic profiles (e.g., country), and have been organized into four categories: economic (e.g., value of landings), ecological (e.g., habitat importance), socio-cultural (e.g., participants’ dependence on fisheries) and governance (e.g., the management instruments used). This core set of attributes will serve as a common basis to the collection of new data from cases studies around the world.

For capturing and searching information about existing case studies, publications, projects, organizations and fisher/community experiences, a common set of descriptive theme and issues were developed and divided into the same four categories. These themes and issues are akin to keywords in citation databases or search tags in news-oriented websites. The mechanism for specifying themes and issues, both during data entry and when searching for data, is checking items in a standard list. Users can suggest “other” themes and issues not currently on the list, and popular suggestions will be added to the standard list.
All data on small-scale fisheries are linked to locations using a flexible geography that allows any information to be attached to a geographic scope ranging from a specific location (e.g. community) to a large region (e.g. a continent). Such flexible geography, combined with support of temporal information, provides a powerful framework for describing small-scale fisheries that can support complex analyses of the data and comparisons across space and time.

**Results**

Some of the core components of the ISSF are operational and publically accessible on the Web through the TBTI Website (http://toobigtoignore.net). Data that will be available from ISSF include small-scale fisheries profiles (e.g. regional or country profiles), a state-of-the-art review of the literature, information on researchers and organizations involved in or supporting small-scale fisheries, location and details about case studies, etc. While ISSF will be expanded in the coming years to provide additional datasets and new tools, users can at the moment explore and search the database using a map or a table view (Figure 1), export selected data to text (CSV) or Google Earth (KML) files for further analysis in third-party software, view and print reports for specific small-scale fisheries entries.
Conclusions
This paper introduced the Information System on Small-scale Fisheries (ISSF), the first global repository of small-scale fisheries data, providing information on various aspects of small-scale fisheries, including data profiles on various countries or regions, a state-of-the-art review of the small-scale fisheries research, information on researchers and small-scale fisheries organizations. ISSF has been populated with core data collected from earlier studies or using online surveys but its success will largely depend on its ability to mobilize the small-scale fisheries community and capture its knowledge of the different facets of this sector, in a hope to provide a more complete view, better understanding and recognition of small-scale fisheries around the world.

Acknowledgements
Thanks are due to all of the members of TBTI Working Group 1 for their continuous help with the design of the ISSF, as well as many other TBTI members and the working group leaders for their feedback and data contributions through online surveys and other consultations. We are also grateful to the Canadian Social Sciences and Humanities Research Council (SSHRC) for funding ISSF through the TBTI project.

References

Plenary 3: Food, rights and governance

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Right to food, food security and small-scale fisheries: Concepts and linkages

Alejandro Flores, Food and Agriculture Organization of the United Nations, Chile

The right to food was reaffirmed by heads of states and governments in 1996 through the declaration of the World Food Summit, stating that it is everyone’s right to be free of
hunger and to have access to safe and nutritious food. This summit also recognized the urgent need to advocate and make every effort to reach food security, which was defined as the condition in which all persons have permanent access to sufficient safe and nutritious foods to satisfy daily dietary needs to have a healthy and active life. Within the context of improving food security, the provision of fish as a main source of protein already plays a paramount role in many countries around the world, particularly those of Asia and the Pacific Island States. Other regions such as Africa, where undernourishment is still a major problem, SSF and SS-aquaculture though offering a high potential for its reduction, still face many technical and legal problems. In Latin America, where some 47 million people are still chronically hungry, the potential of SSF is still hampered by weak institutional sectorial arrangements. However, increased recognition of the importance to safeguard food rights and food security in these regions, is beginning to include SSF and SSAq within right to food and food security legislations and policies.

The health and well-being of fishers in Australia
Tanya King, Deakin University, Australia

Abstract - The health and well-being of fishers in Australia - as elsewhere - is complicated by many factors that are specific to the industry. This presentation describes a research project in which the industry attitude to physical and mental health issues are explored. The project makes a number of distinctions that help to clarify the challenges to fisher health and well-being, including the difference between 'symptoms' and 'stressors', as well as between stressors that are 'traditional risks' and those that are 'modern uncertainties'.

Co-management of coastal fisheries in the Pacific Islands: Defining roles and prioritizing actions to move forward
Hugh Govan, Locally Managed Marine Areas Network, Fiji

Abstract:
The importance of coastal fisheries in the Pacific Islands, while self-evident, is only slowly being recognized in regional and national policies. Community-based management has long been identified as a fundamental building block and large scale uptake of these approaches have been demonstrated by the LMMA Network across more than 500 communities. But in a region with nearly 10,000 such communities there is an urgent need for coherent national approaches to small-scale fisheries management. While lack of policy, capacity and finance are often proposed as obstacles to progress this presentation explores experiences in strategic implementation that look promising for providing core national fisheries management services within existing constraints.
Further detail:
Inshore fisheries upon which the majority of coastal populations depend are generally fully exploited, or in some cases, over exploited. Increases in population and demand will drive many of them to collapse unless ways can be found to manage them sustainably. The majority of the population of Melanesia is dependent on inshore fisheries for their subsistence and local economic needs. This high reliance on inshore fisheries is exacerbated by the limited alternative opportunities and increasing external pressures which have already driven the most valuable fisheries such as bêche-de-mer into a spiral decline of boom and bust. Climate change will increase vulnerability and management strategies are urgently needed to increase resilience and adaptive capacity. Elements of the way forward have been identified but strategic and effective implementation is still lacking:

Communities: The more than 10,000 Pacific Island communities have traditionally been stewards of their land and coastal marine resources and as predicted by Johannes (2002) have been able to demonstrate potentially viable hybrid approaches to managing SSF that build on this - usually with the help of NGOs. However, this fundamental building block for SSF management has not been adequately harnessed in national approaches (Govan et al 2009).

Policies: Regional and national policies have increasingly incorporated SSF and especially, community based management of SSF. Countries with policy or legislation that reflects community co-management of SSF include Samoa, Solomon Islands, Vanuatu, Fiji and PNG. Regional policy includes the Apia Policy (2008) and the sub-regional initiative covering Melanesia where the bulk of the Pacific Islands' population reside - the MSG Roadmap for the Protection of Inshore Fisheries for Food Security. However, the policies have not resulted in significant, if any, advances in co-management of SSF (Govan 2013a, 2014; Pratt and Govan 2010).

Institutions and capacity: While it is true that the formal fisheries management institutions are under-funded and short-staffed it appears that the major challenges reside in identifying the appropriate roles of communities and government to co-manage Pacific Island fisheries and strategically deploying the available resources to maximum effect. Strategic implementation - just doing it: The most promising advances seem to be emerging from concerted discussions between fisheries officials and community leaders and their supporters relating to the fundamental roles and responsibilities of each party in co-managed fisheries. From this some practical initiatives have emerged that bear promise and above all seek to avoid adding to the un-implementable weight of increasing policy, strategies and legislation. The shift needed and being trialled is towards strategic and actionable workplans with specific tasks assigned and devolved to staff at the lowest appropriate level (Govan 2013bc).

Special session 3.1: Outcomes of neoliberal policies on small-scale fisheries: what the narrative doesn’t tell us
Organized and chaired by: Evelyn Pinkerton, Simon Fraser University, Canada

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<td>Thirty years after privatization: Opportunities and constraints in fisheries livelihoods in Iceland</td>
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<td>Abigail Bennett</td>
<td>Cooperatives, fish buyers and pepineros: Geographically differentiated effects of neoliberal policy reform on local responses to globalized market pressures in Mexican small-scale fisheries</td>
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<td>K.Kuperan Viswanathan</td>
<td>Neoliberalism and fisheries subsidies, where do small-scale fishers stand?</td>
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<td>Neil Ladell</td>
<td>Analyzing the potential for integrating the Canadian government’s intertidal clam fisheries management plan and local aboriginal management principles in the Broughton Archipelago</td>
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<td>Jessica MacIntosh</td>
<td>The Tragedy of the Independent: Public Policy and Traditional Recruitment in Nova Scotia’s Small Boat Fishery</td>
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<tr>
<td>Evelyn Pinkerton</td>
<td>How are small-scale fisheries faring in under ITQ systems internationally and what does the future hold?</td>
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Discussion of questions developed in common

**Session length:** 1.5 hours  
**Session time:** Thursday  
**Session format:** 5 min presentations by 7 participants followed by discussion of questions developed in common.

Questions to be addressed, in priority order:

1. How do neoliberal policies affect SSFs and their communities (social capital, cultural and social relations, local institutions, governance of fishing, quota allocations, subsidies, financialization of environmental conservation)? What are the costs associated with these effects?

2. How have neoliberal policies in the context of small-scale fisheries evolved or taken different forms over time? Are effects cumulative, permanent, or path-dependent?

3. Are there any opportunities for positive outcomes for SSFs within a neoliberal framework? How can local institutions resist or mediate the effects of neoliberal policies?

**Session Synopsis:** Six presenters reporting on case studies in Malawi, Malaysia, Mexico, Iceland, and Canada, together with one presenter considering policy issues affecting all these cases, examine the impact of neoliberal policies on small-scale fisheries. A number of common themes emerge in these papers, including: (1) the ability of some local institutions to resist or mediate the effects of neoliberal policies and (2) the disconnect between neoliberal discourse about policy objectives and the reality faced by small-scale fisheries governed by neoliberal policies. Among the effects of neoliberal policies, the papers consider: (a) the effect of subsidies and withdrawal of subsidies on the economic conditions faced by SSFs, (b) the financialization of environmental conservation through
the unaccountable role played by NGO donors, (c) the downloading of costs onto co-managing communities inhabited by small-scale fishermen, (d) the barriers to assuming actual power-sharing faced by small-scale fishermen’s organizations, (e) the impacts of inequitable initial quota allocation to small-scale fisheries, and (f) the costs associated with the loss of coastal community livelihoods.

Thirty years after privatization: opportunities and constraints in fisheries livelihoods in Iceland

Catherine Chambers, University of Alaska Fairbanks, USA / Blönduós Academic Center, Iceland. cpchambers@alaska.edu

The majority of fisheries in Iceland are governed under the nationwide privatized quota system first instituted in the 1980’s. Much has changed - economically, politically, and culturally - in Iceland since that time, yet the quota system remains a topic of serious debate. Fisheries privatization had and continues to have serious impacts on rural communities and small-scale fishing operations, and the constitutionality and ethic of the quota system are often questioned. Although access to fisheries is still largely limited, there are a handful of opportunities for fishers to commercially fish outside the quota system in small-boat seasonal fisheries. This research compares individuals engaged in non-privatized small-boat fisheries with those participating in the small-boat privatized fisheries in an effort to better understand the opportunities and constraints that varying management schemes have on the cultural dimensions of fisheries. This paper presents the results of a nationwide survey of small-boat fishers exploring themes of job satisfaction, conservation, management processes, and family and community relationships. Preliminary analyses show the complexity of the lives of fishers, who tend to be engaged in multiple management systems over time within a wide range of boat sizes, home ports, and species. The nuanced variation in motivations, experiences, and attitudes of Icelandic small-boat fishers serves as a reminder of the dynamic nature of fishing livelihoods and reinforces the need for culturally-appropriate and equitable fisheries management schemes.

1. Introduction

The vast majority of fisheries in Iceland are privatized in an Individual Transferable Quota (ITQ) system, in which the right to fish is a limited and tradable commodity. The economic logic behind privatization rests on the notion that individuals are fully engaged in competitive profit-seeking behavior, to the point that without private property rights and boundaries, effort will flood into non-privatized fisheries until all potential profits are dissipated, thereby destroying long-term sustainability of the resource (Árnason 1995; Christy 1996; Hannesson 2005, Scott 1999). Privatized fisheries management schemes therefore assume one specific cultural logic regarding motivations for engagement in fisheries - individuals are inherently self-interested and the absence of top-down control will bring ruin to commonly held resources. However, this logic may not apply to some
small-scale fishers; after implementation of the privatization system, many small-boat owners felt forced to sell out of the system, and public discontent with the equity of privatized fisheries continued to grow (Eyþórsson 2000; Karlsdóttir 2008; Pálsson and Helgason 1995; Skaptadóttir 2007; see Olson 2011 for a review of social impacts of fisheries privatization around the world). Eventually the small boat ITQ fisheries were split from the large-scale industrial ITQ fisheries to counteract the accumulation of quota. Additionally, in 2009 the Icelandic Ministry of Fisheries instituted a new quota-free small-boat *strandveiðar* or “coastal fishing” season in an effort to bolster rural seasonal employment and offer access to traditional fishing lifestyles that the privatized ITQ system had severely limited. Despite these efforts to support small scale fisheries, displeasure with fisheries management and politics continues to grow and is often expressed in national media (Benediktsson & Karlsdóttir 2011, Einarsson 2011). This research explores variations in characteristics, attitudes, and experiences of small-scale fishermen in the three main small boat fishery systems in Iceland: the small boat privatized ITQ system, the new open *strandveiðar* option, and the stakeholder-managed lumpfish fishery that has always existed outside the quota system.

Increasingly, the creation of private property institutions to govern natural resources is replacing existing forest, agricultural, fishery, and wildlife commons arrangements around the world (Mansfield 2008; Zimmerer 2006). Common-pool resources and the common property regimes organized around those resources are converted into private property ownership systems, and this can change not only how humans interact with nature, but how people interact with each other (Carothers and Chambers 2012; Mansfield 2008; McCarthy and Prudham 2004). The privatization and commodification of the right to access natural resources is part of a larger push for market-based solutions to natural resource management and reflective of neoliberal assumptions about human behavior. However, around the world there is a wide variation of motivations for engagement in particular fisheries that exist beyond solely the generation of income and profit (Carothers 2010, Davis 1996), and the value of small-scale production and lifestyle fishing is an area of active social science research (Kooiman et al. 2005). For example, fisheries can be a way to make only a small amount of money without the intent to increase production or build up status, a flexible opportunity to maintain income in times of few options, and an activity that weaves together cultural and historic ties to a way of life not fully centered on commercial gain and full engagement in commercialized fisheries (Carothers 2010).

2. Methods

Data were collected with a nation-wide mailed survey that tested and explored themes gathered through earlier phases of ethnographic interviewing and participant observation. Mailed surveys were chosen as a compliment to qualitative research because they can collect detailed or complex information from a larger number of individuals and may minimize response effects based on the interviewer (Bernard 2006: 258; Salant and Dillman 1994). The Iceland Fisheries Directorate 2012 license database was used to produce a random list of 500 informants (44%) from the listed 1,145 unique addresses of small boat license holders (all species of long line, jig, and net boats under 30 GT). The 500 surveys were stratified to sample fishermen in the three main management schemes.
for small boats in Iceland: small boat quotas, lumpfish, and *strandveiðar*. Addresses affiliated with the large boat quota system (shrimp boats, purse seines, and pelagic and bottom trawlers over 30 GT) were excluded from the sample list. Additionally, crewmembers are not included in this database and therefore the survey sampled only license holders. The survey was made up of four sections: demographics and fishing participation, employment and community, fisheries management, and conservation and environment. Questions consisted of Likert scales, multiple choice, and open-ended responses.

3. Results and discussion: Highlights

Of the 500 surveys mailed, 21 were returned as undeliverable, and 164 were completed and returned for an adjusted response rate of 34.24% (14% of the total population of small boat license holders in Iceland). This response rate is similar to the average response from mailed surveys to targeted occupational groups in Iceland (25-35%) and therefore reflects a viable sampling process. Surveys were returned from respondents in the primary fishery groups in similar stratified percentages as were sampled (Table 1).

Table 1. Survey response.

<table>
<thead>
<tr>
<th>Primary Fishery</th>
<th>Database total</th>
<th>Surveys received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumpfish</td>
<td>142 (12%)</td>
<td>11 (7%)</td>
</tr>
<tr>
<td><em>Strandveiðar</em></td>
<td>460 (40%)</td>
<td>36 (22%)</td>
</tr>
<tr>
<td>Lumpfish &amp; <em>Strandveiðar</em></td>
<td>114 (10%)</td>
<td>49 (30%)</td>
</tr>
<tr>
<td>Small Boat Quota</td>
<td>206 (18%)</td>
<td>27 (16%)</td>
</tr>
<tr>
<td>Small Boat Quota &amp; Lumpfish</td>
<td>133 (12%)</td>
<td>16 (10%)</td>
</tr>
<tr>
<td>Small Boat Quota &amp; <em>Strandveiðar</em></td>
<td>48 (4%)</td>
<td>13 (8%)</td>
</tr>
<tr>
<td>All three systems</td>
<td>42 (4%)</td>
<td>12 (7%)</td>
</tr>
</tbody>
</table>

3.1. Respondent demographics and fishing participation

Respondents were on average 58 years old, male, and had over 30 years of fishing experience (Table 2). These characteristics are not surprising but do show the phenomenon of the graying of the fleet, as original quota holders stay in the system and new entrance is limited.

Table 2. Respondent demographics.

<table>
<thead>
<tr>
<th></th>
<th>Mea n</th>
<th>Mi n</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>58</td>
<td>21</td>
<td>80</td>
<td>12.9</td>
</tr>
<tr>
<td>Years fishing</td>
<td>33</td>
<td>2</td>
<td>61</td>
<td>15.</td>
</tr>
</tbody>
</table>
Individuals reported a mean of 3.2 generations of family engaged in fishing, however many responded with answers such as "since the 1800s," "from the beginning of Icelandic history," "since the oldest men remember," "all mine before and after," and sometimes simply "all." There were no differences between fishery group and generations fishing. Although we can see the importance of family history and cultural heritage present in small boat fisheries, only 30% reported earning all of their income from fishing, while another 26% reported earning less than 20% of their total yearly income from fisheries. Strandveiðar fishers earn significantly less money from fisheries than lumpfish/strandveiðar combined (p=.0001) or from quota fishers (p=.027). But there was no difference between lumpfish/strandveiðar combined, both fishery groups earn about 70% of their income from fisheries, as opposed to strandveiðar only at 45%.

Respondents tended not to identify with a particular species, cod being the most important in all fisheries systems. However, many individuals reported fishing multiple species, with multiple gears, and on multiple boats. 62% had been engaged in a different system in their lifetimes.

3.2. The job of fishing: Satisfaction, opportunity, and community

Respondents completed a Likert scale question set related to job satisfaction consisting of 12 aspects of job satisfaction found to be relevant in other studies (Pollnac & Poggie 2006). Job satisfaction factors loaded on three distinct components with a PCA analysis, aspects of the business of fishing (component 1), self-actualization (component 2), and fatigue (component 3) (Table 3).

Table 3. Job satisfaction principal components analysis.
There was no difference between fishery management systems with regard to overall job satisfaction. In response to the question "How often are you satisfied in your fishing job," the mean was in between "neutral(3)" and "often(4)" and there was no significant difference between demographics. In an open-ended response, fishermen explained that satisfaction to them meant being their own boss, and being able to provide for their families.

In response to "would you advise a young person to enter your fishery," respondents were split down the middle. "No" responses were more likely to come from those engaged in strandveiðar only, and respondents listed reasons such as low salary and "not worth the effort."

3.3. Management, science, and stakeholder participation.

In response to open-ended questions about management and science, there was a general consensus that it is not very easy for fishermen to get involved directly. A sense of helplessness permeated the responses with comments such as: "They are always changing the rules," and "We don’t make the rules." Fishers in all systems felt helpless in the decision-making process, and that rules regarding privatization were made to benefit large companies under the guise of caring for the fishery resource. As one man said during an interview, “Worrying about open access with small boats is like worrying that the women walking with the baby carriages will ruin the sidewalk” Additionally, there was report of significant "rule-breaking" by all the of the management systems, which may support the thought that privatization itself does not ensure care for the resource.

4. Conclusion: Key points

- A comparison of the open small-scale fisheries in relation to ITQ fisheries presented an opportunity to better understand the relationship between management and culturally specific dimensions of fisheries, and the ways varying management schemes affect people’s abilities to access resources and engage in culturally and historically important livelihoods.

- The privatized fisheries system continues to be a source of conflict at the community and national level, while the new quota-free summer fishery strandveiðar creates a new power struggles. While the multiple social, political, economic, and conservation goals in fisheries management are often complex, current conversations regarding fisheries privatization from the side of fishing families and rural communities often focus on equality, fairness and opportunity for marine-based livelihoods (Olson 2011). Private property can be an asocial, narrow view of how people organize around resources (Singer 2000). Property is intertwined with complex relationships between gender, class, political and
historical factors, among many others, and differences between people can become more apparent when access to fisheries is enclosed and some people are excluded from fisheries as in the case with Icelandic small scale fisheries.

- **The current management systems available do not allow for flexibility, which is a primary aspect of small-scale fishermen.** Resource-based livelihoods are influenced by natural, cultural, and economic factors as well as the social relationships associated with those factors. Having the flexibility to access different marine resources to make a living enables individuals to adapt to various political, social, economic and environmental situations. Access to natural resources, particularly in rural areas, is important not only because of generation of income but because individuals often have cultural and historic ties to resource-based livelihoods.

- **A revised management system needs to have avenues for stakeholder engagement and a transparent process.**

5. Selected references


Cooperatives, fish buyers, and pepineros: Geographically differentiated effects of neoliberal policy reform on local responses to contemporary market pressures in Mexican small-scale fisheries

Abigail Bennett, Duke University, USA. abigail.bennett@duke.edu
Xavier Basurto, Duke University, USA. xavier.basurto@duke.edu

Abstract
Local-level governance arrangements play an important role in determining social and ecological outcomes in small-scale fisheries. As small-scale fisheries become increasingly integrated into diverse processes of globalization, it is important to understand how local-level institutions governing resource use are shaped by broader political and economic dynamics. In Mexico, neoliberal policies during the 1980s and 1990s that encouraged private investment in fisheries and reduced support to fishing cooperatives reshaped the local institutional landscape of the country’s small-scale fisheries. These policies served to empower firms and fish buyers and undermined the role of fishing cooperatives. However, the localized effects of policy changes have not been geographically uniform. In many communities, fishing cooperatives retain an important role in resource governance while in other communities fish buyers and private firms predominate. Thus, two important questions arise regarding the interaction between local governance dynamics and external political economic processes. First, what mediating factors can explain the geographically differentiated effects of neoliberal policy changes in small-scale fisheries? Second, what are the contemporary implications of these differentiated effects for social and ecological outcomes? Reporting on a comparative case study of two small-scale fishing communities in Yucatán, México, this paper examines local and multi-level institutional responses to recent connections to global sea cucumber markets. The results suggest, first, that local resource users are capable of designing institutional solutions to maintain control of access and use of resources under market pressures. Second, institutional linkages with the State are necessary, but creating and monitoring those linkages presents a collective action problem to resource users. Third, the ability of local resource users to respond to markets and enlist State authorities is influenced by
locally-specific effects of neoliberal policies that have shaped the existing context within which fisheries actors engage with markets.

Introduction
In an era of increasing globalization, new markets can reach local fisheries so suddenly that existing governance institutions are unable respond to the high demand for resources in time to prevent overexploitation or collapse of the fisheries (Berkes et al., 2006). International markets for sea cucumbers serve as an alarming example of this trend. Sea cucumber markets have reached almost every region of the world (FAO, 2008), expanding outward over time from the primary source of demand in Asia and exhibiting typical boom and bust cycles that have accelerated since the 1960s into recent decades (Anderson et. al., 2011). What management responses are possible to mediate this fast-paced sequential exploitation of resources spurred by global market demand?

Incentives to design effective and contextually appropriate management institutions may exist among locally situated groups of resources users (Ostrom 1990), but such groups are often ill-equipped to deal with a sudden incursion of outsiders attempting to access the resources, as frequently results from new market pressures. When exogenous pressure on resources, for example from markets, threatens local fisheries, scholars often incite multi-level governance approaches as a key part of the solution (Berkes et al., 2006; Cinner & McClanahan, 2006; Cudney-Bueno & Basurto, 2009). However, in multi-level governance or polycentric regimes, in which there are multiple centers of power, decision-making, and interests across different levels, State actors may face incentives to encourage the proliferation of commercialization mechanisms or markets rather than help to regulate or limit harvesting pressure (Adger et. al., 2005; Agrawal, 2003; Robbins, 2000). Thus, although there is a role for the State to play in the governance of resources with high global demand, it remains unclear what that role should be and how the State and local resource users can form institutional linkages. The results below suggest that local actors play a key role in establishing and maintaining institutional linkages with the State, but neoliberal policies influence their capacity to do so.

Research methods
Co-author Bennett conducted field research in Yucatán, México from June to August, 2012 and August 2013 to July 2014, carrying out participant observation in the towns of Celestún and Río Lagartos, semi-structured interviews with fishing cooperative presidents from 10 towns in Yucatán, México, and a census of local fish buyers in Río Lagartos and Celestún.

Results
In Mexico, neoliberal policy changes have altered the local institutional landscapes of small-scale fisheries and the context in which resource users engage with domestic and international markets. Neoliberalization is often characterized by a diminution of State involvement in environmental governance and primary sector development. Beginning in the 1980s and further entrenched by 1992 amendments to article 27 of the 1917 Constitution, Mexican fisheries policy saw a number of changes that reduced subsidies
and loans to fishing cooperatives, encouraged private investment in fisheries, and opened up permits for species previously reserved for cooperatives to firms and individual entrepreneurs (Hernandez & Kempton, 2003; Young, 2001). In both Celestún and Río Lagartos, fishing cooperative leaders recall a time when subsidies were more plentiful and accessible and when cooperatives benefited from the higher lobster price paid by the now-privatized parastatal marketing firm.

Although the relative prominence of fishing cooperatives has decreased in Yucatán overall, these changes have not been geographically uniform. According to interviews with fishing cooperative presidents conducted during 2012, the two large fishing cooperatives of Río Lagartos have increased in membership size since formation while the smaller cooperatives of Celestún have decreased or remained constant in membership. Concurrent with neoliberal policy changes, Celestún experienced rapid population growth compared to that of Río Lagartos (Figure 1). Beginning in 1984, as part of a program to manage social and economic fallout from the failing henequén industry (an economically important agricultural crop) the government encouraged rapid expansion of the state’s fisheries. Celestún, located within Yucatán’s henequén zone, experienced the brunt of the resulting immigration (Fraga Berdugo, 1993). Río Lagartos, located in a region where ranching predominates, was relatively shielded from this demographic pressure. Table 1 shows the results from interviews with fishing cooperative presidents throughout the region, indicating that only cooperatives located in the state’s ranching zone and possessing formal rights to fish lobster have grown since formation. Despite neoliberal policy changes opening reserved species to private firms and individuals, lobster has, in practice, remained reserved for the cooperative sector. While table 1 reports on existing fishing cooperatives, a large fishing cooperative also operated in Celestún until it was dismantled the 1990s.

In Celestún, the decline of fishing cooperatives has been accompanied by a rise in the number of individual entrepreneurs and the persistence of two large firms. A census of fishing reception centers in the marina revealed a total of 77 fish buyers who possess capital inputs for fishing (e.g. boats and gear) and form patron-client relationships with fishers. The rate at which new fish buyers establish themselves has accelerated in recent decades (figure 1). Nearly 90% responded to operating with a fleet of 10 or fewer small-scale fishing vessels that each employ between two and four fishers per fishing trip. In Río Lagartos, nine fish buyers operate fleets of an average size of 12 fishing vessels.

In addition to differences in the organization and distribution of the fishing fleet among private entrepreneurs and fishing cooperatives, Río Lagartos and Celestún also differ in their local institutional responses to global sea cucumber markets. In short, the sea cucumber fishery in Celestún is characterized by a lack of control over access and use of the resource. During the most recent season in April 2014, while only 23 of the local fish buyers interviewed reported having permits to harvest and commercialize sea cucumber, 62 said that they were currently selling the product. Those buyers not involved in the sea cucumber fishery had voluntarily elected not to participate, explaining either that the investment in equipment and crew was not profitable due to low production, it was too
dangerous for fishers who were fishing farther from shore and risking diving-related injuries, or that religious beliefs prohibited them from taking part in poaching. Many fishers continue to work throughout the year, outside of the legal season, processing the product in hidden camps out of town and transporting it to buyers by sea or using bribes to bypass authorities on the highways. The fishery shows signs of over-exploitation, with fishers venturing to greater depths to find sea cucumber and switching to a lower-value species as more valuable stocks shrink. Cooperative leaders described failed efforts to control illegal fishing, including a blockade of the entrance to the marina and a vigilante group of men and women who carried out monitoring excursions but later succumbed to bribes by illegal fishers.

The sea cucumber fishery in Río Lagartos initiated in spring of 2013, almost three years after the first permits were issued in Celestún. It is characterized by greater local institutional control exercised by the two large fishing cooperatives in the town. Local fishers limit harvests of sea cucumber to within the short 14-day seasons. During the season, the cooperatives concern themselves with controlling the activities of local private permit holders. During the first season, cooperatives denied access to two buses of outside fishers brought by a local fish buyer. By the beginning of the second season later that year, the fishing cooperatives had convened a meeting with all permit holders to create new rules for the fishery, setting limits on the number of boats that each permit holder could dedicate to fishing and prohibiting fishers from taking any fishing gear apart from what is necessary to harvest sea cucumber in order to prevent poaching of other valuable species. Controlling outsiders and illegal harvesting of the resource is costly, requiring constant vigilance by cooperatives. For example, fishers missed the first day of the December 2013 season, as cooperative members created an overnight boat blockade in response to the sudden arrival of hundreds of unpermitted boats. When members observe illegal fishers, the cooperative sends a small group of boats to capture illegal fishers and turn them over to authorities. Throughout early 2014, cooperative leaders made multiple trips to the state capitol and México City in order to petition the assistance of authorities in combatting illegal fishing, with no substantial results. Thus, any monitoring and enforcement of illegal fishing continued to be carried out unilaterally by fishing cooperatives. However, on June 11th, when violence between local cooperatives and illegal fishers escalated, a highway blockade led by fishing cooperatives spurred negotiations with the state and federal government that, for the first time, resulted in effective monitoring and enforcement by state and federal fishing authorities.

Discussion
The capacity of Celestún and Río Lagartos to respond to the arrival of new-high demand markets for sea cucumber was influenced by the distinctive institutional landscape of each community, differences that need to be understood within a broader context taking into account development of fisheries policy beyond the community level. As neoliberal changes to the country’s fisheries reduced support to cooperatives in general, those with access to the valuable lobster fishery and subject to relatively lower demographic pressure were able to prosper. Neither access to lobster or low demographic pressures itself was sufficient, suggesting that state-level policies manifest in a variety of permutations
depending on locally differentiated institutional-geographical configurations. The continued presence of large cooperatives in Río Lagartos meant that arenas within which institutional innovations could be designed and implemented were already in place. The much more fragmented fishing fleet in Celestún proved intractable to implementation of institutional methods to control harvests. In addition, the formation of institutional linkages with State authorities in Río Lagartos was the result of local forms of collective action and active political engagement by local leaders funded and organized by the fishing cooperatives. This comparative study suggests that multi-level linkages with the State become important to control new market pressures, especially as power struggles within the local level and with outsiders escalate to violence. However, incentives for State authorities to enforce regulations may not exist, placing the onus on local-level actors of to create and maintain such linkages. In the case of Yucatán sea cucumber fisheries, the capacity to overcome costly collective action to create multi-level institutional linkages was shaped by local manifestations of decades of State fisheries policy changes. In some cases, neoliberal policies provided a context in which individualist rather than collective forms of organization flourished producing a fragmented fishing fleet incapable of responding quickly to new market pressures.

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Zone</th>
<th>Formal rights to lobster</th>
<th>Increase in membership</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Cuyo</td>
<td>El Cuyo</td>
<td>Ranching</td>
<td>Yes</td>
<td>Yes</td>
</tr>
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<td>Heroes Marinos</td>
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<td>No</td>
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<tr>
<td>Manuel Cepeda Peraza</td>
<td>Rio Lagartos</td>
<td>Ranching</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td></td>
<td>Yes</td>
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<tr>
<td><strong>Ensenada Celestún</strong></td>
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<td>Henequén</td>
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<td><strong>Cayo Arenas</strong></td>
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<tr>
<td>Celestún</td>
<td>Henequén</td>
<td>No</td>
<td>No</td>
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</table>

Table 1. Change in membership since formation of fishing cooperatives in Yucatán.
Figure 1. Municipal population and local fish buyers in Celestún and Río Lagartos
Image: Abandoned fishing cooperative building in Celestún
Garantizada seguridad y vigilancia

Image: Newspaper article with photograph of cooperative officials informing fishers that authorities have agreed to enforce regulations.

Works Cited
Neoliberalism and fisheries subsidies, where do small-scale fisheries stand?

K. Kuperan Viswanathan, Professor, Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah Darul Aman, Malaysia. Email: kuperan@uum.edu.my or kuperan@gmail.com

Neoliberalism refers to a public policy orientation that promotes pro trade liberalization and minimum state intervention in the economy. How this orientation has affected small-scale fisheries in Malaysia is examined by looking at the issue of subsidies in the small-scale fisheries sector. The impact of subsidies and the arguments against it premised on the neoliberal view of the world is examined by the level of subsidies received by small-scale fisheries in Malaysia and the level of acceptance of neoliberalism at the government and fisheries stakeholder levels. How successful is the government in pushing neoliberalism views among small-scale fishers is examined by looking at the state of earning of different groups of fishers operating in the three spatial zones used for managing fisheries resources in Malaysia. The level of acceptance of neoliberal views on subsidies by small-scale fishers’ vis-à-vis the levels of subsidies received is examined for different type of fishing gear operators. Small-scale fishers generally have very little faith on the long term wealth generating capacity of pro trade liberalization and are generally hostile to attempts by the state to withdraw support in the form of subsidies for the small-scale fisheries. The connection between trade liberalization and reduction in subsidies to the resource sector is however not fully appreciated by both the government and fishers. The problem this raises for managing the small-scale fisheries is discussed in the paper.

Introduction

The study found that the fuel subsidies in the fisheries sector of Peninsula Malaysia has resulted in increased fishing effort. Fish stocks are declining as indicated by the increasing effort required to land fish and also the increase in landings of small sized fish reported by fishers. Studies found that fishing vessels operating in all fishing zones have reached close to the full technical efficiency and capacity utilization. Abu Talib et al. (2003) found that the demersal species are already overexploited and the level of fishing
effort is beyond that needed for maximum sustainable yield. Depleting fish stocks have adversely affected the food security and employment opportunities of fishers. This situation if not rectified will worsen further the food security and employment opportunities of fishers and will lead to further decline of the health of the fisheries sector in Malaysia.

The subsidies however have important socioeconomic benefits to the fishing communities especially for the small-scale fishers classified as Zone A fishers in the Malaysian fisheries Management scheme. The Malaysian government is pursuing a more neoliberal approach for managing the fisheries. This is indicated by a commitment to reduce subsidies to the sector and to encourage more production and trade in the fisheries sector. The small-scale fisheries sector however benefits most from the fisheries subsidies by increasing fishing incomes and providing livelihood to coastal fishers. The neoliberal policies on the sector however call for the gradual removal of fisheries subsidies. There is strong resistance from coastal fishers on the issue of across the board removal of subsidies for all types of fishers.

Methods

The approach taken in the study is that of a detailed desktop research of publications and sources on subsidies in the fisheries sector in Malaysia and international sources. The information gathered is then used to undertake interviews and meetings with relevant government agencies/quasi government bodies and research institutes to validate information on impact of subsidies on the fisheries sector. On ground interviews and discussions were than carried out with fishermen/fish processors/exporters/fish equipment suppliers on the impact of subsidies on their activities. The approach used in the UBC study on fisheries (Sumaila and Khan 2010) of classifying subsidies into three categories namely beneficial, capacity enhancing and ambiguous is used in this study.

The study looked at Peninsula Malaysia only. Based on the number of fishers and total landings, the states considered for surveys are Kedah, Perak, Selangor and Terengganu. Much of the data for the study are from secondary sources supported with some in-depth discussions with fishers and fisheries administrators.

Subsidy Programs

The Malaysian government provides subsidy to the fisheries industries. There are three types of subsidies: fuel subsidy, livelihood subsidy, and catch subsidy. Fuel subsidy refers to price support where fishers obtain diesel or petrol subsidy of RM0.60 and RM0.70 sen per litre respectively. There is a maximum limit of 2000 litres of diesel or petrol per month per boat. The livelihood subsidy mainly refers to cash support of RM200 per month per licensed fisher. Livelihood subsidy includes government support for fishing assets such as boat, net, engine, life jackets, and GPS. Catch subsidies refer to price support where fishers are paid RM0.10 sen per kg of fish landed. There is a ceiling on the
catch subsidy of a maximum RM200 per month per fisher. The government expenditure on infrastructural development for fisheries industries are also considered a form of subsidy and these include expenditure on fish landing jetties, fishing ports, infrastructure for wholesale and retail fish markets. Total expenditure on subsidies is shown in Table 1 and the percentage distribution is shown in Figure 1.

Table 1: Total Amount of Subsidies (RM) and Percentage Composition, Peninsular Malaysia, 2009-2012

<table>
<thead>
<tr>
<th>Components of Subsidies</th>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livelihood Incentive</td>
<td>105,382,40</td>
<td>0</td>
<td>173,761,400</td>
<td>82,924,000</td>
<td>172,831,200</td>
</tr>
<tr>
<td>Catch Incentive</td>
<td>33,437,417</td>
<td>34,258,752</td>
<td>53,135,869</td>
<td>63,739,882</td>
<td></td>
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<tr>
<td>Diesel Subsidy</td>
<td>387,518,780</td>
<td>429,390,275</td>
<td>400,952,761</td>
<td>424,433,933</td>
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</tr>
<tr>
<td>Petrol Subsidy</td>
<td>45,168,116</td>
<td>44,845,339</td>
<td>44,933,360</td>
<td>49,522,623</td>
<td></td>
</tr>
<tr>
<td>Others Support Program</td>
<td>11,715,614</td>
<td>12,405,750</td>
<td>69,129,727</td>
<td>4,199,950</td>
<td></td>
</tr>
<tr>
<td>Total Subsidy</td>
<td>583,222,327</td>
<td>694,661,515</td>
<td>651,075,717</td>
<td>714,727,588</td>
<td></td>
</tr>
</tbody>
</table>

Sources: LKIM

Note* Others Support Program: Included Dana, LKIM Scheme, loan etc

Results
These hosts of fisheries support programs have mixed contributions to the welfare of fishers and impacts on the fisheries resources. Fishers however claim that the fuel subsidies are most important for them as it affects their cost of operations and results in a higher income for individual fishers. Undoubtedly fuel is a major cost component in Malaysian marine fisheries. Hence the removal of fuel subsidies will impact greatly the revenues from fishing. Of all type of vessels the traditional boat is impacted the most and the B purse seine the least in terms of percentage reduction in net revenue as a result of a removal of the fuel subsidy. Reductions in monthly shares vary between 56.8% and 75.5% (A vessels), 22.8% and 27.4% (B vessels) and 46.9% and 49.4% (C vessels). In all cases the ordinary crew is affected the most. Refer to Table 2 below.

Table 2: Impact of Subsidies on Share of Monthly Net Revenue (RM)

<table>
<thead>
<tr>
<th>ZONE</th>
<th>A</th>
<th>B</th>
<th>B</th>
<th>C</th>
<th>C</th>
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<th>C2</th>
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<td>WL</td>
<td>E</td>
<td>SEINE</td>
<td>SEINE</td>
</tr>
<tr>
<td>Base</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>REVENUE</td>
<td>3,358</td>
<td>20,591</td>
<td>40,172</td>
<td>33,381</td>
<td>19,587</td>
<td>54,740</td>
<td>92,530</td>
</tr>
<tr>
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<tr>
<td>INCOME</td>
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<td>5,348</td>
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</tr>
<tr>
<td></td>
<td>43,765</td>
<td>3,647</td>
<td>1,824</td>
</tr>
</tbody>
</table>

Note: CI = catch incentive, LA = living allowance, F = fuel subsidy

The simultaneous removal of all three subsidies (fuel, catch and livelihood) has the greatest impact on the income of Zone A fishers. Net revenue is reduced by 89.4%, 29.5% and 54.9% for the A, B and C vessels, respectively. In terms of the monthly income, it is reduced by more than 90% for all three categories of stakeholders. For the individual crew member the monthly income is just RM43, well below the per capita hard-core poverty line of RM190.

The study found that there is much room for improvement in the way subsidies are managed that will lead to more productive use of the subsidies and reduce the leakage of subsidized fuel to other sectors. The fuel subsidies at the moment do contribute to overfishing and more detailed analysis of the data on fuel subsidies are needed to fully understand the effects of subsidies on the productivity of fishers.
Discussion and Conclusions

Directions for improving subsidies management should focus on the enforcement of the subsidies and on targeting the subsidy recipients and reducing gradually the subsidies such as the fuel subsidies that result in greater fishing effort. Looking at ways to manage the fisheries resources more efficiently and sustainably will require eliminating subsidies that increase fishing effort and focusing on subsidies that will encourage sustainable fishing behavior from the fishers. The use of closed seasons and provision of subsidies for fishers during the closed seasons is seen as a much more effective way forward to handle simultaneously the environmental concerns of fisheries and the social and economic aspects of fisheries management. The use of subsidies to engage in boat buy out schemes is not likely to work as new entrants into the fisheries are difficult to restraint especially in the case of fishers in Zone A and Zone B.

There is little current data on stock conditions for the fisheries of Malaysia. Fisheries stock assessments are needed to support sustainable fisheries by providing fisheries managers with the information necessary to make sound decisions. Stock information can be used to develop management plans for specific locations or stocks. A national fishery monitoring program that allows for continuous collection of catch data which can be used by stock assessment scientists and managers is urgently required. The data can be obtained through dockside monitoring in partnership with fishers association and the use of logbooks. Data required are fish abundance data(a measure of relative index or the number or weight of fish in the stock) and biological data(information on fish growth rates and natural mortality).

A subsidy rationalization program should be started by the Government to gradually move away from input based subsidies to livelihood support programs for poor fishers. A program to identify poor fishers and determine the actual level of poverty among fishers should be undertaken and livelihood programs planned out with community participation to overcome the dependence on fuel subsidies. This will involve the leveraging of neoliberal policies with community centered objectives that will ensure that the poorest of fishers are not badly effected by any effort to remove subsidies from the fisheries sector.

References

InG. Silvestre, L. Garces, I. Stobutzki, M. Ahmed, R.A. Valmonte-Santos, C. Luna, L. Lachica-Alino, P. Munro, V. Christensen and D. Pauly (eds.) Assessment, Management and Future Directions for Tropical Coastal Fisheries in Asian Countries. WorldFish Center Conference Proceedings 67, 1 120 p


Analyzing the potential for integrating the Canadian government’s intertidal fisheries management principles in the Broughton archipelago

Neil Ladell, Simon Fraser University, Canada, nladell@sfu.ca

Abstract: In recent decades, intertidal clam fisheries on Canada’s Pacific coast have undergone considerable regulatory changes, which in theory are meant to address concerns about conservation, economic viability, and the rights of aboriginal people. But in practice the federal Department of Fisheries and Oceans’ (DFO) capacity and effectiveness in managing wild clam fisheries have been weakened by federal government cutbacks since the late 1990s and the promotion of aquaculture over wild fisheries. In the Broughton Archipelago, local aboriginal communities are frustrated that the DFO’s clam management strategy serves as a barrier to the traditional fisheries rules and practices that were used to sustainably manage clam beaches for centuries. Although the federal and aboriginal approaches to management have differences, DFO and local aboriginal people share common interests in meeting conservation and socio-economic goals. Thus the core of the problem is more about how DFO is trying to achieve these goals than what it aims to achieve. Taking these goals into consideration, I analyze the two systems and identify opportunities for improved management results by integrating components from each system. The results from this research demonstrate that local knowledge and values can play an important role in achieving management objectives in small-scale fisheries.

Introduction

In recent decades, fisheries on Canada’s Pacific coast have faced a range of neoliberal reforms, including privatization (e.g. individual transferable quotas and aquaculture), cutbacks in government spending, offloading of management costs to fishers, and the rationalization of fishing fleets. Such reforms have been shown to both undermine government capacity (Lane and Stephenson 2000) and have negative social and economic impacts on fishing communities (Carothers 2011; Pinkerton and Silver 2011; Pinkerton and Edwards 2009), particularly for those in remote and rural coastal locations (Ecotrust
This paper focuses on the effects of regulatory changes on the intertidal clam fisheries in British Columbia, particularly in relation to aboriginal fishing communities. In theory these changes are meant to address concerns about conservation, economic viability, and the rights of aboriginal people. But in practice the federal Department of Fisheries and Oceans’ (DFO) capacity and effectiveness in managing wild clam fisheries have been weakened by federal government cutbacks since the late 1990s and the promotion of aquaculture over wild fisheries.

Using the Broughton Archipelago, British Columbia as a case study, I argue that in spite of differences between the federal and aboriginal approaches to management, DFO and local aboriginal people share common interests in meeting conservation and socio-economic goals. Thus the core of the problem is more about how DFO is trying to achieve these goals than what it aims to achieve. Taking these goals into consideration, I analyze the two systems and identify opportunities for improved management results by integrating components from each system.

**Methods**

This case study draws primarily from semi-structured interviews with 34 Musgamagw Dzawada’enuxw people, as well as participant observations over 7 weeks in June-July 2012, as well as four shorter field visits in 2012 and 2014, and data from secondary sources. Interviewees included elected councilors, elders, active and retired clam harvesters, and other community members. Interviews took place in Gilford Village, Kingcome, Alert Bay, Port McNeill, Port Hardy, and Nanaimo, British Columbia. Most interviews were conducted in collaboration with a community researcher from Gilford Village, Percy Williams.

**Cutbacks and Reforms to the Wild Clam Fisheries in BC**

This section identifies key neoliberal policies that have either directly or indirectly impacted the viability of the wild clam fisheries in BC.

**Fleet Rationalization**

In the 1990s, Canada’s federal government sought to address concerns about conservation and economic viability of finfish and shellfish fisheries in BC. To do so, it began buying back licences from fishers and implemented licensing policy reforms aimed at reducing the overcapitalization of investments in fisheries by cutting the fishing fleet in half (Ecotrust 2004). Licences losses were felt particularly hard in small rural and Aboriginal fishing communities where 45 percent (540) of major fisheries licences (e.g. salmon, prawns, crabs) were lost, versus a 30 percent loss in urban communities (Ecotrust 2004). While a fishing boat is not required to obtain a commercial intertidal clam licences, revenue generated from a clam fishery are too small to cover boat ownership and maintenance costs. Without a licence for more profitable fisheries such as salmon, clam diggers are unable to justify the costs of boat ownership. This means that cuts in other
fishing licences had the indirect consequence of limiting boat access necessary for clam diggers to reach many beaches.

Clam Reform

Clam fisheries on Canada’s Pacific coast have undergone considerable regulatory reform since they began just before the start of the 20th century. Federal regulators did not pay much attention to this fishery until after they began recording landings of individual species in 1951, followed by limits to openings for harvests and new area-based licensing in the 1980s (DFO 1998). Similar to other fisheries described above, DFO, in an effort to address management and conservation concerns, implemented major changes to the clam fishery in 1990s, resulting in the 1998 “Clam Reform”. These reforms took place during a period of significant cutbacks to DFO’s budget, where nearly a quarter of full-time jobs were cut (Lane and Stephenson 2000). The new clam regulations involved the rationalization of the clam fishery, including the implementation of licence limitations, local area management initiatives (in two of seven management areas), and creation of licenses specifically for aboriginal people (DFO 2013). Aboriginal Commercial Licences (Z2ACL) were introduced as a form of recognition of the historical representation of aboriginal people in the fishery (DFO 2010). DFO (2013) is currently considering whether to allow privatization of clam licences through re-nomination or transfer. Commercial clam landings declined to by two-thirds, from 1,357 tonnes to 403 tonnes from 2002 to 2011 (DFO 2013). DFO (2013) cites several issues that are currently impacting the economic viability of this fishery, including “the loss of beach access as a result of the expansion of intertidal aquaculture tenures, treaty settlements, water quality concerns, and increasing recreational use” (p. 14). Losses of wild clam beach access have occurred as both the federal and provincial governments have been promoting privatization through the expansion of shellfish aquaculture over the wild fishery (Silver 2010).

Management Issues

This section outlines the management issues arising as a result of the policies mentioned above, and the impacts felt in aboriginal fishing communities. As discussed above, aboriginal people’s access to commercial fisheries has declined, particularly in salmon fisheries, because of restrictive fisheries management strategies, fleet rationalization programs, and conservation concerns in Canada. However, since 1998, aboriginal people have had limited commercial access to clams through the Aboriginal Commercial Licences. Access to commercial licences is important for small, remote, and isolated aboriginal communities because clam digging often represents a vital source of winter income (Heaslip 2008a; Pinkerton and Silver 2011). Yet, fishery access alone pales in comparison to the historic role that aboriginal people had in ownership and management of clam resources. Further, as discussed below, regular access to the commercial clam fishery is declining.
Aboriginal rights in clam fisheries have been constrained by several differences between the federal government’s and aboriginal people’s historical approach to clam management. Cutbacks to DFO have also limited the department’s effectiveness in managing clam fisheries. Key issues include:

1. The monitoring techniques that are used to inform management decisions are based on a scientific approach that does not consider the value of aboriginal traditional ecological knowledge (Heaslip 2008a).

2. The privatization of some clam beaches challenges aboriginal people’s ability to exercise their rights to clam beaches in their traditional territories (Pinkerton and Silver 2011). In the management area south of the Broughton Archipelago, the privatization of beaches for shellfish tenures has reached a point that it may reduce commercial openings (DFO 2013).

3. In recent years, stock assessments for individual beaches or some entire clam management areas have not been DFO’s priority, meaning aboriginal communities lack basic information about the health of the fishery. Surveying every beach is not considered practical by DFO (2013), so it relies on catch per unit effort data to assess relative stock strength. Yet, DFO (2013) acknowledges that there is an inconsistency in the catch data reported to and documented. DFO (2013) also recognizes that this leaves considerable uncertainty about stock status, intensity of harvests, and natural variation in stocks (e.g. winter die-offs due to freezing).

4. While DFO has begun using a consultative process for clam fisheries by introducing clam management boards in some areas (DFO 2010), there remains a need for the government to recognize the legitimacy that local management has in sustaining clam fisheries (Pinkerton and John 2008).

5. The federal and provincial governments’ promotion of both finfish and shellfish aquaculture pose a threat to aboriginal communities’ ability to access and maintain clam beaches. First, private ownership of clam farm tenures gives the owner exclusive access, enhancement, and harvesting rights to tenured beaches, and thus can displace clam diggers from wild harvest beaches (Pinkerton and Silver 2011). Second, federal regulations prohibit the harvest of shellfish within a 125-metre radius of finfish aquaculture open net pens (DFO 2013). In the Broughton Archipelago, where open pen salmon farms are common, concern has been raised in regards to the effects of having finfish aquaculture anywhere near clam beaches. Some local aboriginal people believe that waste from salmon farms is polluting beaches (Heaslip 2008a; Pinkerton et al. 2014).

6. Limited commercial openings in each area may not meet the economic needs over 1,000 licence holders across the BC coast (DFO 2013).

Traditional Clam Management in the Broughton Archipelago
The traditional clam management rules and rights of aboriginal people in the Broughton Archipelago were used for decision-making in access, management, exclusion, and stewardship of beaches and clam populations (Heaslip 2008b; Pinkerton et al. 2014). Though the practice of these protocols has been in decline in recent decades, there is currently collaboration between researchers (Neil Ladell and Evelyn Pinkerton) and the Musgamagw Dzawada’enuxw people of the Broughton Archipelago to document and adapt, and build consensus on the principles that sustained an abundant clam fishery for centuries (this work builds on that of Heaslip 2008b). Below is a brief highlight of some of the principles that the Musgamagw Dzawada’enuxw people are working to adapt to address concerns within the commercial clam fishery in the Broughton Archipelago.

1. Leave some clams behind on the beach when harvesting.
2. Leave small sized clams behind on the beach.
3. Alternate beaches and leave time for regeneration of clams between diggings.
4. Leave clams alone when spawning.
5. Clam diggers are encouraged to return a favour to communities who control the beaches for the privilege to use the resource.
6. Clam diggers should communicate their plans to harvest clams in the area.
7. Actively manage and alter clam beaches to keep them productive.

Discussion and Conclusion

Steps are currently being taken to adapt these traditional management principles to the present situations in the commercial and food clam fisheries. For instance, increased monitoring and reporting can occur through regular communication between clam diggers and the local aboriginal band office, which can map and record harvest date from each beach. This would create an opportunity to focus stock assessments on regularly targeted beaches and for the Musgamagw Dzawada’enuxw office to ensure diggers are aware of which beaches have reached their harvest limits for the season. Such actions are meant not only to preserve cultural values and assert the rights of the Musgamagw Dzawada’enuxw to their traditional territory, but also to rebuild the clam fisheries in the Broughton Archipelago. Given the issues related to DFO’s management approach outlined above (particularly issues one to four), adapting traditional management may be a locally appropriate method of addressing these concerns.

In addition, the reestablishment of traditional aboriginal management principles presents a learning and collaboration opportunity between the Musgamagw Dzawada’enuxw people and DFO to experiment with historically effective practices. Supporting community involvement in governance of common-pool resources may be the best way to ensure effective management decisions. As Shlager and Ostrom (1993) demonstrate, the more complete a set of property rights that are held by a community, the more likely it is to invest in institutional arrangements that can address and resolve common-pool resource dilemmas. Arguably, such a method would be more effective at ensuring viable wild clam fisheries than the federal government’s current management strategies.
References


The Tragedy of the Independent: Public Policy and Traditional Recruitment in Nova Scotia’s Small Boat Fishery

Jessica MacIntosh (Marine Affairs Program, Dalhousie University, Canada)
Email: jmacintosh@dal.ca

Abstract
The industrialization and modernization of the fishery in Atlantic Canada has had a destructive effect on small boat dependent fisheries communities. The neoliberal policies and processes of the current political economy support corporate, wealth accumulation fishing and make it extremely difficult for small boat marine harvesters to participate in the fishery. This disrupts important local level social and economic processes that underwrite family and community in coastal settings. In particular, traditional patterns of recruitment based on networks of kith and kin relations are challenged by restrictive management policies. These traditional processes mobilize the continuation of local knowledge, fishing skills, and the family unit over generations, and as such are a key source of human and social capital, and thus sustainability, in small boat dependent fisheries communities. However, restrictive entry and allocation policies such as limited entry licensing and individual quota management make it increasingly difficult for youth to choose fishing as a livelihood.

This research assembles fundamental data regarding small boat dependent fisheries communities and how they have changed in response to the political economy over time. It also incorporates survey data from a sample of small boat marine harvesters which illustrates family and life histories in coastal communities in Nova Scotia. The Sustainable Livelihoods Approach (SLA) is used to illustrate the value of the social and human capital present in social networks in fisheries communities, and argue that these more qualitative types of capital assets are necessary for achieving sustainable livelihoods, fisheries and communities.

Introduction
The dominant neoliberal political economy that has governed the fisheries management system in North America for over one hundred years challenges the very existence of the small-boat marine harvester. Neoliberal management policies are based on erroneous assumptions about human behaviour, and they lack due consideration for the social and cultural qualities that underwrite family and community in small-boat dependent fisheries communities (Davis and Ruddle, 2012; McCay and Jentoft, 1998). As such, the traditional processes of recruitment are challenged and largely disabled and fewer young people from fishing communities have the ability to fish for a living, as fishing as a viable livelihood option diminishes.

The purpose of this study is to investigate traditional recruitment as a critical factor in the sustainability and dynamism of small-boat dependent fisheries communities. The research focuses on how these communities in Nova Scotia have changed over time in response to the dominant neoliberal political economy and its resource management framework, and the effects of this change on traditional patterns of recruitment. Social surveys conducted
over the past thirty years reveal the rich social fabric of small-boat fishing families, and the kinship networks that support the small-boat dependent fisheries community. Traditional patterns of recruitment are based on networks of kith and kin relations which stimulate the growth of social and human capital. It has been argued that human and social capital are critical components to a sustainable livelihood (Scoones, 1998; Berkes, 2003), yet the dominant political economy’s emphasis on financial capital and economic rationality make little room for them (Allison and Ellis, 2001). What is needed is a new frame of reference such as the Sustainable Livelihoods Approach (SLA), within which to understand and enable the political economy as not defined solely by the neoliberal capitalist wealth accumulation model, but one informed by the merits of community structure and the requirements for sustainable livelihoods.

**Methods**

The research strategy includes a literature review and secondary analysis of data gathered through several social surveys and interviews. In addition, data on catch landings, income and the number of marine harvesters, licenses and vessels were retrieved from the Department of Fisheries and Oceans (DFO), and census records from Statistics Canada provide key demographic data. The Sustainable Livelihoods Approach (SLA) is also adopted as a framework through which to understand the value of social relations in small-boat dependent fisheries communities, and the social and human capital present in them.

The data used in the secondary data analysis comes from three primary datasets collected by Drs. Anthony Davis and Victor Thiessen, the Social Research for Sustainable Fisheries (SRSF) project and the Fishermen and Scientists Research Society (FSRS). Survey results from these datasets were analyzed using the Statistical Package for the Social Sciences (SPSS) software. All three datasets include responses to a selection of recruitment and community attachment related questions which were all identically worded, enabling a comparative study of the response distributions over time.

**Results**

Since the modernization and industrialization of the fishery began, policies were designed with an economic rationality that fails to recognize the complex social components of small-boat marine harvesters’ livelihoods. As such, certain policies have had notable impacts on the socioeconomic structure of the fishery. For example, the adoption of individual quotas (IQ) in the groundfish fleet stimulated a concentration of fishing licenses in the hands of a few marine harvesters, as illustrated in Figure 1. After a 9 percent drop in the number of commercial licenses following the imposition of the cod moratorium in 1992, the number of licenses actually increased between 1995 and 1998 by 33 per cent, from 11, 073 to 16, 441; however, the number of license-holders declined by 20 per cent at this time from 11, 465 to 14, 647.

Another notable trend is the simultaneous decline in the number of license-holders and increase in the number of licenses after the license buy-back program implemented by DFO after the Marshall Decision in 2001. Individual sellers benefitted from this arrangement, but it changed local market values to such an extent that accessing licenses and quota has become substantially more difficult for non-native marine harvesters. (Davis and Jentoft, 2001).
Figure 1 Note the 9% drop in licenses after the groundfish collapse; the 33% increase in licenses and 20% decrease in license-holders around 1997 – only a few years after the introduction of ITQs in the groundfish fleet, and the concurrent decline in the number of license-holders and increase in number of licenses after the Marshall Decision and DFO’s license buy-back program in 2001 (DFO, 2013).

While fisheries management policies have fuelled changes within small-boat dependent fisheries communities, a shifting political economy including changing populations, migration, education attainment, and changing social perceptions have also lent to the transformation of the small-boat fishery. All of these changes contribute to the current dilemma of recruitment in the small-boat fishery. Since 1996, the only county in Nova Scotia to experience population growth has been Halifax County, the urban core of the province, and an average of 1200 young people leave the province every year (Statistics Canada, 2012). Since 1955, employment in the fishery has declined by 50 percent, and the number of marine harvesters in the province has declined by over 60 percent (DFO, 2013). The change in participation in the fishery can be partly attributed to the fact that the total income for self-employed marine harvesters in Nova Scotia has declined by about 11 percent a year while the average cost of a vessel and license has increased about 632 times. These statistics are concerning because fishing is a valuable industry, both economically and socially. Nova Scotia is one of the most active fishing provinces in Canada, and the value of the fishery in Nova Scotia has increased even as landings have decreased. However, the corporate sector accounts for a disproportionate share of this wealth, as they land the most fish and employ the least amount of people.

Social survey data collected over the past thirty years reveals that fishing as a livelihood is embedded with kinship and as such is a source of social and cultural capital. Two similar surveys were conducted in small-boat dependent coastal communities in Nova
Scotia that investigated the level of community attachment among marine harvesters, in 1988 and in 2001. When asked whether they feel like they belong to the harbour where they fish, 99.2 per cent of respondents in 1988 indicated that they felt they belong or really belong. In 2001, 98.1 per cent of respondents said that they feel like they belong or really belong. Contrasted with the response to this question in the 1988 survey, it is evident that this sense of belonging has not notably changed over the years.

Coupled with this sense of community attachment is a notable livelihood satisfaction among marine harvesters. In 1988, 2001 and 2007, marine harvesters were asked whether they would choose to go into fishing again if they had their lives to live over (see Table 1). In 1988, 89.6 per cent of respondents said they would choose fishing again. In both the 2001 and 2007 responses, no less than two in every three and, more commonly, over four in every five respondents indicated that they would probably or definitely choose to go into fishing again.

As might be anticipated, such high levels of attachment are embedded in and express the fact that most of these people are ‘from’ and ‘of’ fishing families with multi-generational roots within the fisheries and, commonly, the fishing port. In 1988, 30.5 per cent of Captains said that their sons fish or have fished, and in 2001, 28 per cent of the respondents indicated that their sons fish or have fished.

The act of fishing in younger generations has not appreciably changed over the years; however, the support for young people entering the fishery as a livelihood has noticeably changed. There is a hesitancy among marine harvesters to advise young people to begin fishing, regardless of community and livelihood attachment and patterns of kinship within the fishery. Contrasting responses from 1988, 2001 and 2007, it is evident that the hesitancy to advise a child to begin fishing as a livelihood has increased over time (see Table 1).

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>1988 (Captains) %</th>
<th>1988 (Captains’ Wives) %</th>
<th>2001 %</th>
<th>2007 %</th>
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</thead>
<tbody>
<tr>
<td>Would you advise a child of yours to go into fishing if they had to start...</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>...from scratch</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Definitely/Probably</td>
<td>26.2</td>
<td>13.9</td>
<td>19.6</td>
<td>19.0</td>
</tr>
<tr>
<td>Probably Not/Definitely Not</td>
<td>73.8</td>
<td>86.1</td>
<td>80.4</td>
<td>81.0</td>
</tr>
<tr>
<td>...with a boat and lobster license</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definitely/Probably</td>
<td>73.4</td>
<td>59.0</td>
<td>45.6</td>
<td>61.8</td>
</tr>
<tr>
<td>Probably Not/Definitely Not</td>
<td>26.6</td>
<td>40.2</td>
<td>54.4</td>
<td>38.2</td>
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</tbody>
</table>
...with a boat and all of the important licenses

<table>
<thead>
<tr>
<th></th>
<th>n=123</th>
<th>n=126</th>
<th>n=159</th>
<th>n=332</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definitely/Probably</td>
<td>82.9</td>
<td>68.0</td>
<td>83.5</td>
<td>70.0</td>
</tr>
<tr>
<td>Probably</td>
<td>17.1</td>
<td>31.1</td>
<td>16.5</td>
<td>30.0</td>
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<tr>
<td>Not/Definitely Not</td>
<td></td>
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...with your inherited boat and licenses

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<tr>
<th></th>
<th>n=124</th>
<th>n=126</th>
<th>n=159</th>
<th>n=332</th>
</tr>
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<tbody>
<tr>
<td>Definitely/Probably</td>
<td>81.5</td>
<td>69.7</td>
<td>69.0</td>
<td>65.6</td>
</tr>
<tr>
<td>Probably</td>
<td>18.6</td>
<td>29.5</td>
<td>31.1</td>
<td>34.4</td>
</tr>
<tr>
<td>Not/Definitely Not</td>
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**Discussion and Conclusion**

When the relationship between neoliberal policies and the small-boat fisheries community is examined, it is clear that the state, through its policies, is neglecting the interests of the small-boat fisheries community. The state operates on the belief that the proper or only way to develop is through a system based on economic rationality and efficiency. This system is guided by market forces and propelled by the desire to accumulate wealth. The small-boat fishery is unable to compete in this system because it is not driven by the desire to accumulate wealth. Small-boat marine harvesters are characterized as such because they exist within a context of intimate social relations where such are given priority when possible over exclusively economic considerations. The corporate sector’s profit maximization motive drives them to fish for the accumulation of wealth and has created the competitive environment that fuelled the problem of overfishing in the first place.

As such, the interests and preferences of the corporate industrial sector is fundamentally at cause for the creation and implementation of neoliberal/allocation management policies such as IQs and ITQs. These policies have been challenging for small-boat marine harvesters because they allow a system to govern the fishery that increases the cost of fishing relative to the income earned, permits the accumulation of privileges in the hands of a few, and reduces the amount and range of fishing opportunities for fishing families. Declining employment opportunities for marine harvesters also implies a lack of livelihood options for fishing families in coastal communities. Traditionally, there were opportunities for family members to work in fish processing plants or as crew on a family member’s vessel (Apostle and Barrett, 1992). The economic rationality of neoliberal policies has reduced these opportunities in coastal communities, as jobs are reduced and confined to larger ports and vessels.

Consequently, there is an out-migration of youth from coastal counties in search of other opportunities. More young people are leaving coastal counties and higher levels of education are being pursued. These demographic changes are influenced by a variety of factors, but of particular interest is the hesitancy among marine harvesters to encourage youth to enter fishing. Most all survey respondents expressed a strong level of community attachment and livelihood satisfaction over time; therefore, it can be inferred that the reason for advising or not advising a child to enter fishing is strongly dependent on the political economy controlling the context within which one fishes.
The excuse used for the implementation of restrictive allocation management policies was ‘too many fishermen chasing too few fish’, but it is clear that the corporate sector was, and still is to this day, responsible for the majority of marine resources removed from the sea. Regardless of that fact, small boat marine harvesters still have had to face these restrictive policies that are based on erroneous assumptions about human behaviour (Ostrom, 1999). They assume that people act in rational economic ways, and they neglect any social or cultural underpinning of the familial and community context in which people live. Small boat marine harvesters’ lack of adequate financial capital inhibits their ability to succeed in this political environment. The inability to maintain fishing as a livelihood throughout generations is greatly affecting the social capital found among fishing families and communities, and as such ultimately affects the sustainability and dynamism of small-boat dependent fisheries communities.

References
Statistics Canada. (2012). Table 051-0012 - Interprovincial migrants, by age group and sex, Canada, provinces and territories, annual (persons), CANSIM (database).

Title: How Are Small-Scale Fisheries Faring in under ITQ Systems Internationally and What Does the Future Hold?

Evelyn Pinkerton (Simon Fraser U., Canada) epinkert@sfu.ca

Abstract: This paper reviews recent literature on small-scale fisheries (SSFs) managed under Individual Transferable Quota (ITQ) or catch share systems, considering dimensions/aspects of the fishery which have been changed by ITQs, including (1)
increased fixed costs of surveillance relative to income, (2) leasing costs when insufficient quota is initially allocated to small-scale fishermen, (3) increased risks to safety taken by SSFs because of their financial marginality, (4) greater corporate control of quota markets, (5) inequitable initial allocation and increasing inequality among fishing sectors, (6) barriers to entry for family members, and (7) the relative position in the industry of coastal communities where SS fishermen live. This discussion will engage with recent responses to critiques of ITQ systems in an effort to move the discussion to a higher level.

Regular Session 3.2: Institutions and markets

MSC’s role in the governability of sustainable small-scale fisheries

Mandy Doddema (Marine Stewardship Council)
Nicolas L Gutierrez (Marine Stewardship Council)

Governing fisheries is not a small challenge. A key tenet of fisheries governance and particularly governance of small-scale fisheries is the sustainability of the fisheries resource. While there is no ‘best’ governance structure in fisheries to achieve this goal, key characteristics of any fisheries system include its inherent diversity, complexity and dynamics. From an interactive governance perspective, we consider that in order to increase governability and achieve sustainable fisheries, governance structures must be aligned to these inherent characteristics.

Governance of small scale fisheries is the result of interactions between governing actors at different levels, ranging from meta-governance to institutional arrangements to fishery specific management. Through case studies, we contrast how the Marine Stewardship Council (MSC) as a standard setter for sustainable fisheries and through market-based incentives it provides, can positively influence the governability of small-scale fisheries systems. The analysis presented here shows what governing systems and systems-to-be-governed in small-scale fisheries engaged with MSC have done to enhance their performance and highlights lessons that can be learnt from this process.

Is fisheries certification suitable for small-scale fisheries? Impacts, challenges and potential solutions

Nicolas L Gutierrez (Marine Stewardship Council)
Oluyemisi Oloruntuyi (Marine Stewardship Council)
David J Agnew (Marine Stewardship Council)
Marked-based incentives have been conceived to promote the development of sustainable fishing practices and to reduce impacts on associated ecosystems. Of these, certification and eco-labelling has been the most prominent and fastest growing, requiring fisheries to comply with a set of provisions designed to achieve healthy fish stocks, minimize environmental impacts, and promote effective management. In return, eco-labelled products may attract new markets, and attain higher prices and wider consumer acceptability, or a combination thereof. Nevertheless, this growth has also led to debate and some concerns including the actual effectiveness and suitability of seafood eco-labelling schemes for small-scale, data deficient fisheries.

Here, we present how certification and eco-labelling has provided socio-economic benefits while improving fisheries management practices and delivering environmental improvements. Through case studies of small-scale fisheries certified by the Marine Stewardship Council, we highlight direct effects of certification such as improved co-management, empowerment of fishing communities, price premium and access to new markets, along more sustainable fishing practices. We also examine main challenges faced by this global certification program in improving the accessibility of small-scale fisheries, particularly related to data deficiencies. Finally, we discuss current initiatives to overcome such challenges and new potential solutions to better use this market-based approach to sustainable management of small-scale fisheries globally.

**Fair Trade Certified™ capture fisheries standard**

Ashley Apel, Fisheries Program Manager, aapel@fairtradeusa.org

Like their developing country counterparts in agriculture, many fishing communities struggle against fluctuating market prices, competition with corporate suppliers, limited direct market access, and unregulated working conditions. Furthermore, with many fisheries under inefficient or limited management, fish stocks and marine species are dwindling at an ever-increasing rate, and fishermen are struggling to improve their livelihoods while engaging in practices that don’t degrade the resources upon which they depend.

Fair Trade USA seeks to address these challenges by adapting its agriculture certification process for use in wild capture fisheries. A third-party certification organization, Fair Trade USA focuses on social empowerment, environmental sustainability, and economic development. We audit and certify products from around the world that are sold in North American and European markets.

When consumers purchase a product with the Fair Trade Certified™ label, they know the farmers, fishermen, and workers who produced it got a fair deal for their hard work. This means better prices and wages, a financial incentive via the Fair Trade premium, safer working conditions, and improved environmental protection.

Fishery improvement takes time, manpower, money, and patience. Fair Trade USA provides a financial incentive to tackle fishery improvements, while simultaneously helping fishermen and their communities. It’s a program that’s accessible for small-scale
fisheries, moving them on a path to sustainability through a step-wise process. And it’s a well-recognized certification label, allowing consumers to vote with their dollars and support Fair Trade fishermen, their communities, and the resources upon which they depend.

Understanding ocean grabbing

Ricarda Reuter (Africa Contact, Denmark; Lund University master student in Human Ecology, Sweden)  
Carsten Pedersen (Masifundise, South Africa)  
Jennifer Franco (Transnational Institute, Netherlands)  
Timothé Feodoroff (Transnational Institute, Netherlands)  
Mads Barbesgaard (Africa Contact, Denmark)

Our presentation will introduce the audience to a research project on Ocean Grabbing that was initiated in 2011 by Masifundise and Africa Contact building on inputs from the World Forum of Fisher Peoples.

“‘Ocean-grabbing’ – in the shape of shady access agreements that harm small-scale fishers, unreported catch, incursions into protected waters, and the diversion of resources away from local populations - can be as serious a threat as ‘land-grabbing,’.” With this statement Olivier De Schutter, UN Special Rapporteur on the right to food, stressed the importance of access-rights for food security in a 2012 speech.

Whilst many NGOs, scholars, and governments seek opportunities and options for the development of SSF only in adaptive measures such as co-management, Marine Protected Areas, or Climate Change mitigation our findings suggest that such a focus is not sufficient to solve the root-cause for the crisis in SSF communities. To seriously enable just development in SSF securing human-rights based access rights must be a priority.

Our project presents an example for problem driven and trans-disciplinary research bringing together academia, NGOs, and fisher folk.

The outcome – a primer on Ocean Grabbing – will be presented. It highlights the impacts of neo-liberal resource policies and capitalistic interests on SSF from a local perspective that examines concrete local cases on corporate grabbing of resources and loss of fisher people's livelihoods, and a global perspective that contextualizes those cases.

From market failure to capacity-building:  
Catch shares and adaptation in the new england groundfishery

Jennifer F. Brewer, University of New Hampshire, USA, jennifer.brewer@unh.edu

Abstract
In the New England groundfishery, evidence from participant observation, interviews, and document review shows that a catch share program impedes adaptation to environmental change in the small boat fleet. In response, public, private, and non-profit leaders are building adaptive capacity through a broad spectrum of institutional innovation and social learning, particularly at local levels. With some fish populations in collapse, questions arise about the sustainability of these efforts, and their benefits for fishing communities. The case raises related issues around the scalar dynamics of collective action.

**Introduction**

Adaptive capacity enables socio-ecological systems to adjust to environmental change, enhancing opportunities and limiting damages. It can be understood as the ability to mobilize collective action, including active efforts in the present and latent capabilities for the future (Adger et al. 2003). Multiple-loop social learning can potentially increase adaptive capacity. Through social interactions, groups can establish new cognitive patterns, replace outdated assumptions, and foster social structures for transformative change (Armitage et al. 2008). How environmental markets might hasten or hinder adaptation is less widely studied, however.

This study examines the case of New England groundfish, where quota markets have failed to conserve key species. It finds that while quota management per se may erode adaptive capacity in the small boat fleet, social learning in response to impacts of quota management and fish population seems to build adaptive capacity. Activities include community organizing, advocacy for small boat communities in management processes, seafood marketing cooperatives, harvester permit banks, collaborative research and gear experiments, marine and riparian conservation projects, and education and training for emerging industry leaders. Nonetheless, with key fish populations in precipitous decline, we must view these “successes” through a broad socio-ecological lens. If there is no future fishery, to whom might any benefits accrue?

**Methods**

This study draws on portions of several datasets spanning the periods of 1990-1992 and 1997-2014. These include participant observation in fishing communities and management and policy arenas, 85 mail and phone surveys, more than 175 structured and semi-structured interviews, more than 200 informal conversations with informants, attendance at more than 90 meetings totaling one hour to four days each, and review of documents produced by government, non-profit groups, and trade publications. The most intensive data collection centers on the Gulf of Maine coast. Analyses follow a modified grounded theory or constant comparison approach, forming categories, themes, hypotheses, and conceptual frameworks in an iterated fashion simultaneous with data collection.

**Case**

The New England groundfishery is centuries old, historically ranging from Long Island, New York to the Canadian Maritimes, and including ports in Connecticut, Rhode Island,
Massachusetts, New Hampshire and Maine. In recent years, most of the fleet has consolidated to Massachusetts, with a few boats remaining in Maine, New Hampshire, and Rhode Island. Groundfish vessels presently range from 30-120 feet in length and harvest 15 bottom-dwelling finfish species, including cod, haddock, flounders, pollock, redfish, hake, and others. Most use otter trawls or gillnets, while a few smaller vessels use hooks.

**Catch share implementation**

During a half decade of focused implementation, United States catch share policy has enjoyed widespread support from conservation groups, but opposition from many small scale fishers. In 2010, catch share advocates imposed transferable quotas on the New England groundfishery, circumventing legislative efforts to protect the smaller-boat fleet. Supporters argue that market reallocation of fishing effort rewards efficiency and incentivizes conservation of target species. Evidence from this case demonstrates, however, that these benefits can be limited by challenges of commodity standardization, externalities, and industry consolidation.

Quota markets encourage capital investments premised on single species assessments that neglect spatio-temporal variation of interlinked biophysical and social forces, thereby entrenching false assumptions of system stability over time, and homogeneity across space. They disguise heterogeneous ecosystem goods and services as standardized commodities, generating externalities. For example, in recent years, statistical models used to regulate cod, haddock, and flounders have made sudden and poorly explained reversals in the course of a few months, even while fish landings matched quota allocations. At some moments, assessments have found some populations (such as pollock) to be dramatically more abundant than last predicted, and found other populations (such as cod) to be dramatically less abundant than last predicted. Perhaps related, evidence suggests that replacement of seasonal inshore area closures by less spatio-temporally adaptive quota allocations allows larger trawlers to break up boulders and ledges where fish hide, resulting in degradation of habitat and fish populations (Brewer 2014).

Quota allocations penalize boats that maintain adaptive cycles of participation in a variety of fisheries, and reward those that focus exclusively on groundfish. Historically, the small boat fleet shifted effort seasonally among groundfish, lobster, scallops, shrimp, and other species. Periodic adjustments to those patterns could allow depleted populations to recover. Allocations based on past landings histories provide such small allocations to diversified boats that many can only lease out their quota, not fish it. Some such leases shift effort from small, diversified boats using hooks, gillnets, or small trawls, to larger, specialized boats with heavier and higher-impact trawl gear. Quota holders feel pressured to maximize use of their allocated quota, retaining a continuous landings history and perhaps surviving future quota reductions (Brewer 2013a).

Simultaneously, larger firms benefit by accumulating market and regulatory power. Not surprisingly, deeper pockets can generate greater profits. They can buy quota at larger
volumes and lower prices, so that within a year of quota management, 20-40% of some species quota totals were controlled by three firms. In addition, quota markets are opaque and lumpy. Administration of quota sales through cooperative-like “sectors,” with first-refusal rights to same-sector boats, raises transaction costs of out-of-sector transfers, and limits the availability of price information. To avoid transaction costs, most firms trade quota in species bundles, which are awkward for small firms. Rarely does an available quota bundle match the species needs of a single small boat. Quota was initially allocated to boats based on historical landings, but the mix of species is different in each geographic area and changes over time. Larger firms with more and larger boats can break up quota bundles and shift smaller allocations from one boat to another. They can also fish larger areas, seeking out species populations to fill their available quota. Small boats can only fish local waters in good weather, making them more vulnerable to short term changes in quota availability for whatever species show up at that time and place. As species migrate northward and offshore with changing water temperatures, further market complications emerge. The New England fleet now finds unfamiliar southern species in their catch, ostensibly requiring quota transfers from mid-Atlantic firms. As a result of these various challenges, many boats choose to lease quota instead of fishing it. Firms with no intention of actively fishing their quota again begin to care more about its monetary value than about market distortions or discrepancies between fish population assessments and the complexities of the fished ecosystem (Brewer 2013a).

Further, small boat fishermen are afraid speak publicly about the ecological impacts of large trawl gear, or the ability of larger firms to influence quota transactions. They rely on larger firms to lease them quota, particularly since they often need additional quota for a scarce species when it swims with a more abundant species for which they do have quota. They also fear retaliation from larger trawlers while fishing, since gear entanglements can have swift and deadly consequences (Brewer 2014). Incentives to accumulate and share local ecological knowledge diminish with rising uncertainties around fish population assessments, regulatory responses, and quota values. With waning hope that their children or neighbors will ever fish, fishermen who once boasted rich stores of local knowledge has become absentee “sealords.”

Meanwhile, several groundfish species are in decline. Whether one blames overfishing, climate change, habitat degradation, inadequate decision support, trophic shifts, or other factors, annual Gulf of Maine cod harvest limits have declined from about 18,000 tons in the early 1990s to about 1,500 tons in 2014. Despite the promise of catch shares, the latest assessment finds Gulf of Maine cod stocks to be virtually collapsed, with spawning rates at 4% of target levels. Even fisheries scientists have become frustrated with management processes that prioritize quantitative precision over socio-ecological realism (Brewer 2013a).

**Social learning as adaptive capacity?**
In response to the impacts of quota management and declining fish populations, industry, public, and non-profit groups have organized to support a range of institutional innovations intended to aid both fishing communities and fish populations. A few of the
cooperative-like quota-management sectors are allied with non-profit groups or state agencies to offer permit banks, which lease quota to less capitalized fishers at subsidized rates. Several are involved in industry-science research collaborations, including projects to develop more selective or lower-impact fishing gear. Most employ staff to facilitate intra-sector group process, and to conduct government relations and public outreach. Meanwhile, community organizers with fishing-related non-profit groups have allied small boat fishers with environmentalists, food systems activists, and scientists to propose alternate regulatory approaches, ones more sensitive to variations in fish behavior and habitats, fishing technologies, seafood marketing, fishing livelihood strategies, and industry financing. They are conducting outreach and education programs in public schools, as well as workshops for fishers who can help local peers to play strategic and responsible roles in management venues and conservation efforts (Brewer 2013b). A number support new seafood marketing cooperatives, which sell freshly caught fish directly to consumers and restaurants, and increase public awareness of fishing industry perspectives. A few are exploring direct sales to institutional buyers with educational missions, such as schools and hospitals.

Taken as a whole, these efforts represent a significant increase in multiple-loop social learning. They create new collaborative linkages across groups that were not previously linked. New relationships span fishers and environmentalists, fishing families and schoolchildren, fishery managers and fishing community organizers, food systems advocates and research scientists, health care providers and seafood processors. A shared agenda is developing, one that places fishing livelihoods in the broader context of socio-ecological sustainability across marine, coastal, rural, urban, and suburban ecosystems. Local ecological knowledge gains social standing, and collective visions emerge for alternate futures.

Surely this is adaptive capacity? These activities increase the ability to accommodate ongoing environmental change by facilitating the transfer of information and knowledge across any number of relationships that would not otherwise exist – information about climate impacts on habitat, fish behavior changes, trophic interactions, fuel-efficient technological innovations, new product markets, environmental health, shoreside labor, and regulatory strategies. It creates the trust relationships that enable collective action, and the coalition-building that is necessary to influence policy decisions. Such coalitions become increasingly important as historically unprecedented climate-related environmental changes overwhelm existing management efforts, including catch shares. As the New England groundfish case demonstrates, it is no longer reasonable to assume that future patterns of fish behavior, growth, and reproduction will resemble the past. Fishery management must re-invent itself. Such rapid transformation is unlikely to succeed without multiple-loop social learning.

As described above, many of the capacity-building efforts on behalf of small boat fleets have organized around the imposition of quota markets. Some community organizers have been mobilized by fear that catch share policy could precipitate industry consolidation, eliminating smaller boats. Others have been inspired by the possibility that sectors can manage their own quota cooperatively, and wish to build on that precedent for collective decision making.
By now, however, it is not clear that there will be a 2015 groundfishing season, at least in the Gulf of Maine. Cod are often a “choke” species. They intermix with other species, and are difficult to avoid. If managers cannot allocate cod quota, it may be impossible for smaller boats to harvest any groundfish species. Large, more mobile boats may be able to fish farther south, and acquire the necessary quota, but small boats run as family businesses are less likely to leave home harbors. Given the innumerable challenges they have faced in recent years, most will lack the necessary financial and emotional resources. In fact, if climate is a driving cause of cod population collapse, the species may never rebound in these waters. This prospect poses interesting challenges to capacity-building. How might fishing communities organize around goals that do not include fishery access? Hypothetically, some boats might switch to other fisheries, such as lobster or scallops, but options such as shrimp, urchins, and herring are also in decline. Further, lobster, scallop, urchin and herring fisheries have entry restrictions, and most groundfishers who qualified for profitable fisheries already switched over in past years. Sustainable community organizing normally requires a vision for positive change, not just anger or sadness about loss. Fishing community members may initially adjust to the loss of groundfishing by self-identifying as former groundfishers, but ultimately they can only thrive by establishing other identities. The social learning and capacity-building among activists, scientists, public officials, businesses, and consumers around seafood and fished ecosystems may continue, but without the involvement of a small boat groundfishing fleet. Perhaps small boat fishers harvesting other species will take on new roles in those networks, or perhaps the living perspectives of fish harvesters will morph into historical narratives. Such narratives may retain an important place in the ideologies that mobilize collective action. Without any ongoing relationship to the lived experiences of small boat fishers, however, they may evolve into myth and legend.

**Conclusion**
Quota management has failed to conserve the groundfishery and has eroded adaptive capacity in the small boat fleet. Public, private, and non-profit groups try to compensate through institutional innovations and social learning, generating new reserves of adaptive capacity. Ultimately, however, if groundfish populations will not support a small boat fishery, the longer term benefits of these capacity-building investments might not accrue directly to small boat communities. It is possible that the transformative legacy of these efforts will be more dispersed across spatio-temporal scales, improving management of coastal ecosystems and their fisheries in general terms, but not the place-time-specific livelihoods of the groundfishers who first inspired them.

**References**

“Pre” step-zero and beyond: local Institutional paths in marine conservation in Latin America and Caribbean

Francisco Araos, Grupo de Pesquisas em Conservação e Gestão dos Commons (CGCommons) of the University of Campinas, UNICAMP, Brazil
Cristiana S. Seixas, Grupo de Pesquisas em Conservação e Gestão dos Commons (CGCommons) of the University of Campinas, UNICAMP, Brazil
Julia Fraga, Laboratorio de Antropología Marítima y Costera of Centro de Investigaciones y de Estudios Avanzados, CINVESTAV, Unidad Mérida, México.
Jenny Glikman, Centro de Investigaciones y de Estudios Avanzados, CINVESTAV, Unidad Mérida, México.

This paper aims to analyze the institutional paths that precede the establishment of marine protected areas (MPAs) in three regions of Latin America: Municipality of Navidad in the central coast of Chile, Ibiraquera Lagoon in southern Brazil and the Municipality of San Felipe in the southern east of Mexico. The study highlights the main historical moments of the development of fisheries management arrangements and a mixed of bottom up and top down MPAs in a broad sociopolitical context related to sustainable use of fisheries in each location.

The local institutional paths analysis explores the array of drivers that led to propose the establishment of a MPA. The analysis goes back in history rescuing the customary and legal rules in local fisheries management, reconstructing the institutional framework and the local organization of fishers, ending in the description of the “step zero” stage, the initial idea of the establishment of a MPA. This analytical movement goes beyond the MPA implementation looking for possible directions in marine conservation paths in a global and local drivers in each location.

The institutional path analysis, therefore, is very useful in the social and political studies of marine conservation in a translocal and historical perspective, showing some recurrent issues and connections across places and the emergence of alternatives arrangements looking for sustainability in changing worlds.

Regular Session 3.3: Governance (II)

Towards a theory of small-scale fisheries self-governance in a globalized world
Abstract
It is fascinating to think that to a large extent the multi million-dollar global seafood trade rests upon informal self-governance arrangements among fishers and fish-buyers. Organizing labor through cooperatives (co-ops) and patron–client relationships are the most common cooperative and non-cooperative strategies of self-governance among small-scale fishermen. In this paper I examine how these two main types of self-governance differ from one another. I do this to build the basis to be able to later explore what are the main implications of their similarities and differences for issues related to conservation, rights-based approaches, and more generally, the development of institutional infrastructures needed to build democratic processes in rural coastal marine environments. I examine these issues using examples from case studies and surveys conducted in Mexico.

Introduction
According to FAO (2014) there are more than 800 million people suffering from chronic malnourishment. Given that the fisheries sector alone provides jobs to tens of millions and supports the livelihoods of hundreds of millions, fisheries and aquaculture are expected to increasingly play a significant role in eliminating health and reducing poverty in the next decades (FAO 2014). Whether FAO’s predictions turn true or not depends on how fisheries production is organized. The goal of this paper is to examine theoretically and empirically how the main ways fishers self-organize differ from one another. More specifically I focus on examining what are the main implications of their similarities and differences for issues related to conservation, rights-based approaches, and more generally, the development of institutional infrastructures needed to build democratic processes in rural coastal marine environments.

Theoretical Background
Self-governance is a feature of most small-scale fisheries around the world, particularly in developing countries, where external regulations, monitoring, and enforcement are particularly challenging given central governments’ limited capacity. Cooperative and non-cooperative self-governance are thought to be two ubiquitous forms of self-governance (Basurto et al. 2013). Cooperative self-governance takes place when fishers formally contract with others and determine the roles and responsibilities of working collectively as a formalized group like a fishing cooperative, or co-op. Cooperative strategies demand fishers’ ability to overcome the upfront costs of engaging in collective action, such as agreeing on a set of constitutional, collective-choice, and operational rules associated with the extraction and/or commercialization of their catch (Ostrom 2005). Usually, property rights to fisheries resources are owned in common by the cooperative (herein co-op), and collective action is needed to ensure that individuals do not shirk duties or otherwise undermine the group’s efforts. Fishing co-ops are ubiquitous examples of cooperative self-governance. In Turkey, one in every four fishers belongs to
a co-op (Unal et al. 2009). In Mexico, officials estimate the existence of more than 3200 co-ops (Juárez-Torres et al. 2007), and more than 620 fisher’s syndicates are reported in Chile (Marín et al. 2012).

A patron-client relationship is a common example of noncooperative self-governance. Under noncooperative self-governance a fishing crew does not engage with others in collective action to coordinate and share the transaction costs associated with organizing for harvesting or commercialization, nor do they formally contract with each other (Wang 1999). Instead individual fishers engage in informal agreements with fish buyers to buy their catch (Merlijn 1989). Johnson (2010:265) describes this form of self-governance arrangement as “common economic arrangements… that link powerful individuals with numerous subordinates. In exchange [for] favors, including loans, protection, or intermediation, patrons receive labor, goods, political support or other benefits.” The need for fishers to engage in informal agreements with patrons (i.e., fish buyers) emerges from the fact that most fishers operating in small-scale enterprises often cannot afford the upfront costs of fishing trips (e.g., gas, bait, and food). In the worse cases fishers do not own fishing means of production (e.g., boat, motor or fishing gear) or do not have a fishing license, effectively precluding them from access to the fishery. In these cases the patron with access to the fishery will agree to upfront the costs of the fishing trip, or rent them the fishing means of production in return of the promise to landing the catch to him. Fishers’ loans and other expenses are discounted from the value of the catch and the resulting amount constitutes fishers’ profit.

How do cooperative and noncooperative forms of self-governance compare in terms of sustainability? Cooperative self-governance is more costly to organize and sustain than noncooperative self-governance but over the long run might lead more easily to equitable human well-being and ecosystem health than patron-client relationships (Basurto et al. 2013). Co-ops for instance, invest in production and infrastructure in particular places where often fishers have property-rights (traditional or formally recognized) to their fishing areas. Under these contexts it is more likely fishers can eventually find incentives to invest in the sustainability of their marine areas. In contrast, patrons—who are often fishbuyers in patron-client relationships—are often under pressure from customers to supply particular target species year around regardless of their availability due to biophysical constraints in particular locations. Thus, fishbuyers face incentives to move around large areas often engaging with different sets of fishers to overcome this situation and effectively supply demand. Not surprisingly, fishbuyers often oppose place-based regulatory schemes such as area controls (Cinti et al. 2010), highlight the need to find different paths for sustainability than those needed for cooperative self-governance.

**Drawing from Empirical Experience**

It will be challenging to understand how self-governance can better lead to human well-being, ecosystem health and rural democratic development without a better handle on the conditions that might lead to the emergence of different forms of self-governance in the first place.
To examine the determinants of the emergence of co-ops versus patron-client relationships we draw from literature and empirical work conducted by colleagues, students, and myself in the Yucatán peninsula and the Gulf of California Mexico, where both forms of self-governance are present. We use two interrelated strategies to draw empirical and theoretical insights: participant observation and informal interviews from case studies, and surveys and structured interviews with fishers organized under cooperatives and patron-client structures. We use these two approaches iteratively in an effort to identify drivers of self-governance with which to generate hypotheses about their implications for ecosystem health and human well-being modeled using an agent-based modeling approach. Once there, we can generate new hypotheses to be further tested empirically beyond the confines of our current empirical effort.

At the time of this writing our case studies have helped us tease out three drivers influencing the emergence of cooperative or noncooperative self-governance approaches in our case studies in Mexico. Managerial skills, reliability, and a history of working together, I briefly describe them below.

Managerial skills
Managerial skills play a role in the emergence of self-governance that has the highest likelihood of sustaining themselves through time. We defined managerial skills as the ability of the buyer to manage his business and knowledge of fishing regulations and licensing procedures. The skillset of a successful fishbuyer is different from the skillset that makes a successful fisher. Fishers that decide to become fishbuyers in patron-client structures for instance, need to develop a new skill set. Key informants summarized managerial skills as “good with people,” “good with numbers,” “never to run out of capital, always have savings,” and able to find new markets, better clients.” Fishbuyers need to be “good with people,” be capable to develop and maintain relationships with fishermen and clients, two very different types of actors operating under very different types of constraints and cultural backgrounds.

In Mexico as in many other developing country settings, under a patron client structure small-scale fishers often need to be provided with upfront cash to go fishing in return of a promise to bring the catch to the fishbuyer. Thus, a fishbuyer needs to be able to identify and develop informal short-term contracts with trustworthy fishers, in order to build a successful business enterprise. If a fishbuyer surrounds himself mostly of fishers that will shirk on the agreement to land their catch to him, he will eventually run out of capital. Thus, besides being good with people, interviewees mention fishers also need to be “good with numbers.” Keeping good accounting of how much a fisher has borrowed and how much catch he brings so it can be discounted from the loaned amount, is critical for a fishbuyer’s ability to stay in business. As an interviewee put it, a fishbuyer with strong managerial skills “never runs out of capital, always has savings, because lots of buyers that go up and down as they start to spend a lot, and many times in things you should not spend, and then they are without capital. The season starts and they have no cash.” Fishbuyers lacking good managerial skills risk being unable to pay fishers on time for their catch. In some places fishers are used to being paid daily for their catch. As one
fishbuyer informant stated “you need to pay what you buy.” Fishbuyers lacking good managerial skills risk developing a reputation of unreliable buyers, and the best fishers will likely work for someone else more reliable. As a result fishbuyers with poor managerial skills will tend to associate themselves with not the best fishers, which in turn endangers the sustainability of their business.

Fisher reliability
Fisher reliability varies widely within a fishing community. We define reliability as the degree to which fishers go fishing on a predictable basis and fulfill agreements made to a particular fishbuyer or to others with whom they have a working relation such as members of their own fishing cooperative. Interviewees described reliable fishers as having three main characteristics: 1) Fishers that go fishing in a predictable basis, as opposed to not going out (e.g., because of substance abuse, or mechanical problems) when the weather is good. 2) Fishers that are reliable producers as those who go fishing and are able to bring adequate catch because they have the knowledge and skills to do so. Finally, 3) reliable fishers also are those that do not cheat on their agreements with the fishbuyer, such as bringing the catch to someone else that offered them a better price.

Under non-cooperative self-governance such as a patron-client structure, fishbuyers and fishers have limited means to enforce their contracts. Thus, fishbuyers’ success is partly a function of their ability to identify and develop trustworthy relationships with highly reliable fishers. Without being able to rely on a pool of reliable fishers providing a constant supply of fish, fishbuyers are significantly hindered in their ability to, in turn, develop trustworthy relationships with their clients, because they will constantly un-fulfill their promises to them. Same is the case for fishers operating under a cooperative structure.

Lending money to fishers that are not going to bring back catch at all, or at not the right time, or in the appropriate amount to enable them to fulfill commitments with their clients, can prompt a fishbuyer to go out of business, or a cooperative to go bankrupt and dissolve. Fishbuyer interviewees stated that once they have identified a reliable fisher who does what he says he is going to do and brings fish in a reliable way, they will continue to work with this person as long as they can. Reliable fishers do what they say they will do. A fishbuyer informant described reliable fishers as “someone that does not ask you for money, goes out to work, and brings you a lot of fish.” Another fishbuyer stated that reliable fishers are “responsible, hard working, come through with their commitments, and learn my working system.” Yet another highlighted that “there are fishers that ask you for work and if one sees that they are not responsible you do not lend them for gas, they better go ask to someone else, it doesn’t matter that they go with another buyer… because they are not responsible, they are too much trouble, they are more of a problem than the benefits you get from their catch.”

A history of working together
All communities we have examined where fishers formed co-ops also evidenced the presence of traditions of successful collective action. The presence of this factor has been linked to well-functioning co-ops in other regions of Mexico (Castañeda et al. 2012) and
elsewhere (Poggie et al. 1988) and more generally to common-pool resources in general (Ostrom 2009).

In Mexico fishers often developed a tradition of working together along family lines. Sometimes their desire to work together was motivated by their need to take their fish to the market, not be associated with fishers involved in illegal activities or their desire to better their livelihoods as a group. As a result of previous interactions, establishing co-ops later on did not imply incurring significant transaction costs of developing new relationships with fellow fishers. They already knew what to expect from each other in aspects related to their fishing activities. The same applied to non-cooperative self-governance, such as patron-client relationships.

**Moving forward**

During the conference presentation, and manuscript resulting from this conference presentation I will focus in discussing what are the main implications of the similarities and differences of cooperative and noncooperative self-governance for issues related to conservation, rights-based approaches, and more generally, the development of institutional infrastructures needed to build democratic processes in rural coastal marine environments.

**References**


### The small-scale fisheries learning circles project

Arthur Bull, Bay of Fundy Marine Resource Centre, Canada  
Sherry Pictou, Bay of Fundy Marine Resource Centre, Canada

Building the small-scale fisheries (SSF) movement will require finding new ways for SSF organizations and their leaders to communicate on a regular basis, in order to identify common issues, share strategies and learn from each other. The Small-Scale Fisheries Learning Circle Project is about finding ways to make this happen. The project is coordinated by the Bay of Fundy Marine Resource Centre, based in Nova Scotia, Canada, funded by the International Development Research Centre (IDRC) and includes SSF participants from six continents. It consists of a series of Skype-based learning circles focusing on specific areas relating the SSF worldwide, including privatization, Indigenous SSF, intertidal SSF and the implantation of the Voluntary Guidelines for Sustainable Small-Scale Fisheries (VG-SSSF). Each learning circle workshop is recorded, transcribed and shared on the project website, along with reading lists and other resource materials. Other learning circles will be added, based on interest from SSF organizations. This workshop will be an opportunity to discuss some of the themes and questions that have arisen from these conversations so far, and how they might apply to future communication links between SSF organizations and researchers world-wide. The workshop will also address some practical questions encountered by the project, such as translation, web-based technologies and building new alliances, reflecting the project’s goal to develop a methodology for sustainable, ongoing links between SSF groups.

### International ocean research priorities: how do issues relevant to small-scale fisheries fit into the big picture?

Murray A Rudd (University of York)

Oceans support a high proportion of global biodiversity and provide diverse benefits for humans but they currently face serious threats stemming from human activities and global
environmental change. The diverse range of challenges highlights the pressing need for targeted marine research that systematically identifies and addresses critical challenges. In a recent global survey of scientists from across disciplines, I ranked 67 important research questions that had been previously identified in a number of horizon scanning, big question, and research prioritization exercises. The 67 were synthesized from a broader selection of 657 issues / research questions from 23 regional and global studies of needs for ocean-related research and from studies of broader needs relating to biodiversity conservation, environmental contaminants, and sustainable food supply chains. Many of these questions have direct relevance for small-scale fisheries and coastal management. A total of 2187 scientists from 94 countries completed the survey, which involved a relatively complex series of ranking comparisons. The respondents brought a tremendous amount of oceans knowledge to bear on research needs, accounting for approximately 36,000 person-years of collective work experience and a portfolio of over 65,000 published journal articles. In this talk, I provide an overview of the results particularly salient for small-scale fisheries, including a summary of where various issues of interest (e.g., the use of local knowledge, interactions between fisheries and aquaculture, seafood trade, the role of stewardship in coastal management, various approaches to governance) ranked and respondents’ views on constraints to answering important questions relevant for small-scale fisheries.

A decision support tool for global change in marine systems: IMBER-ADApT

Isaacs, Bundy, Chuenpagdee, Cooley, Defeo, Glaeser, Guillotreau, Li, Perry

Global change is occurring at a faster rate than predicted often with consequences far beyond those anticipated. Although there is a wide range of assessment approaches available to decision makers, managers and stakeholders to address specific aspects of global change, there is currently no framework to identify what coping strategies have worked elsewhere, what entities have facilitated change, and what preventative options are possible, given financial resources and human capacities. In identifying this need, we present IMBER-ADApT as a decision support tool that builds on knowledge learned from past experience of responses to global change, to enable decision makers, researchers, managers and local stakeholders to: (1) triage and improve their responses; (2) make decisions efficiently to transition towards marine sustainability; and (3) evaluate where to most effectively allocate resources to reduce vulnerability and enhance resilience of coastal peoples to global change. It approaches the question of how to best respond to global change from the perspective of the people experiencing the change, offers knowledge based solutions, synthesises this knowledge into a learning tool, and, critically, includes an appraisal of responses. Although IMBER-ADApT has the capacity to be applied to a wide range of global change issues in the terrestrial and marine realms, our current focus is on fisheries and aquaculture, which are likely to suffer from multiple simultaneous pressures as a result of global change. It has the potential to contribute to timely and cost-effective policy and governing responses, as well offering cross-scale
learning for affected communities to help ameliorate, and eventually prevent, loss of livelihoods, food sources and habitat.

**On Access and Adaptive Capacity: lessons from small-scale fishing cooperatives in Baja California Sur, Mexico**

Elena Finkbeiner (Stanford University, USA)

Maintaining productivity and diversity in marine ecosystems is critical in conferring direct and indirect benefits to small-scale fishing communities. In this context, ecosystem health can increase adaptive capacity of fishing communities in a changing environment. However, ecosystem health is a necessary but not sufficient condition for human adaptive capacity; if communities or individuals do not have effective access to these resources then benefits will not be conferred. This study explores the link between access to marine resources in small-scale fisheries and the ability for fishers to adapt and respond in a changing environment. A comparative case study approach was used to explore this research objective across fishers’ and fishing cooperatives in Bahia Ulloa, Baja California Sur, Mexico, using diverse techniques, such as participant observation, semi-structured interviews, and the collection of fisheries catch and economic data. Results show that diverse and flexible access to marine resources minimizes fluctuations in fishers’ inter-annual income, given frequent biophysical and market changes that fishers in this region experience. This study provides empirical evidence that access plays a critical role in food and livelihood security and in strengthening adaptive capacity in a variable and changing environment.

**Self-fulfilling Prophecies: Small scale fisheries, Government Policy and the Transition to Aquaculture**

David McGrath (Earth Innovation Institute and Universidade Federal do Oeste do Pará)*
Oriana Almeida (Universidade Federal do Pará)
Leandro Castello (Virginia Polytechnic Institute)

Small-scale fisheries (SSF) are estimated to support several hundred million people worldwide. Small scale inland fisheries also provide an important economic and social justification for maintaining aquatic habitat and the ecological services they provide. Increasingly, though, the viability of SSF is threatened by the depletion of fish resources and the promotion of aquaculture. This paper investigates the interaction between small scale floodplain fisheries of the Amazon River and Brazilian government policies for fisheries management and aquaculture development. Beginning in the 1990s considerable progress was made in formalizing the community management of Amazon floodplain fisheries. However, in the late 2000s these efforts were largely abandoned by government...
fisheries agencies. With minimal government regulation, there is now little to prevent the progressive depletion of the Amazon’s floodplain fisheries. At the same time, these same government agencies are investing heavily in aquaculture, based on the rationale that fisheries development involves a transition from the inefficient capture of wild fish to the efficient farming of domesticated varieties. This development model is self-fulfilling as investments are shifted from providing technical assistance for the community management of floodplain fisheries to training aquaculture technicians and promoting aquaculture development. If this trend continues, the livelihoods of floodplain fisher families will be increasingly undermined, and the economic justification for maintaining aquatic habitat will be eliminated, facilitating the transformation of the Amazon floodplain into aquaculture ponds and large scale irrigated farms.

Special session 3.4: Small-scale fisheries: mobilizing scalable pathways to sustainability
Organized and chaired by: Brian Crawford (University of Rhode Island, Graduate School of Oceanography, Coastal Resources Center, USA)

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<td>Brian Crawford</td>
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<td>Jorge Alejandro Risi Mussio</td>
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Type of session:
Panel presentation, 1.5 hour

List of confirmed panel presenters:

Session synopsis:
Co-organized by the University of Rhode Island’s Coastal Resources Center and the Rockefeller Foundation’s Ocean and Fisheries Initiative, this session will present and discuss ongoing market and rights-based initiatives to reduce fisheries overcapacity, build more resilient and equitable livelihoods for fisher communities, and conserve productive and resilient marine ecosystems. The session will include six panel speakers from the
United States, South East Asia, Africa, and Latin America. Dr. Brian Crawford will act as panel chair and facilitator. Invited speakers and the title of their presentation topics are:


2. Brian Crawford (University of Rhode Island Graduate School of Oceanography, USA). “Addressing the Overcapacity Issue in Small-Scale Fisheries.” This presentation will provide an overview of the overcapacity problem and challenges to addressing overcapacity in small-scale fisheries.

3. Nygiel Armada (ECOFISH Project, Philippines). “Towards Management of Access in Small-Scale Fisheries: Innovative Technologies for Registering Fishers and Vessels in the Philippines.” The presentation will discuss the use of mobile technology and particularly TV white space technology to register fishers and fishing vessels and monitor fishing efforts. These technologies complement other initiatives, such as species/gear specific management, permitting of fishing operations, fisheries use zoning, right-scaling of the spatial scale of the management unit, up to "right-sizing" of fishing effort, that all together help address overcapacity and help manage small-scale fisheries at an ecosystem scale.

4. Dawda Foday Saine (National Sole Fishery Co-Management Committee - NASCOM). “The Gambia: Use Rights and Empowering Stakeholders in the Sole Fishery.” The presentation will explore the collaborative process involving government and resource users which led to exclusive collective use rights being granted to artisanal fishermen of the Gambian Sole fishery. Using a Fisheries Improvement Project like process, the initiative built on the provisions of the 2007 Fisheries Act to establish a co-management approach and management plan for the sole fishery. The fishery is working towards MSC certification of this export commodity.

5. Brendan Fisher (World Wildlife Fund, USA). “Fish, Farms and Food Security: Building Resilience in Diversified Coastal Livelihoods.” This presentation will discuss the importance of putting fisheries into a larger livelihoods and resilience context. Integrating fish and farm-based development programs in food security initiatives is therefore critical given the daily dynamics of mixed-livelihood households, but also with respect to rapidly changing resource conditions at sea and on land. Such an integration of programs and approaches also provides a suite of opportunities for improving food security in the most cost-effective manner.

6. Jorge Alejandro Risi Mussio (Sociedad Nacional de Pesqueria, Peru). “Peru: Reducing Overcapacity through Sustainable Financing.” Sustainable financing methods and market-based incentives that aim to mitigate social costs resulting from fleet reduction within Peru’s largest fishing resource, the Anchoveta fishery, will be presented.

The panel will begin with an overview of the Rockefeller Foundation’s emerging Oceans and Fisheries Initiative—its goals, impacts and intended outcomes. An overview of the overcapacity problem in small-scale fisheries will be followed by a collection of four ten-
minute case vignettes that illustrate promising pathways to sustainability. The presentations will showcase experiences and lessons learned from a variety of countries around the world. Examples of issues and opportunities that will be discussed during the presentation are:

- Approaches to addressing overcapacity issues in small-scale fisheries in developing countries
- The application of collective use rights
- Technology innovations for implementing registration schemes
- Strategies for developing diversified livelihoods and economic opportunities in fishing communities
- Applying market-based and sustainable finance approaches

A structured discussion will follow the six presentations. The discussion will address key thematic challenges covered during the panel presentations as noted above and the applicability and scalability of promising approaches in various contexts.

**Addressing the overcapacity issue in small-scale fisheries**

Brian Crawford, Ph.D., Coastal Resources Center, University of Rhode Island, United States, Brian@crc.uri.edu

**Abstract**

Many small-scale fisheries worldwide suffer from overfishing. The main cause of overfishing is overcapacity. Overcapacity exists when the harvesting ability or fishing effort exceeds the necessary level to harvest an optimum yield. Some main causes of overcapacity in small-scale fisheries are open access fishing regimes, weak governance policies and lack of fisheries data and enforcement mechanisms. Subsidies can exacerbate the overcapacity problem. The consequences of overcapacity negatively impact the ecosystem and affect its biological productivity, result in economic losses and lead to severe social consequences with cascading multiplier effects.

To address overcapacity, approaches need to be multifaceted using a mix of interventions. Initially, assessing the degree of the overcapacity problem requires defining the ideal level of capacity and determining which management measures can be put in place to achieve the desired target levels of fishing capacity. The two main approaches to reducing overcapacity are regulated open access or assigning property rights. Additional management measures to reduce capacity include regulatory and technical measures, such as input and output harvest controls. An integrated approach looks beyond the immediate resource management problems and considers broader economic development issues of poverty, vulnerability and marginalization of fishing households and communities.

The challenges of implementing these approaches and strategies include limited information to assess fisheries, inadequate governance capacity to enable application of
output measures and a lack of alternative livelihoods for those potentially displaced due to capacity reduction. Despite these challenges, there are numerous fisheries around the world where overcapacity issues have been resolved.

1 Introduction

World marine capture fisheries production has leveled off and declined slightly in recent years with approximately 80,000,000 MT produced annually (FAO 2012). Most believe this is due to the fact that human harvesting capacity has now exceeded the limits of what the world’s oceans can sustainably produce. Typically, fisheries that recently achieve a harvest level status of fully exploited or over-exploited are already in a situation of overfishing and overcapitalization. Over the last few decades, more stocks have been found to be fully or overexploited. This problem of stock depletion suggests a worldwide problem of overfishing which in turns suggests a significant problem with overcapacity in the world’s industrial and small-scale fishing fleets.

Overcapacity or overcapitalization can be defined as a long term problem in a fishery whereby the size of the fishing fleet, its harvesting ability or fishing power exceeds what is necessary to harvest an optimum yield (OECD 2013).

2 Causes of Overcapacity

2.1 Open Access

In small-scale fisheries, the problem of overcapacity is often viewed as a problem of open access, or conversely, as a lack of managed access or property rights in fisheries. In most cases of marine fisheries, access to the resource is free (open access), so resource rent is not internalized either in an individual’s cost considerations or when deciding to invest in fishing equipment.

2.2 Subsidies

Subsidies exacerbate overcapacity by further reducing the total costs of fishing, attracting additional entrants into the fishery and pushing the open access equilibrium further down the yield curve. Policies that incentivize additional effort simply results in further depressing catches.

3 Consequences of Overcapacity

The quantification of the problems caused by overcapacity is often expressed in economic terms of lost dollars or poor efficiency. Economists would argue that this is wasteful as both excess capital and labor is used where it is not needed to maximize profitability. The effects of overfishing caused by overcapacity can alter the ecosystem and its biological productivity, resulting in changes in marine trophic structures and species composition, habitat degradation and incidental catch of non-targeted species (Alverson 1994, Hobdey et al 2000, Morgan and Chuenpagdee 2003, Pauly et al 1998 and Pikitch et al 2014).

Overcapacity also increases the vulnerability of fishers, their families and communities to an inevitable decline and possible collapse of their main livelihood. In highly dependent fishing communities, the collapse of a longstanding fishery can lead to severe social consequences with cascading multiplier effects. As fishing stocks become more depleted, increasing desperation to earn a living and maintain a way of life can lead to an upturn in illegal fishing activities. The propensity to engage in illegal actions increases especially when deterrence factors are weak (low penalties and low probability of violations being detected or sanctions applied).
4 Approaches to Addressing Overcapacity
Since there are many dimensions to the overcapacity problem, solutions need to be multifaceted with actions requiring a mix of interventions.

a. Assessing Overcapacity
One of the first tasks to addressing overcapacity issues is to assess the degree of the problem by defining the ideal level of capacity desired by managers and then estimating the current capacity level in the fishery. Generally, most fisheries experts would recommend an exploitation level somewhere between MSY and MEY. However, most governments have multiple objectives for fisheries, including addressing local food security (maximization of yields) or improving profitability (MEY), maintaining employment (often effort well beyond MSY or maintained as open access), or for conservation and recreation purposes. These objectives often conflict with one another, resulting in policies that diverge considerably from what experts recommend. This discrepancy is often referred to as the fisheries management dilemma. Figure 1 illustrates this using the classic catch-effort bio-economic model.

![Figure 1. The Fisheries Management Dilemma (SOURCE: Beddington et al 2007)](image)

Assuming the level of capacity can be measured accurately for a given fishery, and there is clear target reference points related to management objectives, then management measures can be put in place to achieve the desired target levels of fishing capacity. Quantitative approaches measure overcapacity as a ratio of potential to target levels. This requires quantitative techniques and models to measure both parameters. Typically, this approach requires detailed information that is often lacking in small-scale fisheries, especially in developing countries.

Qualitative approaches are more likely to be used in data poor fisheries, a situation typical of developing country contexts. While qualitative approaches still require a level of information on the fishery, such as the biological status of the fish stock, additional measures indicative of overcapacity problems are considered. They include declining profitability of the fishery, increasing age of fishing vessels, and a significant decline in catch per unit of effort.
b. Capacity Reduction Approaches
There are two main approaches to reducing overcapacity, or preventing it from occurring in the first place; (1) regulated open access, or (2) assignment of property rights. These two approaches are also described as incentive blocking or incentive adjusting instruments (Table 1).

Table 1: Management Instruments to Control Fishing Capacity

<table>
<thead>
<tr>
<th>Incentive blocking instruments</th>
<th>Incentive adjusting instruments</th>
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<tr>
<td>• Limited entry</td>
<td>• Individual transferable quotas (ITQs)</td>
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<td>• Buyback programs</td>
<td>• Taxes and royalties</td>
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<tr>
<td>• Gear and vessel restrictions</td>
<td>• Group fishing rights (CDQs, etc.)</td>
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<tr>
<td>• Aggregate quotas</td>
<td>• Territorial use rights (TURFs)</td>
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<tr>
<td>• Non-transferable vessel catch limits</td>
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<tr>
<td>• Individual effort quotas (IEQs)</td>
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SOURCE: (OECD 2013)
Regulated open access involves the imposition a number of regulatory or technical measures of harvest control which restrict fishermen’s options on what they use to catch fish (OECD 2013). Regulatory approaches often involve input controls or output controls or a combination of the two. Examples are illustrated in the blocking mechanisms column in Table 1.

Input controls include measures such as such as gear restrictions, limiting the number of vessels, their size, engines used, or outright bans on fishing techniques or gear, as well as seasonal and area closures or establishment of marine reserves.

Output controls include measures such as a seasonal cap on total landings for the fishery such as an aggregate quota, or individual fishing quotas.

Property rights confer a right on the owner of the permit or license to catch a certain percentage of an allowable catch of a fish stock. These rights are generally saleable or transferable, which means that the resource rent is internalized in the market price of the license.

Pomeroy (2012) has recommended an integrated approach to addressing the overcapacity problems in small-scale fisheries in Southeast Asia, and this approach can apply as well in other small-scale fisheries contexts around the world. This approach has four main pillars: (1) resource management, (2) resource restoration and conservation, (3) livelihoods and economic and community development, and (4) restructured governance arrangements. This approach looks beyond the immediate resource management problems and considers broader economic development issues of poverty, vulnerability and marginalization of fishing households and communities.

5 Challenges to Addressing Overcapacity
There are many challenges to implementing the strategies mentioned above in order to address the overcapacity issue. Among the challenges described are:

Limited information to assess the magnitude of the overcapacity problem: Estimating the magnitude of the overcapacity problem requires good estimates of current capacity levels as well the optimum capacity levels desired. Quantitative approaches provide good
information on various aspects of the fishery; however they are often absent or limited in small-scale fisheries and developing country contexts. For instance, in many small-scale fisheries, even motorized vessels may not require a registration permit so the actual number of vessels may not be accurately known. Hence improvements in information and monitoring systems as well as establishment of vessel registration systems are often necessary preconditions for moving towards managed access and property rights approaches for managing capacity.

**Displacement of fishing capacity rather than elimination:** If a management program is successful in reducing capacity in any given fishery, this may result in a spillover problem to other fisheries. For instance, vessels shut out of one fishery can retool and target another fishery, creating overcapacity problems elsewhere. If vessels are not fully retired by decommissioning or scrapping, the problem is just displaced.

**Inadequate governance capacity to enable application of output measures:** Nations may not have the capacity to implement property rights in fisheries effectively. This could include the lack of a legal basis for instituting property rights in fisheries, or in some cases, national polices may promote the concept, but legislative changes have not yet been made to enable implementation of these policies.

**Absence of political will to implement required reforms:** Many high level decision makers in the fishery are very much in tune to any policy choices and impacts on voter constituencies and therefore may be unsupportive of making “hard” choices that require large numbers of people to lose their fishing livelihood.

**Lack of alternative livelihoods for those potentially displaced due to capacity reduction or unwillingness of fishermen to give up fishing as a livelihood:** Alternative livelihoods are sometimes introduced to reduce pressure in open access fisheries, allowing fishermen to reduce effort or give up fishing for better economic options. However, worldwide experience has shown that fishermen are often unwilling to leave fishing. In open access regimes, if several fishermen give up fishing for a living, profits will increase for those who remain. However, this then attracts additional people into fishing, increasing effort until all profits are again dissipated and earnings remain at the opportunity wage. Another strategy is to promote diversified livelihoods. This paradigm, which focuses on households rather than just fishermen, maintains that broadening the livelihood options available to households will make them more resilient and better able to adjust to management measures that restrict fisheries access or reduce fishing effort. Hence it can be viewed as a means of mitigating the socio-economic impacts that reductions in fishing effort or restricted access might have on households in the future. By providing access to savings and credit and training in technical and enterprise-related skills that help them diversify their income sources, fishermen and their households become less dependent on fishing.

To sum up, alternative and diversified livelihood development strategies will only help reduce overcapacity in fisheries if they are part of a coordinated and integrated approach that includes a mixed strategy of managing and/or restoring resources, strengthening access rights, conservation, and community development. However, a recent review of experience demonstrated that many livelihood components of marine and fisheries conservation programs fail (Torell and Tobey 2012).
6 Discussion and Conclusion
Despite the challenges of addressing overcapacity in small-scale fisheries, there are numerous examples of fisheries around the world where overcapacity issues have been resolved. Many of the examples illustrate how a transition from open access to managed access and the application of property rights regimes has been a fundamental reason for successful change. An overwhelming majority of these examples are in northern developed country and industrial fishery contexts. However, there are an increasing number of emerging examples for small-scale fisheries in low and medium income countries. While the numbers may be small, a more in-depth look across the portfolio of small-scale fisheries in low and medium income countries could provide more insights in how to successfully design such initiatives. In addition, it is clear that more “experimentation” with attempts at instituting managed access and property rights regimes and tailoring the basic concept to the unique context of these small-scale fisheries is in order.

7 References Cited

Use rights and Empowering Stakeholders in the Sole Fishery of the Gambia
Introduction:

The process began in 2008 when a local Gambian NGO, Gambia Artisanal Fisheries Development Agency expressed interest to the Marine Stewardship Council (MSC) for an Eco-label of the Sole Fishery of the Gambia. MSC honored the expressed interest and organised a workshop which resulted in the identification of three fish species, namely Sole, Bonga and Catfish, of which the sole fishery was given priority and then a special committee was formed to take the follow-up lead.

MSC financed the pre-audit of the sole fishery and its finding revealed a relatively positive situation, but with some deficiencies. A selected few among them are data, governance, scientific and local ecological knowledge, knowledge on by-catch, especially ETP- Endangered, Threatened and Protected Species.

The USAID/Ba Nafaa project was launched in 2009 with the objective to assist the Gambia Department of Fisheries achieve some of its fisheries development objectives such as responsible fisheries management, good governance, and research and capacity development.

The aforementioned deficiencies were tabled to the project for remedial action by the Department of Fisheries. The project kick started with the following strategic approaches,

- Information, Communication and Education (IEC) on Co-management, resource management, Fisheries Act 2007 and its associated Regulations of 2008, collaborative research and regional exchange visits
- Restructuring the Governance Mechanism in the Fisheries Sector, through unifying two associations namely, National Association of Artisanal Fisheries Operators (NAAFO) and Gambia Artisanal Fisheries Development Agency (GAMFIDA), integrating the Association of Gambia Fishing Companies (TAGFC) and developing the capacities of the Department of Fisheries staff
- Workshops on local knowledge, data collection, stock assessment and research.
- Creation of the National Sole Fishery Co-Management Committee (NASCOM) along with Landing Sites Co-management Committees (LACOMs)

The signature and approval of the management plan was based on the conductive legal framework of the 2007 Fisheries Act and its associated Regulations of 2008 which has provisions for co-management and empowerment of artisanal fisheries operators and organisations. The following sections of the Act were the driving force behind the historic breakthrough in the Gambia’s fisheries as well as an example in the world.
Sections:

Section 14 and associated regulations of 2008, provide the authority for the Minister of Fisheries, Water Resources and National Assembly Matters to designate special management areas for the purpose of community-based co-management in the interest of conservation, management and sustainable utilization of fisheries resources,

Section 11 and associated regulations of 2008 provide the authority of The Minister of Fisheries, Water Resources and National Assembly Matters to allocate property rights over fisheries resources,

Section 15 and associated regulations of 2008, provide the authority for the Minister of Fisheries, Water Resources and National Assembly Matters to establish Community Fisheries Centers (CFCs) for the purposes of community-based fisheries management (in consultation with Local Authorities, and where applicable, in accordance with the Local Government Act and any other laws of The Gambia).

Results and Conclusion:

In view of the quoted sections of the law, in the Co-Management Plan, NASCOM and associated LACOMs which represent community based organizations and are affiliated with the CFCs in landings sites was delegated exclusive use rights and authority for the responsible and sustained management and conservation of the sole fishery resources in the special management area from the Atlantic shoreline and shorelines adjacent to the estuarine areas of The Gambia River out to 9 nautical miles.

A few key management measures established in the management plan for which NASCOM has direct responsibility and authority are:

Monitoring enforcement of a seasonal closure for all fisheries and all gear out to One Nautical mile from 1st May – 31st October every year. Also of a minimum mesh size (which was recently increased based on new research). One notable result of the use rights granted in the plan is that NASCOM receives 100% of the penalties resulting from violations and manages their use.

Finally, the Co-Management Plan is a living plan based on regular review and adaptive management. NASCOM conducts collaborative stock assessment with the Department of Fisheries in April and November yearly in order to establish the impacts of the closure. We also conduct collaborative gear selectivity studies to advise government on best environmentally friendly fishing gears and methods. Findings are, and already have been, used to amend the plan as The Gambia sole fishery moves towards an increasingly well managed fishery.
The Peruvian experience of the fishing quota system: Mechanisms used to reduce the fleet and address arising social problems

Jorge Alejandro Risi Mussio, Sociedad Nacional de Pesquería, Perú, jrisi@snp.org.pe

Abstract

Commercial fishing in Perú is principally divided into two sectors: (i) direct human consumption (frozen, canned and cured), and (ii) indirect human consumption (fishmeal and fish oil). The fishery for indirect human consumption is sustained by the Anchoveta fishery, the primary fishing resource in Perú.

The harvest of the Anchoveta fishery for indirect human consumption was traditionally characterized and referred to as the “Olympic Race to Fish,” which negatively impacted the fishing sector and threatened the sustainability of the resource. As a result, the Ministry of Production (formerly the Ministry of Fisheries), a state agency governing the sector proclaimed a fishing season with a total allowable fishing quota for the authorized industrial fishing fleet to harvest. Once the total annual fishing quota was reached, fishing ended for that season.

To implement this policy, the government issued Legislative Decree No. 1084 on June 28, 2008, entitled Maximum Catch Limits per Vessel. This law granted each vessel a fixed percentage of the total annual allowable catch, or quota each season.

This new regime brought a lot of benefits to the sector, however, it had to address the social impacts generated as a result of reducing capacity and excess labor which it did through establishing programs designed to address social issues.

Special session 3.5: Foundations of successful small-scale fisheries management: from science to governance
Organized by: Environmental Defense Fund and World Wildlife Fund
Moderated by Dan Whittle (WWF) and Louise Heaps (WWF)

Synopsis:
Small-scale fisheries employ more than 90% of the world’s 36 million capture fishers who directly support more than 100 million jobs across the supply chain, and yet the future of these fisheries and the livelihoods of those they support remain uncertain. Improved management of small-scale fisheries could result in substantially increased productivity and sustainability, but several obstacles must be overcome. These include lack of awareness of the importance and plight of small-scale fisheries, insufficient data and technical capacity for stock assessment, failure to impose science-based regulations, weak governance, insufficient incentives for compliance, lack of transparent market
information, impact of global financial factors, inadequate infrastructure, and inequitable distribution of rights and power vis-à-vis large scale fisheries and other economic sectors.

While many small-scale fisheries are essentially unmanaged, others have been managed with several types of approaches, including spatial restrictions (e.g., marine protected areas and fishery closures), input controls (e.g., gear restrictions and seasons), output controls (e.g. catch limits), access limits (e.g., licenses), and secure catch privileges (e.g., TURFs and traditional marine tenure). In this session, we will describe how some of these approaches have resulted in the improvement of small-scale fishery outcomes, including stock recovery, increased catch per unit effort, increased biodiversity, and improved fishery incomes and livelihoods. Fishery practitioners from Belize, Cuba, Mexico, Galapagos, Pakistan, and Mozambique will illustrate the foundations of good small-scale fishery management by describing how such approaches were implemented in their fisheries. They will focus on how to improve the scientific basis of management with data collection and data limited assessments, how to improve fishery governance to align incentives with desired outcomes, how to create processes that harness local knowledge and facilitate the co-creation of equitable solutions, and how to overcome key obstacles. We will also discuss how fishery management tools can be combined to improve overall fishery performance.

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<td>Mario Ramade FEDECOOP de la Pacifico Norte Mexico</td>
<td>Marine reserves of fishing interest: Participation and co-management</td>
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<td>Impact of the global financial crisis over a local-small scale fishery: The Galapagos spiny lobster fishery</td>
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“Pesca-kucha” Session 3.6
Examining the intersections of post-colonialism, place-making and development in the Pribilof Islands, Alaska

Courtney Lyons, University of Alaska Fairbanks, USA, cdlyons@alaska.edu

Abstract

Social data, while becoming more common in fisheries management analyses, are typically restricted to quantitative economic measures. These data are limited, however, and cannot adequately summarize the dynamics within fishing communities. In contrast, detailed ethnographic research and the theoretical framework of place-making can provide a useful methodology through which to gather social data to understand how fisheries management policies affect resource-dependent communities. Place-making is the process through which places are socially constructed and invested with social and cultural meaning. Place-making ideas and practices can therefore interact with economic development efforts to create (or fail to create) sustainable communities. To examine how place-making and development efforts articulate in the Pribilof Islands, I conducted six months of ethnographic research in the communities of St. George and St. Paul, Alaska. Residents in both communities strategically embrace development, rejecting any initiatives that might undermine local autonomy, in pursuit of creating and furthering a place-based, local economy. Furthermore, residents in St. Paul have harnessed local development efforts in the pursuit of place-making efforts, successfully establishing a halibut day-fishery their community. In contrast, residents of St. George developed narratives of resistance to help gain control over local resources currently controlled by a third-party corporation tasked with representing the village. This research demonstrates: (A) that supporting local autonomy increases chances of success in development projects and, (B) that place-making, with it’s focus on power dynamics, local goals, and non-market, locally valued, place characteristics, provides a useful framework with which to design fishing community policies.

Introduction

Much of the social data currently used in fisheries management are quantitative economic measures. Non-economic social data are often based on surveys or interviews administered during brief visits to fishing communities or garnered from online sources; the data collected are often limited and typically focus directly on involvement in fisheries (e.g., Sepez et al. 2005). In reality, the relationships between fishing peoples and their resource bases are complex and not easily captured in simple survey questions. This is especially true for native and indigenous communities. These social connections in fishery systems thus often remain invisible to resource managers. In contrast, detailed ethnographic research and the theoretical framework of place-making can provide a useful methodology through which to gather social data to understand how fisheries management policies affect resource-dependent communities.
Individuals and groups actively create and shape the places they live into communities through place-making efforts. A study of place-making therefore explores practices that create "structures of feeling that bind space, time, and memory in the production of location (Gupta 1992). It focuses on the cultural creation and understanding of a local environment and therefore encapsulates the indicators of Arctic well-being identified by the Arctic Human Development Project: fate control, cultural integrity and contact with nature (AHDR 2004). Furthermore, place-making ideas and practices can interact with economic development efforts to help create (or fail to create) sustainable communities. Thus, examining intersections between place-making and development provides an ideal lens through which to understand the social structure, both economic and non-economic, of fisheries dependent communities. Below, I provide an example of the framework’s utility, using the Pribilof Island communities of St. George and St. Paul, Alaska as a case study.

Methods

To better understand how place-making and development articulate in the Pribilof Islands, I spent six months conducting ethnographic research in the communities of St. George and St. Paul, Alaska. During this period I conducted 50 semi-structured interviews (26 in St. George and 24 in St. Paul) with participants selected via snowball sampling. Participants were long-term residents and included: men, women, elders, youths, fishermen, government officials, and people not directly involved in fisheries or fishery support services. Interviews were supplemented with information gathered through participant observation efforts. Participant observation is a common anthropological method that involves researchers immersing themselves in communities to gain deeper understandings of local meanings and everyday life, while simultaneously maintaining intellectual distance to reflect upon cultural experiences (Bernard 2006). In this case, it included introducing myself to residents, making acquaintances, volunteering on projects, mentoring students, and interacting in community events.

History, development, and their articulations with place-making in St. George and St. Paul

Attitudes toward development in the Pribilof Islands are shaped by a history of colonial control by the US government. When Alaska was sold to the United States, Pribilof residents became wards of the federal government and conditions in the islands steadily worsened, as first private corporations and then federal agents attempted to maximize fur seal harvest profits. Everyday life was controlled in a number of ways, including: obligatory labor, federal control over local politics, a ban on sugar (which was frequently used to make alcohol), condoning of exile as a punishment, and, finally, a policy of isolation and secrecy designed to prevent outsiders from discovering the cruel conditions shaping local life (Jones 1980). These policies, as well as the issuing of supplies rather than wages, gave government agents a great deal of control over residents. It wasn’t until after World War II, that relationships between Pribilof residents and the government changed substantially. Throughout the latter half of the twentieth century, Pribilof Island
residents won a series of political battles, gaining citizenship, and eventually the right to organize tribal councils and self govern (Torrey 1978). While these circumstances improved life, the communities were dealt a serious blow when fur seal harvesting, their economic base, was prohibited in 1983 (Jones 1980).

These political efforts coincided with two major development projects in Alaska, designed to delineate Native rights toward land and fish resources: the Alaska Native Claims Settlement Act (ANCSA) and the Community Development Quota (CDQ) program. ANCSA was designed to formally designate which lands remained in Native hands, and which became the property of the state and federal government (Berger 1985). Under ANCSA, however, Native lands did not become property of tribal governments. Instead, the act stipulated the formation of Native corporations that then received title to Native lands and could manage or develop these lands for the benefit of shareholders. Thus the act, in addition to settling land claims, represented a development project, designed to provide economic opportunity (and assimilation) through increased industrialization of rural Alaska.

CDQ was a similar piece of legislation. The program mandated the creation of corporate entities specifically created to represent Native interests (NRC 1999). Fish harvesting rights were then delegated to these corporate entities (Ginter 1995; NRC 1999). While initially planning to form a single CDQ group, the Pribilof Island communities of St. Paul and St. George ended up forming separate CDQ groups. Discussions around the formation of a single CDQ group tapped into animosity between the communities and residents could not come to an agreeable distribution of quota or distribution of seats on the board between islands. People in St. Paul advocated that the division be based on population, while St. George residents preferred an even split between the two communities. Unable to fashion a satisfactory compromise, St. George split off to form a different group. Today, St. Paul is the sole member of Central Bering Sea Fishermen’s Association (CBSFA), while St. George is one of six communities in the Aleutian Pribilof Island Community Development Association (APICDA). CBSFA is unique among the CDQ groups as the only CDQ corporation to serve just one village and be headquartered in a constituent village (CBSFA 2013).

As a result of these projects and other local efforts, conditions in the two Pribilof Island communities are very different than they were half a century ago. Halibut and crab fisheries have taken the place of fur sealing in supporting local economic efforts. St. Paul is a bustling fishing community, with a fleet of around 20 local boats participating in a day fishery for halibut from June-October. Taxes collected from a year-round processing plant support the city government, allowing them to build and maintain infrastructure. In contrast, St. George struggles. With no processing plant to provide tax money, the city government depends upon state and federal aid to maintain infrastructure. A handful of boats participate in the local halibut fishery and they depend upon a tender boat to ferry catch over to St. Paul. Bad weather and mechanical problems can prevent the tender from leaving harbor, causing the catch to spoil.
Relationships between place-making and development in the Pribilof Islands are multifaceted and complex, structured by fisheries policies in numerous ways, both directly and indirectly. In general, due to their relative success in transitioning to a fisheries-based economy, residents in St. Paul expressed attitudes of political empowerment and autonomy and were pleased with local development efforts. In contrast, residents in St. George articulated their feelings of disenfranchisement and ambivalence toward development projects. While strongly desiring more development in their community, residents of St. George felt that outsiders design these projects poorly, often ignoring or misconstruing local input. In light of these observations, I believe that residents of St. Paul and St. George strategically embrace development, rejecting any development initiatives that might undermine local autonomy, in pursuit of creating and furthering a place-based, local economy.

Discussion

In St. Paul, residents have largely won the battle for control of local resources, establishing hegemonic equilibrium (Harner 2001), such that means (a fisheries-based economy) align with local meanings (the desire to create a fishing community). This equilibrium was achieved, in large part, through the capture of capital and the strengthening of local autonomy. A lack of power and capital reflects the state of many rural communities and reinforces colonial relationships with government centers in a core-periphery dynamic similar to that in much of the global south (Wallerstein 2004). In St. Paul, development projects such as CDQ and ANCSA, however, allowed the community to manage their own resources to obtain capital. Due to their autonomy, they were then able to use this capital to achieve local goals. This process has not been without struggle, however, some of which resulted from the structure of the development programs creating disparate political fractions within the community. In spite of that, the development programs have been largely successful in St. Paul.

In contrast, control over local resources is still hotly contested in St. George. Local strategies for gaining control draw upon both the resistance narratives (Larsen 2004) and the desire to embrace marginality (Heald 2008). Resistance narratives allow community members to create a sense of place based on opposition to outsiders and outsider projects (Larsen 2004). These narratives develop in circumstances where residents view themselves as wielding little power and as being placed in opposition against outside forces controlling local resources. In St. George, resistance efforts include partnering with nonprofit organizations like Greenpeace to fight unwanted development projects and establishing grassroots campaigns to develop local economies. Grassroots campaigns for local control have brought St. George limited success, however, as local rights to land and resources have been devolved to third-party corporate control. While residents have a voice on the board of the local CDQ corporation, the organization remains an insider-outsider, at best. As such, its goals do not align with local goals and thus reify the local resistance narrative.
While local goals do not necessarily align with those of development agencies, St. George residents do strongly desire more development in their community. As such, their resistance is limited in scope. Rather than eschewing development altogether (embracing marginality; Heald 2008), residents of St. George support a number of proposed projects, including: a hunting lodge, a fish processing plant, ecotourism, and harbor improvements. Local resistance centers, therefore, on place-making efforts and specifically the desire to see the development of a local fisheries-based economy in the community. Furthermore, residents desire this fishery to be structured in a particular way, as a day-fishery similar to the one established in St. Paul. In contrast APICDA, their CDQ group, would rather St. George residents assimilate into larger-scale fishing efforts throughout the Bering Sea.

Conclusions

Many fishing communities are struggling today. Through policies of privatization and declines in resources, residents are losing access to their resource bases. Despite this, and in the face of economic collapse, people are choosing to stay in these communities. These socially created places are therefore important. They represent a shared history, a sense of community and family, as well as a way-of-life that is slower and closer to nature, than that found in urban spaces. In indigenous communities, place furthermore represents a connection to cultural heritage and sense of stewardship toward resources. Only by understanding all these factors, and the importance with which residents view them, can policy-makers understand community sustainability.

Place-making, therefore, provides a useful framework for structuring discussions around community-based fisheries policy. While economic markers are commonly used as indicators for measuring the success of policies, and development programs in particular, they have many limitations. Economic markers cannot predict, describe, or explain conflicts between insider and outsider ideas about development and goals for the future. They cannot demonstrate whether local wellbeing has increased or decreased as the result of an intervention. And, finally, they cannot capture the loss of non-market, locally valued, place characteristics. Place-making, in contrast, can do all of these things and can, therefore, aid in the creation of policies that support fishing communities.

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Estimations of MSY of main finfish fisheries caught in the west Mexican coast of the Gulf of Mexico

Gabriela Galindo-Cortes (Instituto de Ciencias Marinas y Pesquerias, Universidad Veracruzana)
Maria de Lourdes Jimenez-Badillo (Instituto de Ciencias Marinas y Pesquerias, Universidad Veracruzana)
Cesar Meiners (Instituto de Ciencias Marinas y Pesquerias, Universidad Veracruzana)

Small-scale fisheries play a significant role in the Mexican coastal regions in the Gulf of Mexico. This study focused on the marine finfish fisheries caught in coastal waters of Veracruz, western Gulf of Mexico, where are register the highest number of small vessels and the fisheries activities provide a significant source of employment and income to coastal people. In this region the marine finfish stocks support important fisheries in terms of commercial landings. The annual catch of this group exhibits a downward trend that has prevailed since the late 1990s. The assessment of the current status of the marine finfish resources is difficult because the data are scarce. In this approach we applied the simple method for estimating the maximum sustainable yield (MSY) from commercial catch about 15 of the most commercially important marine finfish stocks based on some life history information, such as, intrinsic rate of population increase, carrying capacity, and simple assumptions about relative stock sizes at the first and final year of the catch data time series during 1990-2011. We found that 62% of this stocks have annual average catches around MSY (Catch/MSY>0.75), and they can be classified as fully exploited.
fisheries. In this group are resources belonging to Scombridae, Mugilidae, Carangidae, Centropomidae and Haemulidae families. The rest of stocks have catches below this reference point, which can be an indicator about undesirable situation for those populations. In this category was found resources belong to Lutjanidae, Sciaenidae and Ariidae families.

Small-scale fisheries in the San Andres archipelago (Colombia): Questioning scales and levels analysis

Olivier Randin, Memorial University (Canada), olivier.randin@gmail.com

Abstract

Small-scale fisheries are not a fixed scale in terms of governance and governability. While they may be small by their individual size, small-scale fisheries are strongly interconnected to higher scales and levels of governance. This interconnectedness makes them vulnerable to external influences and shocks, which in turn affect their governance and governability. This chapter calls for an analysis of levels and scales beyond the local community in order to grasp all the complexity, diversity and dynamics of interactions. An illustration of this is the case of small-scale fisheries in the San Andrés archipelago on the Caribbean coast of Colombia. Due to the International Court of Justice decision over boundary dispute between Colombia and Nicaragua in 2012, small-scale fishers in this area lost access to their traditional fishing ground. This chapter examines consequences of this decision using the governability assessment framework and provides lessons about small-scale fisheries governance when spatial scale is a critical issue.

1. Introduction

Most studies of small-scale fisheries are limited to issues at the local scale (Chuenpagdee, 2011). However, in many instances, small-scale fisheries face issues stemming beyond their boundaries. From the interactive governance theory perspective, scale issues play a critical role in determining governability. Further, governance takes place at multiple levels and quality of interactions between these multiple levels contribute to making the system more or less governable (Kooiman and Bavinck, 2013).

The present case study illustrates how scale issues and multi-level governance affect livelihoods of small-scale fisheries. Small-scale fishers of the Colombian archipelago of San Andrés, Providencia and Santa Catalina face a major challenge with a reduction of their territory due to a 2012 decision of the International Court of Justice (ICJ). About 76,000 km² of Colombian waters were transferred to Nicaragua, limiting thus access of the San Andrés archipelago’s fishers to their traditional fishing ground. This international event can be considered as a revealing factor of governance and governability issues in the fisheries system of the archipelago.
In the first part of this extended abstract, the archipelago and its fisheries, the small-scale fishers, the governing institutions and their interactions will be described. The ICJ decision and its consequences in the archipelago will then be presented. The second part will be a discussion on how governability of small-scale fisheries is affected by interactions between and within systems and by scales and levels issues. A conclusion will sum up the salient points.

2. The San Andrés archipelago

The Colombian archipelago of San Andrés, Providencia and Santa Catalina lies in the southwestern part of the Caribbean Sea, about 720 km northwest of the Colombian coast and about 230 km east of the coast of Nicaragua (Figure 1). It is composed of many uninhabited cays and banks and three inhabited islands: San Andrés (27 km²), Providencia (17 km²) and Santa Catalina (1 km²). Fisheries play an important role as a source of income and food security as well as a social and cultural identity (Mow, 2006; CORALINA-INVEMAR, 2012).
**Figure 1:** New borders between Colombia and Nicaragua according to the ICJ decision (ICJ, *Nicaragua vs. Colombia*, Judgment 19<sup>th</sup> November 2012: 89). Prior to ICJ decision: the 82<sup>nd</sup> Meridian set the border between Nicaragua and Colombia. Post ICJ decision: Colombian waters are eastward of the dotted line and also within points A-1-2-3-4-5-6-7-8-9-B. The cays of Quitasueño and Serrana still belong to Colombia but are enclaves in Nicaraguan waters.

### 2.1. The systems-to-be-governed

The natural system-to-be-governed is highly diverse, with about 65 species being fished (CORALINA-INVEMAR, 2012). While time series data and stock assessment for finfish are scarce and incomplete, CPUE decreases with an increase in juvenile catch. Moreover, the behavior of small-scale fishers displays a state of overfishing (Prada et al., 2004; CORALINA-INVEMAR, 2012).

Small-scale fishers (social system-to-be-governed) are in their majority Raizals, a native ethnic group. Their identity and cultural background finds its roots in Anglo-Saxon influences. They are protestant and Creole speakers whereas continental Colombians speak Spanish and are catholic with Hispanic cultural background.

In 2012, the archipelago accounted with a total of 740 small-scale fishers for a total of 178 boats: 538 small-scale fishers in San Andrés with 120 boats and 202 small-scale fishers in Providencia and Santa Catalina with 58 boats. (CORALINA-INVEMAR, 2012).

Small-scale fishers’ relationships with national institutions have been difficult mainly since the implementation of the free port model in 1953 devised to foster economic development of the archipelago. This model encouraged continental Colombians to migrate to the archipelago and Raizals became a minority on their own territory (Howard, H.B., 1992).

Fishing boundaries have recently been strongly reduced by the ICJ decision adding pressure to their social interactions and lifestyle.

### 2.2. The governing system

Fisheries management follows a top-down governance mode. The Ministry of Agriculture and Rural Development is in charge of agriculture and fisheries. The National Authority for Mariculture and Fisheries (AUNAP), in charge of implementing fisheries and aquaculture policies, works under its authority. The Secretariat of Agriculture and Fisheries is the representative of these national institutions in the archipelago.

The Colombian Constitution grants a large degree of autonomy to the archipelago for the management of its natural resources. The archipelago holds two specific institutions: CORALINA (Corporación para el Desarrollo Sostenible del Archipiélago de San Andrés,
Providencia y Santa Catalina), a decentralized regional autonomous governmental agency, that leads the regional planning process and implementation of land and marine use, and the Departmental Fishing Board. Its role, mainly consultative and informative, is to issue permits, manage small-scale fisheries areas and submit fisheries related suggestions to national authorities.

2.3. Governing interactions

The Secretariat of Agriculture and Fisheries encourages the participation of small-scale fishers in fisheries assessments. CORALINA fosters a co-management approach. The Departmental Fishing Board includes a small-scale fisheries representative. Means of communication and interaction between governing institutions and fishers exist but their mere existence does not imply their use and effectiveness. The latter derives from fishers’ participation and capacity to organize, which in this instance is rather low. Regarding scale, interactions between different levels of governance appear difficult as the State is felt to impose its policies without taking sufficient steps to listen to its archipelagic region. Moreover, the national government does not appear to be inclined in devolving more power to the region, though this process would be in accordance with the Constitution.

2.4. Nicaragua vs. Colombia, ICJ decision

In December 2001, Nicaragua filed proceedings to the IJC (The Netherlands) asking for a decision on the title of the Colombian archipelago of San Andrés and the maritime delimitations with Colombia (ICJ, Instituting Proceedings, 2001).

The ICJ decision, final and without appeal, left islands, cays and part of the sea to Colombia, but transferred about 76,000 km² of sea to Nicaragua (ICJ, Judgment, November 19th 2012). The president of Colombia, Juan Manuel Santos, has refused to recognize the ICJ decision.

The Colombian president decided unilaterally to grant to small-scale fishers six months subsidies (January to June 2013) to temporarily attenuate the direct effect of the decision.

Governing institutions of the archipelago regret a unilateral action following a top-down governance model when they try to foster a bottom-up governance model. For small-scale fishers, the State only created troubles and jealousy in the islands. They wished the central government would have paid closer attention to the needs of the archipelago and that the government would have included them early on in the judicial debate at the ICJ.

3. Discussion

The ICJ decision is an opportunity to examine how governance and governability of small-scale fisheries are affected by multiple levels and scales of interactions. A multi-
level approach of the case shows how the micro level cannot be totally grasped without the macro level, and vice versa.

Complexity lies in the scale at which one looks at the problem, the level at which the decision is taken to solve a problem and the level at which the consequence of the decision will have most effects. In the present case, governability depends on the ability of the governing systems to communicate with the system-to-be-governed.

3.1. Interactions

Interactions can be considered at the actor level, which puts forth "the willingness or ability of actors to participate" (Kooiman and Bavinck, 2013: 20). At this horizontal level of the present case study, fishers struggle to work together. Small-scale fishers explain this low quality of interactions as a consequence of a strong sense of individualism and few skills on how to work in group. In addition, small-scale fishers have a low trust in governing institutions, lowering their willingness to interact.

Interactions can also be considered at the structural level where governing system and system-to-be-governed are reflected (Kooiman and Bavinck, 2013). Looking at the vertical interactions of the present case study, there is a low trust from fisher toward governing institutions (mainly national ones) and a low capacity from national institutions to listen to and inform local communities.

The State, instead of acting as a mitigating actor receiving and absorbing the shock, became an additional vector adding stress and tensions. Governability of the system-to-be-governed has been undermined partly because of the unilateral decision of the central government to grant subsidies to small-scale fishers; a decision considered unfit by small-scale fishers and regional governing institutions alike.

Governance is mainly about dealing with "highly contentious sociopolitical issues" (Kooiman, 2013: 364) and governance interactions is about how to cope with unexpected events and deal with conflicts that are not likely to go away easily. According to the archipelago’s regional institutions, governance and governability is negatively affected in two ways: a lack of contextual sensitivity from central authorities and a lack of administrative power of regional authorities.

Governability issues can sometimes be described as "wicked problems" (Jentoft and Chuenpagdee, 2009). But governability issues could also be considered with regard to the wicked solutions implemented to solve a problem. The Colombian State, with its subsidies, fostered a wicked solution developing more problems than offering solutions in its interactions.

3.2. Levels and scales
Consequences of decisions at different scales do not have the same meaning observed from an international level or from a local level. What appears to be a logical, rational and equitable repartition of the sea between two States proves to be illogical, irrational and profoundly unfair in the eyes of the local populations and its small-scale fishers. Both views are valid if observed independently. But if the two scales, international and local, are considered one against the other, there is a discrepancy between the perception of international actors and the perception of local users on what is a maritime boundary (Mantilla, 2009).

The national level could become the interface between both. The impact of the international level on the local level may depend much on the ability of the national government to mediate between the global and the local. Complexity thus lies in the perception of scales when conceptualization of space and boundaries at higher levels – using a larger scale of analysis - are imposed on lower levels. Castro González (2009) points out that pitifully seldom, in the present case, have the interests, hopes, and various relations with the marine system of the ones - fishers, sailors, traders - enjoying it, been taken into account. In sum, the scale at which the dispute over maritime borders took place did not take into account the scale at which the strongest effect would be felt.

4. Conclusion

The ICJ decision demonstrates the importance of having a governance system that is flexible, adaptable and where communication flows throughout all levels of the overall system. Governing institutions should be able to interact in such way that each institution adds to the knowledge of the other to solve problems. In this instance, the constructive sharing of information between levels would play an important role.

In this case study, the problem permeates from the international level through the national level and to the local level. Thus, in the analysis of governance of small-scale fisheries, to delimitate a scale of analysis is important for analytical purposes, but often the situation presents the necessity to look at different levels. Governability of small-scale fisheries is influenced by interactions between governing institutions at different levels (international, national, regional), by interactions between institutions and small-scale fishers and by interactions within the system-to-be-governed itself.

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Building a national network to support artisanal fisheries in Brazil

Leopoldo Cavalieri Gerhardinger (Coletivo Memórias do Mar, Brazil, leocavaleri@gmail.com)
José Andrade (Rede Solidária da Pesca, Brazil, zeobreiro@yahoo.com.br)
Jorge Aziz (Rede Solidaria da Pesca, Brazil, jorgeaziz13@gmail.com)
Fabricio Gandini (Maramar Institute for Coastal Management, Brazil, fabricio@maramar.org.br)
Nubia Gonzaga (Teia Pesca, Brazil, n.gonzaga@uol.com.br)
Sidney Lianza (Universidade Federal do Rio de Janeiro / Rede Solidaria da Pesca, Brazil, sidneylianza@gmail.com)
Beatriz Mesquita (Fundação Joaquim Nabuco, Brazil, beatriz.mesquita@fundaj.gov.br)
Marcelo Raseira (Instituto Chico Mendes de Conservação da Biodiversidade, Brazil, mraseira@gmail.com)
Rene Schärer (Instituto Terramar, Brazil, fishnet@uol.com.br)
Jocemar Tomazino Mendonça (Instituto de Pesca, Brazil, jocemar.mendonca@gmail.com)

Abstract

This paper describes the ongoing self organization process of a ‘network of networks’ in support of artisanal fisheries in Brazil, namely the Brazilian Artisanal Fishing Web. This novel organization is pursuing means to facilitate innovative cross-network communication, learning and capacity building for fisheries stewardship; and the co-design of strategies to safeguard access to traditional fishing territories and aquatic sovereignty.

Introduction

Fisheries is one of the oldest productive activities of humankind contributing as fundamental source of income and food security. In Brazil, artisanal fishers practice the activity of fishing for commercial purpose, generally in autonomous or family-based organization mode. They are usually owners of their means of production, most frequently based upon small-scale technology (e.g., vessels) but still requiring registration with the Brazilian Ministry of Fisheries and Aquaculture (MFA).

In Brazil, it is estimated that the activity engages approximately 2 million people and the sector is responsible for around 45% of the country’s fish production. Even though this sector is much more expressive than the industrial fishing, artisanal fishers suffers from low representativeness in public policies. They form a working class that is still largely excluded from the current capitalist economic system and often pursue organization around cooperatives as a form of social inclusion for securing income generation and livelihood (Maldonado and Santos 2006).
The sector often organizes around fishing colonies, associations, cooperatives, discussion forums, networks and movements of various sorts for building and supporting political claims and positions. However, in general, economic and political behaviour patterns limits the success of such organizations. Consequently, artisanal fisheries are loosing space and minimal conditions of existence and social reproduction in several coastal areas in Brazil. Amongst some of the factors we enlist: lack of basic understanding about cooperatives so as to adopt the philosophy, concepts, entitlements and duties of this organizational model; difficulty in understanding cooperatives’ legislation/bureaucracies and its practical implications; lack of basic information and resources necessary to create and deal with the legalization and implementation of cooperatives, including managerial/business capacity and notions of entrepreneurship (Maldonado and Santos 2006).

The above highlights an enormous limitation in their capacity to be perform as cohesive political actors in communication with main productive powers and conventional Brazilian political institutions (regional or national) such as major landowners, construction builders and the real estate sector, amongst others. As a response to the aforementioned patterns, numerous support networks have emerged in pursue of social, cultural, economic and environmental sustainability of artisanal fisheries in the country. However, these networks often suffer difficulties in articulating its members and fishers, and often lack coordination amongst them.

In general, these networks are composed by representatives of the artisanal fisheries sector and aim to support and articulate the diversity of its constituencies. While these are all legitimate and contextualized networks living closely on the needs of artisanal fisheries, very often these networks struggle in keeping with a structured and pro-active agenda on the long run. Some of these issues include limited financial backing; excessive reliance on voluntary-based core institutional provisions (lack of full-time human resources); low efficiency in communication amongst members and; limited articulation between different networks to enable cross-fertilization of ideas and mutual support. Nevertheless, there is a very clear need for these supportive networks to foster a counter-hegemonic movement, recovering and valuing the artisanal fisheries culture towards the sustainability and survival of small-scale fisheries modes.

This paper presents the on-going emergence of a small-scale / artisanal fisheries organization network in Brazil settled to respond to these issues, enacting a process expected to drive and amplify large scale transformations collectively.

2. Self-organization and strategic foresight of the Brazilian Artisanal Fisheries Web

Several small-scale fisheries related costal-marine networks have recently started to converge into a multi-stakeholder arrangement named Brazilian Artisanal Fisheries (pt: Teia de Redes de Apoio à Pesca Artesanal no Brasil – or simply Teia - Pesca Artesanal). The initiative originated from a converging process of actor mobilization started with the
Solidary Fisheries Network (SOLTEC - Federal University of Rio de Janeiro) and other similar efforts since 2007, and were subsequently strengthened during and after the Ombudsperson of the Sea event held at the People’ Summit (Rio de Janeiro, Brazil - June 2012).

In 2013, three meetings helped shape the concept of the new organization. Firstly, a workshop was held in July/2013 (Brasilia city) with the specific objective of addressing artisanal fisheries public policies and cross-network integration needs. The major outcome was the decision to form a type of network of networks in support of artisanal fisheries, with a focus in traditional territorial rights and management of common pool resources, learning and capacity building and research about necessary subsidies and policies in support of the sector. Two other related events were held in 2013, including the Too Big To Ignore meeting held in Curitiba in 2013 - where a working group was set to engage with the initiative - and a seminar in November 2013 to further align constituencies towards a common objective. By late 2013, several relevant organizations/initiatives were engaged such as the Brazilian Fishermen and Fisherwomen Movement (MPP), the National Fishers Movement (MONAPE), the Solidary Fisheries Network, the Technical Assistance and Rural Extension Network (ATER - Pesca), the International Collective in Support of Fishworkers, Conselho Pastoral dos Pescadores and Cáritas Brazil. Representatives of governmental organizations were also present such as the Secretary of Solidary Economy, Ministry of Fisheries and Aquaculture, Ministry of Environment and Institute for Advanced Economic Studies.

With the financial support of Cáritas Brazil, a first overall group meeting was finally held in Brasilia city in March 2014 and the Teia - Pesca Artesanal was formally and publicly announced. The network thus emerged with an integrative concept while acknowledging and building upon the natural and intrinsic diversity of its constituencies. Some of the key actions being pursued are the exchange of information; coordination of synergetic action amongst existing networks; learning with positive and negative experiences of others; boosting technical cooperation in support of fisheries enterprises and; the articulation of public policies in support of artisanal fisheries. This emerging network aims to improve communication and articulation of people and organizations facing the lack of integration amongst those dedicated to artisanal fisheries in Brazil.

This novel organization presupposes that relationships of each component actor are rich itself and worthy for the entire group in a broad sense. By integrating individuals and groups of researchers, NGOs, fishworkers (men and women), social movements and other fishing organizations, the network aims supporting artisanal fisheries and their respective territories. It represents the involvement of citizens to achieving social change and innovation for their fishing communities rights. It also aims to facilitate dialogue between civil society and government, and thus guide the co-design of public policies for fisheries as well as social and environmental policies more broadly.

The first general workshop held in Mach/2014 identified three strategic focuses for immediate integrated action:
(1) Innovative communication approaches (e.g., implementation of a knowledge-sharing environment based upon social media tools);

(2) Learning and capacity building for fisheries stewardship and;

(3) Co-design of strategies to safeguard access to fishing territories and aquatic sovereignty.

Various activities are already being developed on an integrated fashion. Success will largely depend on the capacity of articulation and communication amongst members of the network and broader social movements. Furthermore, the organization is challenged with the need for continued stepwise, legitimate and transparent structuration and institutional strengthening.

Ultimately, it is expected the process enables creative and cohesive solutions to responsible small-scale fisheries development, increasing efforts targeting potential collective action and the self-governance capacity of fishers.

Final considerations

While specific projects have a start and frequently come to an end, we expect this novel organization leads to effective and long-lasting public policy building. This will require of the Teia - Pesca Artesanal the engagement of key leadership, socio-political articulation, visibility and transparency given the diversity of its constituent actors.

A first set of organizational challenges is already ahead of those engaged, like a more structured articulation with governmental actors, network management and project fundraising and delivery. As more structured partnerships will occur along the way and certainly foster organization, we expect novel communication and political capabilities to emerge along the way. The establishment of this national network may also facilitate international cooperation and jointly support to local and solidary types of economic development.

References


Small-scale fisheries and the emergence and consolidation of Marine Protected Areas: Insights from two contrasting bottom-up initiatives in central Chile

Oyanedel, Rodrigo; Pontificia Universidad Catolica de Chile, Ecology
Marin, Andres; Pontificia Universidad Catolica de Chile, Ecology
Castilla, Juan Carlos; Pontificia Universidad Catolica de Chile, Ecology
Gelcich, Stefan; Pontificia Universidad Catolica; "Bottom-up participatory processes to create and manage No-take Marine Protected Areas have been proposed as a way to scale-up marine conservation, enhance stewardship and deal with the lack of support and compliance of top-down conservation approaches. However, bottom-up conservation does not always lead to positive outcomes, thus it is increasingly important to understand the conditions that determine the emergence and consolidation of these initiatives. Emergence and consolidation were empirically compared for two contrasting bottom-up No-take Marine Protected Areas in Chile that have been developing under the same political setting, however one has been successful and the other is stagnated. Using mixed methods, stakeholders; a) motivations to participate in the No-take Marine Protected Area initiatives, b) communication, support and information flow networks, c) perceived participation and d) satisfaction with the emergence of the bottom-up No-take Marine Protected Areas were assessed. Non-significant differences were found between both initiatives for stakeholder motivations to create a no-take Marine Protected Area. Significant differences were found in stakeholders’ participation, network structure indexes and satisfaction with the emergence and consolidation process. Results highlight that for the emergence and consolidation of bottom-up No-take Marine Protected Areas initiatives, common interests do not necessarily lead to common action; stewardship will not emerge automatically in response to potential benefits. Understanding disparities in participation, information sharing and communication are key aspects of emergence which must be considered if these initiatives are to be promoted."

Optimizing the contribution of small-scale fisheries to food security, livelihoods and resilience in Bolivia’s northern Amazon.

Tiffanie K. Rainville (tiffanie@worldfish.org)
Alison E. Macnaughton (alison@worldfish.org)
Joachim Carolsfeld (yogi@worldfish.org)

Fish are a cornerstone of food security for thousands of rural families in the Bolivian Amazon, who make use of remarkably high fish diversity for subsistence and small-scale commercial activities as part of their livelihood strategy. Participatory research by World Fisheries Trust and partners through the Peces para la vida project (Fish for Life) focused on understanding how to optimize the contribution of fisheries to food security and livelihoods in the region. Data collected since 2011 through a household survey, interviews, focus groups, participatory mapping and value chain assessments elucidated
the key bottlenecks and vulnerabilities in the fisheries value chain and informed project strategies. Results show that rapid development, climate variability, high levels of food insecurity, gender inequality in the value chain, and an introduced species (paiche-Arapaima gigas) are impacting livelihoods in the region. Peces para la vida worked together with local fishers and key stakeholders to (i) strengthen local organizations engaged in national policy frameworks, (ii) improve food security through an indigenous fisher processing plant and lagoon management plan, (iii) create spaces for knowledge sharing and improved fish market, (iv) support family production units led by women, (v) improve diet diversity and recognize the value of fish. We conclude that context-specific fisheries management and policies are key elements of an enabling framework for local resilience, and need to carefully consider the complex local realities as well as the transitory nature of food insecurity and influence of acute seasonal shocks.

Motivations for Community-based Conservation: A Case from Odisha, India

Alex Zachariah (University of Manitoba, Canada)
Dr Fikret Berkes (University of Manitoba, Canada)

"Marine conservation is a complex issue that requires consideration of various factors and relationships. During the past few decades, there have been a shift in conservation approach from the conventional centralized, top-down one, to a holistic, community based participatory system. Community-based conservation that is sensitive to local livelihoods and that tries to achieve a balance between ecological goals of conservation and social/economic ones, is the target of the Equator Initiative (EI) of the United Nations Development Programme (UNDP). UNDP-EI has a rich database of case studies, with the main goal to develop “lessons learnt” by recognizing community-based initiatives for integrated conservation-development throughout the biodiversity-rich tropics. One such community-based conservation initiative is the Samudram Women’s Federation (SWF), a multi-village organization that works for marine conservation mainly to protect olive ridley turtles and develop sustainable livelihood practices among the small-scale fishers of the Odisha coast, Bay of Bengal, India. Through this study we are trying (a) to look into the various motivations that lead to environmental conservation and stewardship by local communities; (b) to explore how motivations for conservation may be linked to sustainability of the local economy and livelihoods; and (c) to understand the match (or mismatch) between community interests and policy maker objectives regarding livelihood and conservation. The research tries to explore the various factors that may enable community based resource management and conservation, with an eye for developing lessons learnt.

Keywords: Biodiversity; Marine Conservation; Community-based conservation; Equator Initiative; olive-ridley turtles; Motivations; Stewardship; Sustainability; Livelihood; Odisha; Bay of Bengal; India."
Examining the intersections of post-colonialism, place-making and development in the Pribilof Islands, Alaska

Courtney Lyons, University of Alaska Fairbanks, USA, cdlyons@alaska.edu

Abstract

Social data, while becoming more common in fisheries management analyses, are typically restricted to quantitative economic measures. These data are limited, however, and cannot adequately summarize the dynamics within fishing communities. In contrast, detailed ethnographic research and the theoretical framework of place-making can provide a useful methodology through which to gather social data to understand how fisheries management policies affect resource-dependent communities. Place-making is the process through which places are socially constructed and invested with social and cultural meaning. Place-making ideas and practices can therefore interact with economic development efforts to create (or fail to create) sustainable communities. To examine how place-making and development efforts articulate in the Pribilof Islands, I conducted six months of ethnographic research in the communities of St. George and St. Paul, Alaska. Residents in both communities strategically embrace development, rejecting any initiatives that might undermine local autonomy, in pursuit of creating and furthering a place-based, local economy. Furthermore, residents in St. Paul have harnessed local development efforts in the pursuit of place-making efforts, successfully establishing a halibut day-fishery their community. In contrast, residents of St. George developed narratives of resistance to help gain control over local resources currently controlled by a third-party corporation tasked with representing the village. This research demonstrates: (A) that supporting local autonomy increases chances of success in development projects and, (B) that place-making, with its focus on power dynamics, local goals, and non-market, locally valued, place characteristics, provides a useful framework with which to design fishing community policies.

Introduction

Much of the social data currently used in fisheries management are quantitative economic measures. Non-economic social data are often based on surveys or interviews administered during brief visits to fishing communities or garnered from online sources; the data collected are often limited and typically focus directly on involvement in fisheries (e.g., Sepez et al. 2005). In reality, the relationships between fishing peoples and their resource bases are complex and not easily captured in simple survey questions. This is especially true for native and indigenous communities. These social connections in fishery systems thus often remain invisible to resource managers. In contrast, detailed ethnographic research and the theoretical framework of place-making can provide a useful methodology through which to gather social data to understand how fisheries management policies affect resource-dependent communities.
Individuals and groups actively create and shape the places they live into communities through place-making efforts. A study of place-making therefore explores practices that create “structures of feeling that bind space, time, and memory in the production of location” (Gupta 1992). It focuses on the cultural creation and understanding of a local environment and therefore encapsulates the indicators of Arctic well-being identified by the Arctic Human Development Project: fate control, cultural integrity and contact with nature (AHDR 2004). Furthermore, place-making ideas and practices can interact with economic development efforts to help create (or fail to create) sustainable communities. Thus, examining intersections between place-making and development provides an ideal lens through which to understand the social structure, both economic and non-economic, of fisheries dependent communities. Below, I provide an example of the framework’s utility, using the Pribilof Island communities of St. George and St. Paul, Alaska as a case study.

**Methods**

To better understand how place-making and development articulate in the Pribilof Islands, I spent six months conducting ethnographic research in the communities of St. George and St. Paul, Alaska. During this period I conducted 50 semi-structured interviews (26 in St. George and 24 in St. Paul) with participants selected via snowball sampling. Participants were long-term residents and included: men, women, elders, youths, fishermen, government officials, and people not directly involved in fisheries or fishery support services. Interviews were supplemented with information gathered through participant observation efforts. Participant observation is a common anthropological method that involves researchers immersing themselves in communities to gain deeper understandings of local meanings and everyday life, while simultaneously maintaining intellectual distance to reflect upon cultural experiences (Bernard 2006). In this case, it included introducing myself to residents, making acquaintances, volunteering on projects, mentoring students, and interacting in community events.

**History, development, and their articulations with place-making in St. George and St. Paul**

Attitudes toward development in the Pribilof Islands are shaped by a history of colonial control by the US government. When Alaska was sold to the United States, Pribilof residents became wards of the federal government and conditions in the islands steadily worsened, as first private corporations and then federal agents attempted to maximize fur seal harvest profits. Everyday life was controlled in a number of ways, including: obligatory labor, federal control over local politics, a ban on sugar (which was frequently used to make alcohol), condoning of exile as a punishment, and, finally, a policy of isolation and secrecy designed to prevent outsiders from discovering the cruel conditions shaping local life (Jones 1980). These policies, as well as the issuing of supplies rather than wages, gave government agents a great deal of control over residents. It wasn’t until after World War II, that relationships between Pribilof residents and the government...
changed substantially. Throughout the latter half of the twentieth century, Pribilof Island residents won a series of political battles, gaining citizenship, and eventually the right to organize tribal councils and self govern (Torrey 1978). While these circumstances improved life, the communities were dealt a serious blow when fur seal harvesting, their economic base, was prohibited in 1983 (Jones 1980).

These political efforts coincided with two major development projects in Alaska, designed to delineate Native rights toward land and fish resources: the Alaska Native Claims Settlement Act (ANCSA) and the Community Development Quota (CDQ) program. ANCSA was designed to formally designate which lands remained in Native hands, and which became the property of the state and federal government (Berger 1985). Under ANCSA, however, Native lands did not become property of tribal governments. Instead, the act stipulated the formation of Native corporations that then received title to Native lands and could manage or develop these lands for the benefit of shareholders. Thus the act, in addition to settling land claims, represented a development project, designed to provide economic opportunity (and assimilation) through increased industrialization of rural Alaska.

CDQ was a similar piece of legislation. The program mandated the creation of corporate entities specifically created to represent Native interests (NRC 1999). Fish harvesting rights were then delegated to these corporate entities (Ginter 1995; NRC 1999). While initially planning to form a single CDQ group, the Pribilof Island communities of St. Paul and St. George ended up forming separate CDQ groups. Discussions around the formation of a single CDQ group tapped into animosity between the communities and residents could not come to an agreeable distribution of quota or distribution of seats on the board between islands. People in St. Paul advocated that the division be based on population, while St. George residents preferred an even split between the two communities. Unable to fashion a satisfactory compromise, St. George split off to form a different group. Today, St. Paul is the sole member of Central Bering Sea Fishermen’s Association (CBSFA), while St. George is one of six communities in the Aleutian Pribilof Island Community Development Association (APICDA). CBSFA is unique among the CDQ groups as the only CDQ corporation to serve just one village and be headquartered in a constituent village (CBSFA 2013).

As a result of these projects and other local efforts, conditions in the two Pribilof Island communities are very different than they were half a century ago. Halibut and crab fisheries have taken the place of fur sealing in supporting local economic efforts. St. Paul is a bustling fishing community, with a fleet of around 20 local boats participating in a day fishery for halibut from June-October. Taxes collected from a year-round processing plant support the city government, allowing them to build and maintain infrastructure. In contrast, St. George struggles. With no processing plant to provide tax money, the city government depends upon state and federal aid to maintain infrastructure. A handful of boats participate in the local halibut fishery and they depend upon a tender boat to ferry catch over to St. Paul. Bad weather and mechanical problems can prevent the tender from leaving harbor, causing the catch to spoil.

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Relationships between place-making and development in the Pribilof Islands are multifaceted and complex, structured by fisheries policies in numerous ways, both directly and indirectly. In general, due to their relative success in transitioning to a fisheries-based economy, residents in St. Paul expressed attitudes of political empowerment and autonomy and were pleased with local development efforts. In contrast, residents in St. George articulated their feelings of disenfranchisement and ambivalence toward development projects. While strongly desiring more development in their community, residents of St. George felt that outsiders design these projects poorly, often ignoring or misconstruing local input. In light of these observations, I believe that residents of St. Paul and St. George strategically embrace development, rejecting any development initiatives that might undermine local autonomy, in pursuit of creating and furthering a place-based, local economy.

Discussion

In St. Paul, residents have largely won the battle for control of local resources, establishing hegemonic equilibrium (Harner 2001), such that means (a fisheries-based economy) align with local meanings (the desire to create a fishing community). This equilibrium was achieved, in large part, through the capture of capital and the strengthening of local autonomy. A lack of power and capital reflects the state of many rural communities and reinforces colonial relationships with government centers in a core-periphery dynamic similar to that in much of the global south (Wallerstein 2004). In St. Paul, development projects such as CDQ and ANCSA, however, allowed the community to manage their own resources to obtain capital. Due to their autonomy, they were then able to use this capital to achieve local goals. This process has not been without struggle, however, some of which resulted from the structure of the development programs creating disparate political fractions within the community. In spite of that, the development programs have been largely successful in St. Paul.

In contrast, control over local resources is still hotly contested in St. George. Local strategies for gaining control draw upon both the resistance narratives (Larsen 2004) and the desire to embrace marginality (Heald 2008). Resistance narratives allow community members to create a sense of place based on opposition to outsiders and outsider projects (Larsen 2004). These narratives develop in circumstances where residents view themselves as wielding little power and as being placed in opposition against outside forces controlling local resources. In St. George, resistance efforts include partnering with nonprofit organizations like Greenpeace to fight unwanted development projects and establishing grassroots campaigns to develop local economies. Grassroots campaigns for local control have brought St. George limited success, however, as local rights to land and resources have been devolved to third-party corporate control. While residents have a voice on the board of the local CDQ corporation, the organization remains an insider-outsider, at best. As such, its goals do not align with local goals and thus reify the local resistance narrative.
While local goals do not necessarily align with those of development agencies, St. George residents do strongly desire more development in their community. As such, their resistance is limited in scope. Rather than eschewing development altogether (embracing marginality; Heald 2008), residents of St. George support a number of proposed projects, including: a hunting lodge, a fish processing plant, ecotourism, and harbor improvements. Local resistance centers, therefore, on place-making efforts and specifically the desire to see the development of a local fisheries-based economy in the community. Furthermore, residents desire this fishery to be structured in a particular way, as a day-fishery similar to the one established in St. Paul. In contrast APICDA, their CDQ group, would rather St. George residents assimilate into larger-scale fishing efforts throughout the Bering Sea.

Conclusions

Many fishing communities are struggling today. Through policies of privatization and declines in resources, residents are losing access to their resource bases. Despite this, and in the face of economic collapse, people are choosing to stay in these communities. These socially created places are therefore important. They represent a shared history, a sense of community and family, as well as a way-of-life that is slower and closer to nature, than that found in urban spaces. In indigenous communities, place furthermore represents a connection to cultural heritage and sense of stewardship toward resources. Only by understanding all these factors, and the importance with which residents view them, can policy-makers understand community sustainability.

Place-making, therefore, provides a useful framework for structuring discussions around community-based fisheries policy. While economic markers are commonly used as indicators for measuring the success of policies, and development programs in particular, they have many limitations. Economic markers cannot predict, describe, or explain conflicts between insider and outsider ideas about development and goals for the future. They cannot demonstrate whether local wellbeing has increased or decreased as the result of an intervention. And, finally, they cannot capture the loss of non-market, locally valued, place characteristics. Place-making, in contrast, can do all of these things and can, therefore, aid in the creation of policies that support fishing communities.

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Regional session 4.1: North America

Does the relationship between fishermen and enforcement officers impact regulatory compliance?

Ruby Moon, Oregon Sea Grant, USA, ruby.moon@oregonstate.edu
Flaxen Conway, Oregon State University, USA, fconway@coas.oregonstate.edu

Abstract:
US fisheries regulations are designed to protect resources for current and future use, yet both enforcement and commercial fishing communities speculate and complain about regulatory compliance. This research studied the relationship between these two communities and regulation compliance in Oregon. Three themes emerged regarding community culture and the interactions within and between the commercial trawl and enforcement communities: personal connections to gain regulatory information; tools used to ensure compliance; and the relationship between knowledge/understanding of regulation and compliance level. Although a difference was noted in the relationships between the varied levels of enforcement and the fishermen, this did not constitute a shift in compliance. Compliance remained high, and fishermen and enforcers alike reported that fishermen have little choice but to follow the rules. Previous research reported that the amount of control participants had matters, and that control in developing regulatory issues leads to compliance. Our research highlights the amount of control participants’ had in regulation development and complying with regulations varied. Non-fishing boat
owners have little control over what happens when their vessel is fishing, yet they are the entity involved in regulation development. Deck hands have little control over whether a vessel fished legally and none reported participating in regulation development. Skippers appeared to have the highest level of control over whether a vessel follows regulations, yet few were involved in regulation development. The relationships within and between these communities might offer potential insights into a variety of outcomes that may impact the fisheries, regulation development, and these communities.

Introduction, Background, and Rationale
Fisheries regulations are designed to protect natural resources for current and future use. Yet both the enforcement community and the commercial fishing community often complain about regulatory compliance and speculate on the reasons why this is the case, often from opposite perspectives. This research investigated how the relationship between regulation enforcers and commercial groundfish trawl fishermen might impact compliance. It took place in Newport, Oregon, a coastal community known also as a fishing community. Newport is relatively dependent on fishing even though the economic structure of the community is somewhat diversified (Gilden and Conway, 2002; Package and Conway, 2010; Norman et al, 2007). In 2010, over $30million were brought into the area from fish landings (Van Voorhees, 2010). The groundfish trawl fleet is one of the prominent gear groups in the community. Regulations are one of the biggest factors influencing fishing practices; the trawl fleet faces a high level of regulation including, most recently, Individual Transferable Quota (ITQ; also known as rationalization or catch shares).

Communication of information has the ability to impact the relationship between and within groups of people in both positive and negative ways. Fishermen rely on information to run their business (Gilden and Conway, 2002). If they do not receive the necessary information to run their business effectively and legally, the price of doing business increases in the form of costly fines and penalties that can force fishermen out of business. This, in turn, creates economic instability in the entire coastal community; bait, net, and boat shops, canneries, processors, fuel stations, and even seafood consumers can be impacted (Gilden and Conway, 2002; Package and Conway, 2010).

One complication in the communication process about regulations is that fishing practices are regulated by multiple agencies depending on the fishery, the place, and the specific activity. “Near shore” fisheries are harvested in state waters (defined by zero to three nautical miles off shore), are regulated by Oregon Department of Fish and Wildlife (ODFW), and the Oregon State police (OSP) provide enforcement. There are exceptions and complexities. For example, the National Marine Fisheries Service (NMFS) is responsible for the federal regulation of groundfish and migratory species (salmon and tuna) regardless of where they are harvested, and the US Coast Guard (USCG) is the enforcement arm for fisheries and sea safety (Wallace, et al). Table 1 displays the agency responsible for policy development and the associated agency responsible for enforcing the regulation.
Table 1. Relationship between regulating agencies and enforcement agencies

<table>
<thead>
<tr>
<th>Policy Development</th>
<th>NMFS</th>
<th>ODFW</th>
<th>USCG</th>
<th>OSP</th>
<th>NOAA</th>
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<td>Federal Fishery Regulation</td>
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<td>State Fishery Regulation</td>
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<td>State / Federal Safety Regulation</td>
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<tr>
<td>Regulatory Enforcement</td>
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<td>Federal Fishery Enforcement</td>
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<td>State Fishery Enforcement</td>
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<td>State / Federal Fishery Safety Enforcement</td>
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Another complication in the communication process is that state and federal regulation enforcers communicate in different ways and varied communication practices create confusion and misinformation within the fishing community (Gilden and Conway, 2002; Opsommer and Conway, 2005). Fishermen feel hesitant and don’t often enjoy working with fishery managers because they feel devalued and unimportant in the process of fisheries management (Gilden and Conway, 2002; Package and Conway, 2010). Regulatory agencies enforce regulations differently and impose different repercussions for similar infractions. State regulators answer to federal regulators when designing state rules. State regulations must meet the minimum federal requirement, but can be more stringent. State regulators submit their plans to the federal level that has the power to approve or ask for amendments (Government, 2009; NOAA, Investigations and Protocols, 2010).

The fishing community is not homogenous and this affects communication. Newport fishermen are independent (Package and Conway, 2010) and managers have stated a lack of comfort working with fishermen due to the intimidating nature of their communication style (Gilden and Conway, 2002). Most fishermen only get involved with ocean policy issues directly related to their fisheries or regions fished because the rules and regulations are difficult and complex (Gilden and Conway, 2002).

Regulations enforcers use various communication strategies to inform fishermen. However, many of these enforcers have difficulty in reaching portions of the fleet for several reasons (Gilden and Conway, 2002). Outreach efforts are hindered by fishing community culture or by not having contact information for all of the fishermen. Some
crewmen just do their job and collect their pay. Others view fishing as a career, become skippers or boat owners, and purposely seek out opportunities to be involved in management (Package and Conway, 2010).

Word of mouth is the primary means for disseminating information within fishing; it is up to an owner or skipper to tell the crew what is happening (Gilden and Conway, 2002; Opsommer and Conway, 2005). One reason skippers are able to keep compliant even when their boat owner fails to communicate new regulations to them is because word of mouth between the informal/insider partnerships that develop with other boats and skippers. Informal networks are effective and beneficial for both fishermen and regulators in developing and maintaining relationships with the fishing community in Newport (Package and Conway, 2010).

Proximity and timing also matter as they can determine who will be given the chance to participate in management meetings. Fishermen who want to be involved in the management process have to make a decision between being involved or fishing (Package and Conway, 2010); most report that if the weather is good, you go fishing and not to a meeting.

Although other studies have investigated regulation compliance, no study has investigated the relationship between regulation enforcers and fishermen in determining the level of compliance. This research sought to fill this gap; both communities supported this research.

Methods
Semi-structured interviews were conducted with trawl fishermen and regulation enforcers to examine what impact communication has on compliance and the number and level of infractions incurred by fishermen. Research subjects were gathered through a sample of convenience that began by first identifying key contacts in each target audience group and giving them business cards notifying them of the opportunity to voluntarily participate in the study. Snowball sampling (Berg, 2001) was used to establish a database of participants to interview.

Twenty-one semi-structured interviews were conducted; 16 from the commercial trawl fishing community and 5 from the enforcement community. Fishing participants included boat owners, skippers and crewmen. Enforcement participants included federal and state enforcement agents. Interviews were tape-recorded, transcribed verbatim, and a content analysis was conducted.

Results and Discussion
Three major themes appeared regarding the culture of these communities and the interactions within and between them. The first theme regarded the connections a person has with others to gain regulatory information. Fishermen talk regularly with each other; they meet at local taverns for coffee and breakfast, they see each other on the docks, and they communicate over the radio while fishing. Every participant acknowledged that
fishermen have ties to each other; yet some spoke of disparities within relationships due to position in the industry. For example, owners have capital investment in the fishery and a vested interest in regulation development and updates:

“Primarily it’s the boat owner or permit holder (if different). We had some older boat owners that don’t fish anymore but they still own a boat and have a crew, or their sons or their relatives who fish the boat. They’ll come collect information [at management meetings] to be able to share with their family and their friends that are fishing and couldn’t come in.” (Enforcement agents)

“I’m involved in a lot of different stuff [management meetings] so I hear about a lot of stuff before the other guys do. So sometimes we get a heads up from enforcement on a particular issue. They’ll come down and talk with us, sometimes but not always.” (Vessel Owner)

Owners share information that impacts fishing practices with skippers. If those fishing practices impact other crewmen it may be be passed to them. Crewmen, for the most part, are not part of regulation development and they have no idea why regulation is being adopted or what the potential impact of the regulation may be for them as individual fishermen. Access to information and engagement in regulation development is dependent on the person’s position in the industry, the size of the vessel, and if the owner fishes or not; which were correlational.

The second theme dealt with the tools used to ensure compliance. These tools reveal a pressure that is appearing as the fishery continues to develop under the capitalistic conditions that exist. For example, ITQs allow owners to buy, sell or trade quota to meet their needs; this study documents a couple of issues regarding ITQs. First, the quota amount was spread throughout all those who had a permit at the time, even if they did not necessarily land groundfish locally. Local vessels with a groundfish permit fishing in Alaska received local quota and therefore the quota amount was “spread thin” between all interested parties. Second, it was inferred that smaller vessels were made better off if they leased their permits and did not fish their quota; allowing the vessel owner to continue to collect revenue from the permit without fishing but putting the vessel’s hired crew out of work. Consolidation of the fleet creating “winners and losers” within the fishery was expressed, as was the ITQ system impacting other fisheries outside of an ITQ system. Participants reported that, due to the guaranteed quota, groundfish fishermen were choosing to fish other fisheries that were more lucrative; waiting until no better options exist before filling their groundfish quotas.

“You talking about the ITQ system? I think there’s gonna be winners and losers... And the losers are the people that have been fishing on the same boat for 25 years or something and then they realize the owner of the boat doesn’t really have enough fish to keep his boat going. So he just sells his fish and 3 people are out of a job. Those are the losers. Everything is going to consolidate and so basically people with the most money are going to win. Just like it always have been. You know? And so to me, how does that create jobs? And it pressures people into other industries.” (Vessel Owner)
The agents themselves were noted as the biggest tool used for compliance. Consistency was brought up by every person interviewed. Agents use every opportunity possible to ensure consistency. Cross training, ensuring regulation interpretation, and shared positions between agencies and the joint operations helps to alleviate burden on any one specific agency while strengthening the collective action and ensuring consistency.

The final theme relates to the level of knowledge and understanding regarding regulation, as well as the actual level of compliance. While a difference in the relationships between the varied levels of enforcement (state; federal) and the fishermen (position held; age) was noted, this difference did not constitute a shift in compliance. Rather, compliance remained high and fishermen and enforcers alike reported that most fishermen follow the rules (fishermen report they have “no choice” but to follow the rules). The knowledge and understanding about regulation within the fleet varied greatly, but did not, however, appear to impact the level of compliance.

The difference in knowledge and understanding about regulation appears to be related to the position a fisherman has in the industry. While, fishermen share information out of necessity, they only share the information that is necessary to do their job:

“They [crew] know because they are participating in the [gear] switch over. But that’s the extent of it. It’s not like we sit down with a public notice. We don’t sit down with everybody on the boat and go over what’s in the public notice. It’s the skipper’s obligation to abide by those rules and his crew is going to do what he’s doing.” (Vessel Owner)

Previous research (Ostrom 2007) sheds some light on this suggesting that what matters is the amount of control participants have, and the assumption is that if a participant has control over regulatory issues it will lead to compliance. In our research, the amount of control participants’ have in regulation development and exercise in complying with regulations varied. Boat owners that did not fish have very little control over what happens when the vessel is fishing, yet they are the industry entity most involved in regulation development. Deck hands had little control over whether a vessel fished legally or not (they are workers following orders) and none participated in regulation development. Skippers had the highest level of control over whether a vessel followed regulations, yet very few were involved in regulation development.

**Conclusion**

Relationships within and between these communities were interesting and potentially responsible for a variety of outcomes that have the potential to impact the fishery, regulation development, and these communities. This study revealed that regardless of the effort to provide consistency throughout the enforcement community, there are different types of relationships between the various levels of enforcement and trawl fishermen. Compliance remains consistently high among the various levels. The real difference in relationships occurs within the fishing community. Boat owners have a higher level of access to information. Skippers may have access to information, and certainly have the highest level of control over whether a vessel follows regulations or not, yet very few
were involved in regulation development. Crewmen’s access to information is limited and they have minimal incentive to, and most do not, participate in regulation development; this creates barriers to fully understanding regulations.

The ITQ management approach may offer solutions to some issues plaguing enforcement in that the fishing community has the potential to create a profitable, efficient industry that attempts to protect the resource while allowing for utilization. ITQs also have the potential to eliminate small family owned vessels and impact the communities in undetermined ways. Some have stated that ITQs are the latest attempt by the government to intervene where the market has failed. The Pacific Fishery Management Council describes the objective of the trawl rationalization plan is to increase net economic benefits, create individual economic stability, provide for full utilization of the trawl sector allocation, consider environmental impacts, and achieve individual accountability of catch and bycatch (PFMC & NMFS, 2010b, 2010). Many have said that the true impact of ITQs is yet to be realized. ITQs have the potential to incentivize smaller vessels to lease their quotas to the larger more efficient vessels and, in the process, limit the opportunity for fishermen to participate in the fishery. This would further consolidate the fleet and concentrate the wealth into fewer hands (Hanna, 2000; Package and Conway, 2010; Robbins, et al, 2010). So time will tell if this approach will offer solutions to, or create negative impacts for, the fishing community, the Newport community, and the groundfish and other fisheries.

References


Can small-scale commercial and subsistence fisheries co-exist? Lessons from Norway House Cree Nation, northern Manitoba, Canada

Durdana Islam (University of Manitoba, Canada)
Fikret Berkes (University of Manitoba, Canada)

Fishing is a part of Canadian First Nations culture, and subsistence fishing has an important role in food security. However, subsistence (domestic) fishing is under-studied, and the interaction between the two kinds of fisheries has not been studied systematically. This paper addresses the gap, and focuses on how to deal with challenges when the two kinds of fisheries overlap in a small community. The study was conducted in Norway House Cree Nation. Data collection methods included questionnaire survey and key informant interviews, October 2013 to March 2014. Commercial fishing in Norway
House takes place during spring/summer and fall seasons, whereas subsistence fishing takes place throughout the year. Commercial fishing mostly occurs in the open waters of Lake Winnipeg; domestic fishing in rivers adjacent to the reserve and in smaller lakes inland. The only place of overlap between two kinds of fisheries is a lake near the community. How do fishers and the community deal with potential conflicts between the two kinds of fisheries? The key is the separation of the two temporally and spatially. At the one place where they do overlap, conflict resolution is handled through (1) monitoring of net ownership (nets are tagged) by a conservation officer working with a community assistant, and (2) informal communication and use of tolerance and reciprocity. The first mechanism is regulatory but really de facto co-management in the way it is implemented. The second is consistent with Cree cultural values, e.g., an old fisher with a single net in a commercial area is tolerated.

The fox guarding the henhouse? : Making the case for co-management of the San Diego sea urchin fishery

Stephen Schroeter (University of California Santa Barbara)
Peter Halmay (Fishermen’s Marketing Association of San Diego)
Ray Hilborn (University of Washington)
Nicolas Gutierrez (Marine Stewardship Council)
Ed Parnell (Scripps Institution of Oceanography)
Peter Nelson (Collaborative Fisheries Research west)
Carlos Mireles (California Department of Fish and Wildlife)
Michael deAlessi (University of Washington)

Artisanal fisheries present challenges to effective, sustainable management. When adequate data are available, fishery management depends on stock assessment models to establish reference points; under data-limited conditions, a set of trigger points based on historical and current catch or CPUE trends are used to adjust catches or fishing effort up or down. We suggest a co-management alternative where fishermen, scientists, and resource managers collaborate to monitor the resource, determine fishery objectives, develop empirical reference points to establish a harvest plan without direct reference to a stock assessment, and adjust harvest levels using the monitoring data. We present results from a community-based data collection program, ongoing since 2004, for red sea urchins (Strongylocentrotus franciscanus) in San Diego, California. This program has collected fishery-dependent and -independent data at appropriate spatial and temporal scales. We recently expanded the program to include stratified random video surveys covering about 0.2% of the fishing area. Resource managers collect logbook data (catch and effort) at a high spatial resolution. As a result, this fishery is now locally data-rich, allowing fishermen, scientists, and resource managers to develop novel empirical reference points to establish the first harvest plan for this resource in the region. We also discuss the role of data sharing by fishermen in building the social capital needed for
cooperative harvesting strategies that optimize extraction of fishery resources and also develop the trust of the resource managers in the validity of the data being collected.

Tidal waves of change in the New England’s small-scale fisheries

Madeleine Hall-Arber, Ph.D., Anthropologist, MIT Sea Grant College Program

Management, fuel costs and marketing are three challenges faced by fishermen regardless of the scale of their operations. The truth of this assertion was revealed to me when these issues were raised in conversations with members of the day-boat trawl fleet of Provincetown, Massachusetts in 1975 and later echoed by participants in the pirogue fleet of Guet Ndar, Senegal in 1981 and 2012. In this presentation, I focus on what we in the Northeast U.S. consider small-scale fishing even though much of it might be characterized differently in another context. The three challenges remain, though the first takes precedence with a national switch in favored regulatory techniques to “catch shares,” a form of quota management closely aligned with individual transferrable quotas (ITQs). In addition, small-scale fisheries of the region struggle to retain access to working waterfront infrastructure.

The fisheries

The Northeast US is characterized by diversity of vessel size, gear, species of interest, ethnicity, fishing grounds and patterns, values, etc. Until recently, the majority of the vessels were owner-operated and family members dominated the crews. This ownership pattern remains true for the inshore lobster fishery of the region, but has radically changed in the other major fisheries: scallop, offshore lobster, and groundfish. Groundfish has long dominated (in volume) the regions’ landings and employed the most fishermen. It has also undergone the most significant changes coincident with the change in management tools applied to the fishery.

Management

The New England Fishery Management Council regulates the catch of groundfish through the Multispecies Fishery Management Plan. Among the groundfish species most important to the region are cod, haddock, pollock and various flounders. Longlines, gillnets and trawl (also known as drags) are the primary gears used and while the vessels range in size, none of the groundfish boats are over 109 ft (33 m).

Seeking to avoid the consolidation and corporatization of fisheries associated with the institution of individual transferable quotas (ITQs), participants in the Northeast fisheries prevailed upon their congressional delegation to require approval via a referendum of fishermen before ITQs could be imposed in the region. Instead of allocating fish using ITQs, with guidance from National Marine Fisheries Service (NMFS), a new organizational structure called “sectors” was developed to receive allocations of fish, i.e., catch shares.
Sectors are comprised of permit holders who agree to abide by specific sector rules. The fish that each sector is allocated is based on its members’ histories. That is, the quantity of fish controlled by the sector is determined by an average of the quantity each member caught during a ten-year period, less a percentage due to conservation reductions. Because the allocations are officially to the sector, these are not considered ITQs, thus no referendum was deemed necessary. However, similar to ITQs, each sector member may only fish the quantity he “brought in” to the sector. If he catches more, or wants to catch more, he must buy or lease quota from someone else.

Originally conceived of by the Cape Cod Commercial Hook Fishermen’s Association (CCCHA), sectors were theoretically groups of like-minded fishermen, including some who would act altruistically to help fellow sector members. The original sector, a New England Fishery Management Council and NMFS-approved experiment, received an allocation of cod, some of which was donated to the sector by members who received but decided not to fish their allocation. At the time, quotas allocations were not sold or leased. Once the allocations could be sold or leased, such altruistic donations ceased.

While membership in a sector is officially voluntary, and there is a “common pool” of fishermen who decided against joining a sector, the vast majority of groundfish fishermen joined one of 17 sectors in the region. This was done quickly, however, and did not necessarily draw together like-minded fishermen, fishermen of the same gear-type or fishing style, or even fishermen from the same port.

Fishing for groundfish has been strictly controlled since 1994 through a host of evolving management measures, including area closures, limits on the numbers of fishing days allowed, quotas, minimum net mesh size, etc. followed by the move to catch shares. Nevertheless, assessments of cod, in particular, show ever-diminishing numbers, blamed in part on a changing ecology such as warmer water in the region. Cod has become a “choke species” limiting the ability of fishermen to catch other groundfish for fear that they will catch more cod than they have allocation.

The sale and leasing of all quota, but particularly cod quota, has become more intense and more expensive. Despite the organization of sectors and catch share terminology, many of the negative impacts associated with ITQs have followed. Fewer of the fishing vessels remain a part of the small-scale fisheries in New England. Fewer are owner-operated (though some of this change is simply due to the aging of the owner population) and a few individuals or companies own multiple vessels and permits. In other words, consolidation and corporatization are associated with the sector/catch share system. One of the local fishermen referred to the program as “ITQs on training wheels.”

Consolidation means that there are fewer vessels, a direct job loss for fishermen, especially crew, and an indirect job loss among the often small, family-owned businesses that were part of the fishing shoreside infrastructure. Another negative impact of consolidation was noted by one fisherman who, when his boat broke down offshore,
looked around and realized there were no other fishing vessels nearby. If the worst happened, no one would even know until they failed to return. Furthermore, assessments are partially based on landings reports, but by eliminating the small-scale fleet, information derived from multiple landings at diverse sites diminishes.

Corporatization raises the specter of corporations unfamiliar with local norms taking over, armchair fishermen, and safety concerns such as pushing for product even if weather conditions are poor.

**Economic tides affect crew**

Perhaps even more indicative of the direction of change is the shifting of economic power on the individual vessels. Thirty years ago, especially in the small-scale fisheries, many crewmembers were working towards the purchase of their own vessels. Fishing costs were lower since fuel, ice and gear prices took a smaller share of the proceeds from the catch. The lay system that dictated how much of a share of the proceeds went to crewmembers varied with the vessels, but a 60-40 split after expenses was not uncommon. That is, 60 percent of the proceeds was divided more or less evenly among the crew members after the costs were paid and 40 percent was for “the boat,” that is, the owner, who was expected to pay for vessel maintenance and gear from the boat share. (This is an over-simplified description of the lay system since he details of these did vary, nevertheless, crewmembers usually made sufficient money to be able to dream of owning their own boat. See Kitts et al. 2011 for a more detailed description of the variations.)

Today, while many of the vessels still work under a share system, the crewmembers share a much smaller proportion of the proceeds. Some vessels have a 50-50 split, others have a 40-60 split with the crew sharing the 40 percent. In addition to the increase in costs of such necessities as fuel, the leasing of quota is also included in the costs that the crewmembers are forced to pay. The crewmembers of groundfish boats today rarely dream of buying their own boat.

Crewmembers are not licensed or permitted in New England, there is no official registry and captains/owners have little incentive to track the crew. Vessels with the largest catches tend to attract the most experienced crew, disadvantaging the small-scale businesses.

Many of the fishermen have “educated” their children out of the fishery, discouraging them from becoming fishermen. This has contributed to a “greying” of the fleet and made the fleets vulnerable to corporate ownership. Some have been forced to sell their vessels and/or permits due to costs or debt incurred due to unanticipated impacts of management change, others have sold in order to secure retirement income.

Other small-scale fishing operations have diversified, participating in science projects, seasonal tourist activities, and in a few cases, ended up on television.

**Role of organizations: lifting all boats?**
As the management changes have led to changes in vessel ownership and economic shifts on the vessels themselves, political power is also in flux. When there were more permits and vessels, a multitude of organizations represented different gear types and/or ports with more or less success in the management and/or marketing realms. Today, there are fewer organizations but they continue to play critical roles in support of their groups.

Perhaps because there are fewer organizations now, each represents more diverse operations than the organizations of several decades ago. In some cases, this reportedly results in power shifts away from the smaller-scale businesses. In the past, small businesses were aligned with other similar small businesses in their own organization and thus the political messages were representative of their common interests. Now, in several organizations the small and larger-scale businesses are represented by the one organization, resulting in mixed messages, or views that reflect the more powerful in the group.

Nevertheless, the organizations that remain in New England are active in lobbying to retain working waterfront; in working with the state government agencies to develop equitable distribution of emergency funds; encouraging vessel safety training; and working to diversify marketing so that the local product receives higher prices, thus benefiting all fishermen.

References


Meridian Institute and MRAG Americas. 2010. Catch Shares in New England: Key Questions and Lessons Learned

Regional Session 4.2: Latin America & the Caribbean

Understanding how nine dimensions of small-scale fishing communities impact management: A Colombian case study
This is a first approach to understanding commonalities and variations found among small-scale coastal and marine fishing communities in Colombia at the national level. Here are presented features of nine examples of fishing communities that directly affect or indirectly influence the outcome of fisheries management, organized in terms of: 1. Geographical, political, and demographic features; 2. Environmental and territorial features; 3. Fishing methods and equipment; 4. Living conditions; and 5. Marketing and economic relationships. A synthetic overview of a sector that was little known from a national perspective, this research makes possible a close understanding of the social, economic, cultural and environmental factors shaping Colombian marine Fishermen. These nine communities illustrate the wide range of conditions characteristic of each ecoregion. Taken together creates an exceptionally rich general picture of artisanal fishing at the national level (with the exception of communities located in marine protected areas and on islands). This high variety supports a regional categorization, although differences and similarities across Caribbean and Pacific communities do not always break down geographically. Combining Chuenpagdee’s characteristics for conceptualizing fisheries with the social and economic characteristics of fishing communities learned from this research allow us to integrate social conditions and fisheries conditions for each of these communities and suggest parameters to take into account for the design and implementation of Fishery Management. The wide variety of fishing activities and social conditions presented in this study enhance the need of taking local, regional, coastal and national perspectives into account, rather than continuing to craft management plans based on a single sector with general features.

Social networks and supply chain dynamics in fish trade, a theoretical perspective

Carmen Pedroza (Universidad Nacional Autónoma de México)
Juan Hernández (Universidad de las Palmas de Gran Canaria)
Silvia Salas (Centro de Investigaciones y de Estudios Avanzados-IPN)

Seafood supply complexity has its origins in the nature of fish resources, the amount of aquatic species with commercial importance, the variety of products, technology and actors that intervene in supply chain organization. This reality, which frames fish trading and is of high relevance in small-scale fisheries, needs classical-adaptive tools able to
explain the dynamics followed by products from fishers to markets. In this context, traditional economic models assume homogeneity among agents, all actors are interconnected among themselves and its access to information is uniform, ignoring that social networks do not present a uniform topology among trading partners. In particular, fish trade relies on a social network and its dynamic structure can facilitate or complicate the flow of products from fishers to markets, and have an impact on income distribution. Complex social network theory and the Resource-Based View of the Firm (RBVF) can contribute to explain fish trade and its consequences, by combining a sociological perspective to analyze the linkages between strategic actor behavior and the use of intangible resources influencing the flow of seafood products along the supply chain. This work presents a theoretical framework, to analyze how the network structure and relationship system can have an impact on the flow of products from fishers to markets and the income distribution along the seafood supply chain. Network analysis is used to evaluate quantitatively the network components, and the ability to make internal and external relationships as a key resource for fish trade performance is explained considering the RBVF perspective.

Diversity and food security in the Amazon estuary

Oriana Trindade de Almeida (Federal University of Pará)
Carlos Mariano Alvez-Valles (Federal University of Juiz de Fora)
Sérgio Rivero (Federal University of Pará)
Natalia Hanazaki (Federal University of Santa Catarina)
Karol Lavado (Federal University of Pará)
Marta Coutinho Caetano (Federal University of Pará)

The Amazon estuary is an extensive area of lowland forests with daily variation of flood tides. It is one of the most densely occupied regions of the Amazon basin. The present study had the objective of studying diversity and food security within Amazon communities. The study area is located in 4 rural communities of the Amazon Estuary, where 195 interviews were carried out. Results show that the main means of livelihood within the estuary are the extraction of açaí (Euterpe oleracea) (77%), the extraction of buriti (Mauritia flexuosa), and fishing (73% shrimp and 66% fish). These activities are also the principal means of food security in the aforementioned communities. In recent years, açaí extraction has gained importance due to an expanded market and rising fruit prices. For the estuary population, agriculture has a reduced importance given it is practiced by only a land-owning minority; a part of these lands do not flood and thus cannot produce. During food shortages most families can buy their food, but a small number of families depend on the donation of friends, neighbors, and parents. Diversification of economic activities and livelihoods is a key feature of many rural populations around the world, and contributes to the resilience of these populations towards such changes. The diversification of livelihoods can also contribute to local food security, which relies heavily on external sources of food and means to buy food.
Artisanal fisher perceptions regarding the sustainability of bottom long line use in the district of Bejuco, Guanacaste, Costa Rica

Andy Bystrom (Universidad Estatal a Distancia-UNED)
Patricia Cardenas Valenzuela (Universidad de Costa Rica-UCR)

The bottom longline spotted rose snapper (Lutjanus Guttatus) fishery is of upmost economic importance for small-scale artisanal fishers in the district of Bejuco, Guanacaste located along Costa Rica’s Pacific coast. This study attempts to evaluate Bejuco fisher perceptions regarding the socioeconomic and environmental sustainability of bottom longline use. Both quantitative and qualitative methods were used to accomplish this. A test was first developed with four variables: (1) perception of wellbeing (in terms of fisher earnings and quality of life), (2) perception of the effectiveness of bottom longline use, (3) perception regarding sustainable fishing, (4) historical perception of the fishery. A Likert scale based questionnaire was then applied. Results were analyzed through Factor Analysis (validity) and Chronbach’s coefficient alpha was applied. Additional questions were also incorporated into the questionnaire in order to construct the fishers’ sociodemographic profile. Results were complimented with qualitative methods (focus groups, open interviews, national fisher forum) in order to complement certain aspects not resolved with the quantitative techniques. The study reveals that fishers earnings are constantly reduced and that they struggle to cover their and their families’ basic living expenses, a situation that is improved, however, by the social equality that exists within their communities. These economic difficulties have forced fishers to change gear types and use gill nets, a technique they consider sustainable, despite having an incomplete understanding of the term. With respect to their understanding of fishery tendencies over the last ten years, fishers have a high level of ecological knowledge.

The loss of fishing territories in coastal areas: The case of the seabob-shrimp small-scale fisheries in São Paulo, Brazil

Fabricio C. Gandini, Maramar Institute for Coastal Management, Rua República do Equador, 100 sl 22, Santos, SP, Brazil, fabricio@maramar.org.br
Maria A. Gasalla, Fisheries Ecosystems Laboratory (LabPesq), Oceanographic Institute, University of São Paulo, Praça do Oceanografico, 192, Cidade Universitaria, São Paulo, SP, 05508-120 Brazil, mgasalla@usp.br

Abstract
The seabob-shrimp small-scale fisheries in the shallow water (3-30m in depth) areas of the State of São Paulo, in Southeastern Brazil, plays an important role in the livelihoods,
providing social and economic benefits for local communities, and a premium regional seafood source. Around two thousand fish-workers produce supplies for restaurants, fishmongers and supermarkets in coastal towns with a total of around 2 million inhabitants. However, the activity has been threatened by marine spatial zoning plans, harbor and naval parking, the construction of pipelines, sewage disposal, seasonal closures and marine protected areas, without receiving any kind of compensation. The present study aims to analyse the timeline of vertically implemented laws/regulations that have reduced the size of territories formerly available to the fishers. In fact, a misunderstanding of environmental mitigation programs appears to have been contributing to increased fishing conflicts, mining multi-stakeholder processes in contrast to the ascendant economic growth of the oil, gas and port industries.

Introduction

The seabob shrimp fishery industry along the São Paulo coast, southeast Brazil (Figure 1) is certainly the greatest in terms of socioeconomic regional importance (Valentini et al. 1991a, 1991b; Mendonça et al. 2013). These particular fisheries perform an important role in contributing to the livelihoods of low-income coastal communities, providing social and economic benefits as well as a regional premium seafood source. Around four thousand fish workers are dependent on the seabob shrimp fisheries to provide shrimp for restaurants, fishmongers and supermarkets in the coastal cities where about 2 million people live (IBGE 2013). However, only recently have the fisheries been recognized as the main shrimp source in São Paulo (Mendonça et al. 2013) since the range of statistical coverage on fishing seems to previously be quite poor.

In order to reveal and discuss the processes behind the most important threats to fishing territories along Brazil’s coastline, an in-depth analysis of the seabob shrimp fisheries off the coast of São Paulo State was undertaken, aiming also to estimate the magnitude of eventual territorial marine losses of fishing over recent decades.

Methods

A territorial approach was proposed to undertake the analysis of the selected fisheries. Firstly, a list of fishing regulations, zoning, and marine protected areas that directly affected the access of fishing grounds by the seabob shrimp fishers during the last 50 years was compiled. Secondly and based on a public open access database, we organized shape files (*.kmz) in a common platform using Google Earth Pro GIS and provided maps that allowed an area-based calculation of exclusion zones. Following the same focus on territorial losses, an analysis of port, oil and gas enterprises and fishing exclusion zones was undertaken based on documents from several environmental licensing procedures, as well as official data available.

Results

Paradoxically, results shown that the smaller the fishing vessel is, the largest the relative fishing regulation imposed was. Figure 1 illustrates that the fishing area up to the 15 meters isobath (shallow coastal areas) received about 15% of area restrictions to the seabob shrimp fishing, due to (1) fishing regulations, (2) marine protected areas, and (3) enterprise-based exclusive areas. On the other side, once we look to the whole area up to
30 meters, the fishing restriction drops to 3%. During the last ten years, about 80% of all the seabob shrimp fishing restrictions were created from the State level (Fig 2). A set of many different enterprises that, according to the law, has the right to occupy the maritime area and generate fishing exclusion zones around the construction work itself, was identified. It ranges from the order of thousand hectares to dozens of hectares of exclusion zones (Fig. 3).

Figure 1 - Total seabob-shrimp fisheries’ marine territorial losses by depth strata (in dark-grey); A - down to the 30m isobath; B - down to the 25m isobath; C - down to the 15m isobath.

Figure 2 – Timeline of the total maritime area (in hectares) that has been restricted to the seabob shrimp small-scale fisheries along the coast of São Paulo (cumulative areas since 1967)
Discussion

Several trade-offs in place should include the questions: what are the limits on alterations to the maritime space along the coast that can be supported in such a way that maintain and allow for the development of activities that rely on marine conservation? And further, how far can we neglect a renewable-based economy that, if well managed, can be sustained for an indefinite period of time, in detriment to another that sustains itself in a market-based logic, compromising the ecosystem services and depending on external factors and reasons beyond local desires or natural resources? The main problem is that, while thinking about which institutional arrangement might be in place to address those questions, the small-scale seabob shrimp fishing territories have been reduced enormously over the last 50 years due to two main factors:

- top-down policies including MPAs and fishing regulations;
- the environmental concession process for enterprises and infrastructure building along the coastal zone.

The process of creation of both protected areas and fishing regulations in São Paulo was based in low societal participation, and conflicts with fishing communities were broadly reported (Diegues 1973, Furlan 2004). The creation of Marine APA (a sort of State MPA) is recent (from 2008) and although it does not regulate the seabob-shrimp fishing yet, it shows some potential for the development of participative approaches.

In respect to the territorial losses due to enterprises and infrastructure, large impacting in coastal zones has received criticism in the last decades since their growth have been faster than environmental legislation’s (Ab’Saber 2001; Figueiredo 2010). The compensation mechanisms due to theses impacts had been weak and poor and the public agency had not been strong enough to mediate this conflict with the fishing sector indicating the need of a new institutional framework to deal with. One have to be in mind, that oil and gas industry, as well ports and harbour activities are very accelerated in Brazil to the high exportation of low value raw commodities claming for new coastal areas occupation. Although some assessments attempted to evaluate impacts on fishing territories, the fact is that the fishing areas have been affected and reduced, and the mitigation and

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>area (hectares)</th>
<th>relative area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredged Material Disposal Area</td>
<td>3940</td>
<td>47.71%</td>
</tr>
<tr>
<td>São Sebastião Harbour Area</td>
<td>1350</td>
<td>16.35%</td>
</tr>
<tr>
<td>Santos Harbour Area</td>
<td>1916</td>
<td>23.20%</td>
</tr>
<tr>
<td>Sewage disposal area</td>
<td>1052.94</td>
<td>12.75%</td>
</tr>
<tr>
<td>Total</td>
<td>8258.94</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Figure 3 – Estimate of the fishing exclusion zones generated by the different enterprises located along the coast of Sao Paulo.
compensation mechanisms have been null or weakly instituted. This can be considered a failure in the attempt to institute a conservation-based economy as a more appropriate development model in the coastal zone of São Paulo. Lastly, the current state of management measures particularly to the seaboat shrimp in São Paulo, has meant the imposing of a "straitjacket" with likely inconsistent closure seasons and zoning that cannot be changed in the short-term due to the legal framework in place. If both the food production right and poverty alleviation need are recognized, new ways of governability should advocate for participatory processes (Gasalla 2011; FAO 2014) characterized by transparency, accountability, cohesiveness, and inclusiveness (Jentoft 2013;).

Conclusions
The study showed that the area for fishing activities in the seawaters of the State of São Paulo has been affected by different regulations imposed by the Government that are somehow associated with the impacts arising from the installation of projects focused on infrastructure, ports, and oil and gas. Despite this, we provide an unprecedented estimate of the affected area compared to the potential area likely to be used by the small-scale seaboat shrimp fishing. Overall, 15% of the potential fishing areas had been reduced due to the implementation of: marine protected areas, coastal zoning policies, and port, oil, and gas infrastructure projects. These three activities are considered legitimate by the different interest groups, however, mitigation and compensation mechanisms for the fishing sector are either weak, out of purpose, or even non-existent.

References
Furlan, S. 2004. Lugar e Cidadania: implicações sócio-ambientais das políticas públicas de conservação socioambiental e situação do Parque Estadual de Ilhabela
Abstract
Participatory research is an approach that helps create power-sharing relationships between stakeholder groups and contributes to the development of strategies to find solutions to local problems. Our group, POPA, was formed in 2011 during a participatory research initiative to investigate problems of Piriápolis’ artisanal fishery in Uruguay. The group is composed of different stakeholders: artisanal fishers, university researchers, DINARA-National Directorate of Aquatic Resources, and the Local Government (in the past NGOs were also part of the group). POPA integrates different experiences and realities with one interest in common: artisanal fisheries. The objectives of the group are: (i) to promote the knowledge and appraisal of artisanal fisheries by the society; (ii) to encourage artisanal fish consumption given growing fish imports; and (iii) to investigate the interaction between artisanal fisheries and sea lions (which feed from gillnets and long-lines). In this paper we tell the story of our multi-stakeholder group, describing what we have done so far, and sharing some of the lessons we learnt in this 3-year journey. While addressing the first two objectives, we organized the First Artisanal Fisheries Festival (2012), which was considered as our first significant accomplishment. A smaller event of this kind was organized in mid-2013, in collaboration with a local restaurant. In
both events there was fish tasting, and photo and fishing gear exhibitions. These activities strengthened the group and motivated us to resume the initial problem identified by fishers (sea lions’ impact). In this regard, since late-2013, we have been working in a government-funded research project entitled “Mitigating the impact of the interactions between sea lions and artisanal fisheries: participatory research to evaluate fish traps as alternative fishing gear”. One of our main lessons is that being part of a diverse group can be very fruitful and it requires continuous respectful communication (particularly when there are contrasting perspectives).

Introduction

In the context of fisheries management, participatory research - sometimes called cooperative fisheries research, has become increasingly common (e.g. Hartley and Robertson 2006, Wiber et al. 2009). In this approach, fishers, scientists/researchers, managers, and sometimes additional stakeholders, are involved in each stage of the research process, from the selection of the topic or objectives to the dissemination of the results. Participatory research helps create power-sharing relationships between different stakeholder groups and contributes to the development of strategies to find solutions to local problems. Some advantages of this approach are that a better understanding of the problem is obtained through the vision of all participants, everybody contributes with their knowledge, and there is greater trust in the results obtained. In this sense, the success of participatory research is focused on the process, not just on the results themselves (e.g. Cornwall and Jewkes 1995, Trimble and Lázaro 2014).

Our group, POPA (For Artisanal Fisheries), was formed in May 2011 during a participatory research initiative to address collectively problems of the Piriápolis’ artisanal fishery in coastal Uruguay. Currently, the group is composed of artisanal fishers, university researchers, members of the fisheries agency (DINARA -National Directorate of Aquatic Resources) and local government of Piriápolis. We have different experiences and realities but one interest in common: artisanal fisheries. Following the criteria to achieve participatory research of the empowering mode (Trimble and Lázaro 2014), one of our principles is that all stakeholders participate in every research stage and every action that the group decides to take. POPA is interested both in the relationships between artisanal fishers and other social actors and in the relationships between fishers and nature. It is an arena where different types of knowledge meet, enhancing mutual learning among participants. Each member contributes to the group from his/her experience and discipline. POPA is a non-profit group, and the participation of its members is voluntary.

The objectives of the group are: (i) to promote the knowledge and appraisal of artisanal fisheries by the society; (ii) to encourage artisanal fish consumption given growing fish imports; and (iii) to investigate the interaction between artisanal fisheries and sea lions (which feed from gillnets and long-lines). In this paper we describe what we have done so far as a group, starting by actions towards achieving the first two objectives Next, we present our current project related to the third objective, where we are trying to alleviate the sea lions’ impact on traditional fishing gear. Finally, we share some of the lessons we learnt in this 3-year journey.
Increasing appraisal for artisanal fisheries and local fish

One of the issues raised by fishers during the group workshops in 2011 was the competition of their products with imported cheaper fish increasingly found in markets and restaurants. We decided to communicate in a positive way to promote and increase appraisal for artisanal fish, addressing POPA's objectives (i) and (ii). After six months of hard work, in February 2012 we organized the First Artisanal Fisheries Festival, which was considered as our first significant accomplishment (nearly 3000 people attended). The festival aimed to: (1) bring together fishers and consumers; (2) value the artisanal fishery as an activity of economic, social and cultural importance; and (3) inform the people so that they could choose to consume more local fish.

The festival included a photographic exhibition entitled “A day in the life of artisanal fishers”); an interactive exhibition of fishing gear (gillnets and longlines) in charge of the fishers; paintings by two well-known artists inspired by artisanal fisheries; an exhibition of children drawings after fishers' visits to the public school; a talk about the benefits of fish consumption by an expert in nutrition; tasting of a wide variety of gastronomic proposals of local fish by Uruguayan and international chefs; and music and dance performance (Figure 1). The event was declared of interest by Governmental agencies and the National Commission of UNESCO. Right after the festival we evaluated the participatory research process until then and highlighted the continuity of the group; its defined path; the climate of mutual respect, honesty and mutual tolerance; increased fishers' self confidence; increased cohesion and trust among participants; and greater attention to fishers by different segments of society.
A similar but smaller event was organized in July 2013, in collaboration with a local restaurant ("Los Fuegos"), including fish tasting, and photographic and fishing gear exhibitions. The event was entitled “Among gillnets and whitemouth croakers”, because the aim was to disseminate the importance of the zafra (harvest season) of this species in coastal Uruguay. The visitors enjoyed different recipes elaborated with croakers and also an interactive exhibition of an artisanal boat and its fishing gear (Figure 2). Around 100 people visited the event, and many of them stayed to have dinner in the restaurant. The people who attended were very interested in the artisanal fishing activity, and informal exchanges with fishers took place. The organization of this event and the First Artisanal Fisheries Festival strengthened the group and motivated the group to resume the initial problem identified by fishers (sea lions’ impact - see next section).
Mitigating the sea lions' impact on artisanal fishing gear

Artisanal fishers in Piriápolis stated that the impact of sea lions is of particular concern during the long-line fishing season, when the target species is the "brótola" - Brazilian codling (*Urophycis brasiliensis*). The impact of sea lions on artisanal fisheries (sea lions feed from the fish caught in gillnet and long-lines, also damaging the fishing gear) is common to most localities in coastal Uruguay. Fishers have adopted a number of strategies to avoid or diminish sea lions’ impact. For example, they have stopped leaving gillnets and long-lines set during a whole day or night; they set gillnets and long-lines in separate “gangs”, because otherwise, if sea lions found one net or long-line, they would eat the fish caught in all of them; fishers try to depart from the port at the same time as others in order to decrease the probability of being impacted by sea lions, or to diminish the impact. Also, fishers may use petards to shoo sea lions away from the fishing gear, but the animals seem to have learned that these are not dangerous.

Until now, however, no initiative in the country has intended to assess methods to mitigate the interaction between sea lions and artisanal fisheries. In this regard, following fishers' suggestions, POPA designed collectively a research project to try fish traps as
alternative gear that could mitigate sea lions’ impact, applying for government funding (DINARA—ANII, National Agency for Research and Innovation). This is significant because it is one of the rare occasions in the country in which fishers work collaboratively with researchers and other stakeholders on defining the entire research proposal, of which they are also team members. After approval, since December 2013 we have been working in the project entitled “Mitigating the impact of the interactions between sea lions and artisanal fisheries: participatory research to evaluate fish traps as alternative fishing gear”. The main objective of this project is to analyse the effectiveness of a new fishing gear in the area (fish traps) to alleviate the sea lions’ impact on the artisanal fishery through a participatory approach. In collaboration with the Fisheries Technology Lab of DINARA, we designed three types of foldable fish traps, with materials of different costs and adequate size for artisanal fishing boats. We have constructed 24 fish traps collectively (8 of each type), and we have made four trials of the traps (Figures 3 and 4). We are now performing four experimental onboard samplings per month, using simultaneously the three trap variants and long-lines. The plan is to compare the catch per unit of effort of each trap variant and long-lines, and to compare the sea lions’ impact on catches and/or gear damage.

Figure 3. Photos showing the collective construction of fish traps among fishers, researchers, members of DINARA and Local Government.
The fish traps project also includes a participatory socialization plan, which defined a target public to which we transmit information about it. The works foresees the development of an "artisanal fisher" profile as of the own views of fishers and other strategic fisheries actors. It also intends the definition by the group of a common message about "artisanal fisheries". The first aim is to involve fishers who have not participated actively during the group activities so far. Then we keep fluent exchange with key organizations, the academy and media mainly through electronic means, media interviews and participation in key events. Regarding our main target public - the fishers, communication materials are being designed taking into consideration previous research on fishers' perception of participation initiatives (Trimble et al. 2014), including POPA's first phase (Trimble and Lázaro 2014). Inter-subjective communication through constant presence of the POPA team, particularly POPA fishers, in the area appears to be one of the most effective ways of establishing a most fluid relationship. Hand-written letters, card invitations, a Newsletter specially designed according to format preferences of fishers (Figure 5), are complementary to visits. In addition, observation of the use of ICTs by fishers has been decisive. Cell phones seem to be the mostly used; therefore, SMS contact at least once a month to inform of the project progress has been found suitable.
Furthermore, POPA maintains a social network account of 788 friends, which is constantly updated by the team members with news and pictures. POPA also has a YouTube Channel and a Soundcloud account to feed audiovisual material to its social network. Usage of these by fishers seems to have been increasing throughout the process. An added value of this effort is that it has allowed for contact with fishers and other stakeholders from other geographical sites (e.g. other parts of Uruguay, Argentina, Chile, Spain). Simultaneously, a formative evaluation of this participatory research project (fish traps) is being evaluated; interviews with non-POPA fishers, questionnaires filled by POPA members, and group meetings to discuss strengths, weaknesses, and strategies to improve the work of the group, are key for this continuous evaluation.
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098 52 32 82

Compañeros de DINARA (09/14)

PRUEBA SUPERADA
El pasado 22 de abril, se llevó a cabo la prueba de los tres prototipos del Proyecto Nasas (Cristales con marco PVC, verde, y verde con marco de vidrio). Se estuvió evaluando el marco del Prototipo. Posteriormente, se procedió a la instalación de dos cristales en la nave, lo cual se vendría realizando en dos de las cuatro navereas de la nave, con lo que se intenta trabajar en las dos máquinas de plasma DINARA con los que se trabaja. Luego, de esta manera, los cristales de plasma se quedarán para realizar las pruebas de la prueba. Tras ajustar el número de cristales necesarios, los prototipos fueron instalados.

GUADALAJARA
EN UN LLANO
Dos pecadores artesanales y tres investigadores de POPA retomaron el proyecto de la innovadora forma de trabajo conocida como el ‘Pescado de la Nave’ y lograron alcanzar los fines en tres años. El 10 Congreso Nacional de Pesca Artesanal que se llevó a cabo en Mérida, México, el próximo 21-25 de septiembre de 2014, fue organizado por los organizadores del evento y a la ONG Pescado Pouch por el apoyo brindado para que POPA pueda estar presente. Será interesante conocer más sobre la pesca artesanal de otros países.

CORTITO
LA GACELLA ANIVERSARIO DEL GRUPO POPA
Porque no todos usan Facebook...

LAS CUENTAS CLARAS CONSERVAN LA AMISTAD
MUCHA AGUA BAJO EL PUENTE
El 14 de mayo el Grupo POPA cumplió 3 años

El Proyecto POPA es un grupo de investigación en acción participativa que se creó en 2011 en Piria. Es un espacio de trabajo, debate y búsqueda de soluciones a problemáticas, que ha cambiado la forma de hacer la pesca. La pesca es una actividad que requiere de mucha atención, pero también necesita de un ambiente propicio para que pueda prosperar.

El Proyecto POPA ha sido financiado por la Agencia Nacional de Investigación e Innovación (ANII) bajo un diseño que la DINARA aportó a dicho proyecto para el desarrollo de la investigación en el sector pesquero. Los fondos se utilizan para financiar los gastos de los trabajos de investigación, el seguimiento de la pesca, la recolección de datos, así como la formación de capacitadores.

El 14 de mayo del año 2014, el Grupo POPA celebra su tercer aniversario. En este tiempo, han logrado destacar en diferentes puntos del país, con la participación de diferentes sectores de la comunidad.

SEGURIDAD MÁXIMA
MUCHOS SE PREGUNTARAN: ¿HAS PECADO ARTESANAL en el Proyecto Nasas? La pregunta ha sido repetida muchas veces. En el pasado, la seguridad era un problema para los pescadores. Actualmente, los equipos de seguridad utilizados en el Proyecto Nasas han mejorado. Estos equipos incluyen barcos con redes de pesca, buceo con oxígeno y seguridad en caso de accidentes.

El 29 de abril, se llevó a cabo el evento de la pesca artesanal en la ciudad de Punta del Este, Uruguay. El evento estuvo organizado por el Grupo POPA en colaboración con el Colegio de Ingenieros de la Pesca y la Consorcio de Investiguadores en Pesca Artesanal.

¿Quiénes pueden participar en el Proyecto Nasas?

El Grupo POPA se encuentra abierto a todos los pecadores artesanales que deseen participar. POPA ofrece un espacio de investigación, donde los pecadores artesanales pueden compartir sus conocimientos y experiencias. El grupo POPA ha realizado numerosas investigaciones sobre el sector pesquero, incluyendo la pesca artesanal.

Este espacio es para vos
¿Tenés algo positivo sobre pesca artesanal que quieras compartir?
Escribí al portapescaartesana@gmail.com
098 52 32 82

Compañeros de DINARA (09/14)

BUENOS VIENTOS
Las hermanas Caterina Díaz del C. de D. y Cecilia Lassar, de DINARA, se unieron al Grupo POPA para investigar y actuar juntas. Con ellas nos acercamos a otros pescadores y fomentamos la pesca artesanal.

Pepito Uriñay
Conclusion
One of our main lessons is that being part of a diverse group, defining common objectives, and doing research and actions together, can be incredibly fruitful. Throughout this 3-year journey we have learned from one another (like when fishers taught researchers how to make the fish traps); we have learned the importance to adapt when unforeseen things happen (e.g. the intense and long work hours required of us all to build the fish traps); and we have increasingly learned to be open-minded and communicate respectfully (despite there being contrasting perspectives sometimes). Trust within the group has greatly increased, which makes us stronger to initiate new projects. We hope to keep growing as a group, and to engage more fishers throughout this rich and challenging learning process.

References


Measuring the development of community-based conservation in small-scale fisheries in the Amazon

Caroline Arantes (Texas A&M University)*
Leandro Castello (Virginia Tech)
Aby Sene-Harper (Texas A&M University)
Nicole Angeli (Texas A&M University)
David McGrath (Earth Innovation Institute)

Small-scale fisheries engage around1 billion people worldwide, making it important to understand the governance conditions required to develop effective Community-Based Conservation (CBC). However, most studies on governance focus on small geographic scales, leaving most small-scale fisheries unstudied. We developed an index to measure...
the development of CBC by quantifying the presence of well-known conditions required for communities to sustainably manage natural resources. We collected data on these conditions from 83 communities via interviews with community members and published literature. We validated the index using data for 40 communities on the populations of Arapaima spp, which is the main focus of CBCs in the Amazon. Finally, we calculated the index for those 83 communities to understand which conditions are met and which are lacking. We found the index to be a reliable indicator of CBC development. We found a positive non-linear exponential, relation, in which increases in the index are followed by minuscule increases in arapaima abundance up to an index of 5.5, at which point small increases in the index are followed by large increases in arapaima abundance. Communities above that threshold had scores related to conditions associated with monitoring systems, graduated sanctions, defined boundaries, and rules for fisheries on average 83% higher than those below the threshold. Policy actions can prioritize the development of these conditions. This approach allows for understandings of CBC development at a large-scale and for prioritizing conservation efforts, which is especially needed where management capacity tends to be underdeveloped, as is in tropical small-scale fisheries.

Capacity development with fishers: a Freirean approach to empowerment

Erika Bockstael (University of Manitoba, Canada)

Capacity development has a long history in practice. Considered a field in itself, capacity development originates in community development practice, and not in any particular academic discipline. It is plagued by definitional disagreements and a lack of theory. Traditional capacity development, for the most part, does not address issues such as redistribution of resources, power differentials, colonial structures, and marginalization of different people and groups. Despite efforts for a more bottom-up approach, it remains predominantly top-down and externally designed. And yet there is a constant call for capacity development in international development and increasingly in environmental governance.

This paper presents an example of a community-based capacity development process in Trindade, Paraty, Brazil, that emerged through a negotiation between a community-based organization, made up of small-scale fishers and boat-trip operators, and a Federal Park Authority.

Carried out by an interdisciplinary team and based on the pedagogical principles of Paulo Freire, this process increased participants’ understanding of their current context, strengthened the unity of the community-based organization, and enhanced their ability to negotiate with the Federal Park Authority. In the field of natural resources and environmental management, policy and practice have historically been based on the assumption of a lack of capacity for indigenous and traditional communities to manage their resources. This case is an example of the opposite, building on existing capacity for empowerment. It also demonstrates that university research projects could play a role to
enhance existing capacities to support communities as they deal with development pressures and rapid change.

Understanding the social aspects of community-based fisheries management: a preliminary map of Amazon experiences and stories of change.

Alison E. Macnaughton (World Fisheries Trust, Victoria, B.C. Canada, alison@worldfish.org)
Guillermo M.B. Estupiñan (Wildlife Conservation Society, Manaus, AM, Brazil, gestupinan@wcs.org)
Mauro L. Ruffino (GSA Consultoíria em Meio Ambienet Ltda, auroluis.ruffino@gmail.com)

Small-scale fisheries in the Amazon represent important contributions to food security and livelihoods for thousands of families, and are complex, often multi-species, endeavors characterized by seasonal variation, mixed rates of participation, use of multiple gear-types, highly dispersed landing sites in diverse environments and multiple and overlapping ‘fuzzy’ boundaries (land tenure, aquatic resource rights and ecology). In the case of the Brazilian Amazon, management approaches to date have focused primarily on development and implementation of community-based fisheries agreements. While initially this was stimulated by crisis, including user-conflicts and/or an interest to protect or recover commercially important stocks, more recently an interest in management for the perceived associated benefits of the management process and its outcomes has emerged, not necessarily as a response to a specific crisis, but rather as a perceived opportunity. In large part, the model was developed out of pilot experiences with international cooperation in the 1990s, institutionalized at the national level in the 2000s and widely applied in the region with varying degrees of implementation and returns to date (see Ruffino, 2011; Estupiñan, 2013). Social aspects, including the resulting benefits (improved livelihoods and food security for example) have only been studied in a few cases (see for example Gardner et al, 2013, Oviedo 2006). More research is required to understand and describe the key elements and pathways through which these initiatives contribute to sustainable resource use and social development, in order that they might better inform future policy and management experiences in other areas. This paper presents an overview of the governance and regulatory frameworks guiding fisheries management in the Amazon, and a selection of existing experiences with community-based fisheries management at different stages of implementation, with a focus on fisheries for ‘pirarucu’ or ‘paiche’ (Arapaima gigas). We apply elements of Ostrom’s (2007) framework for socio-ecological systems to characterize these experiences, and describe the associated stories of change.

KEYWORDS: Amazon small-scale fisheries, socio-ecological systems.
References:


Lack of governance in a small-scale fishery: the case of fishing on grouper spawning aggregations off the Yucatan Peninsula, Mexico

Alfonso Aguilar-Perera (Universidad Autonoma de Yucatan)

Worldwide, the tropical fish called groupers (Epinephelidae) represent a billion dollars fishery. In the southern Gulf of Mexico (SGoM) and Mexican Caribbean (MC), a small-scale fishery is based mainly upon groupers and snappers (Lutjanidae). However, some species have been traditionally exploited during their reproductive period when they form massive and transient spawning aggregations. In the SGoM and MC, a lack of knowledge from the government prevails and the fishery status of these grouper spawning aggregations (GSAs) remains uncertain. Limited scientific documentation has revealed that at least six species (Epinephelus striatus, E. itajara, E. guttatus, Mycteroperca bonaci, M. tigris, M. venenosa) are opportunistically exploited during spawning aggregations. Evidences from particular surveys revealed that few fisher communities appear to strongly depend economically on fishing GSAs. Consequently, the cultural practice of exploiting groupers, such as the Nassau grouper and the Goliath, has been progressively disappearing because of severe population declines of these groupers. It is imperative to call for action to protect these species that are recognized by IUCN as threatened and critically endangered. In Mexico, the government has no legal provisions for the management of GSAs. On this work, some perspectives are offered on the fishing, management and conservation of GSAs, and some proposals based on sound solutions are established.
Regional Session 4.3: Asia/Oceania & Africa

Developing Participatory Fisher Surveys to Monitor Fish Catch in the Mekong River Basin

Shaara Ainsley (FISHBIO - Lao P.D.R. and U.S.A)
Sinsamout Ounboundisane (FISHBIO - Lao P.D.R)
Erin Loury (FISHBIO - Lao P.D.R. and U.S.A)
Harmony Patricio (FISHBIO - Lao P.D.R and Griffith University - Australia)

Over 60 million people depend on fish from the Mekong River and its tributaries for protein, and many engage in small-scale subsistence or commercial fishing. Accessible information on these small-scale Mekong fisheries is essential for developing better estimates of their scope and scale, as well as assessing their contribution to the economy and food security. FISHBIO has been developing a participatory standard fish sampling program as part of a collaborative effort to form a Mekong Fish Network among several organizations. The objective of the program is regular, long-term collection of basic fishery-dependent data following robust, standardized methods, which will provide information on the status and trends of Mekong fishes. Using participatory methods engages local people in data collection and enhances their capacity to enact conservation and sustainable fisheries co-management. Information generated from this monitoring will inform resource management through village-level regulations. In 2013, FISHBIO piloted the proposed sampling protocols in two villages of Lao People’s Democratic Republic in a district where there are no existing government programs to study wild capture fisheries. Local fishers were trained to record basic data on their catch for every day they spent fishing, including species name, fish length, total biomass, gear type and fishing effort. Fishers reported more than 62 species in a three-month period, including two species of commercially valuable fish listed as “endangered” on the IUCN Red List, Probarbus jullieni and Probarbus labeamajor. We are currently evaluating the survey protocols to explore their application in other settings in the Mekong Basin.

Influence of tourism-industry development on small-scale fisheries’ livelihood in Ko Samui, Thailand

Thamasak Yeemin, Wichin Suebpala, Makamas Sutthacheep
Marine Biodiversity Research Group, Faculty of Science, Ramkhamhaeng University, Bangkok, Thailand
Corresponding author: thamasakyemin@hotmail.com
Abstract

Rapid expanding of tourism generates high population growth and the demand of developing related infrastructures which may cause changes in environmental condition, social structures, livelihood, and local culture of small-scale fishing communities. In this research, we analyzed the influence of tourism development on small-scale fisheries’ livelihood and illustrated how small-scale fishers adapt themselves in a rising trend of tourism development in Ko Samui, Thailand. The island is known as a popular tourist destination where marine natural resources are still fertile attracting several million tourists to visit each year. The interviews with key informants revealed us that more than one hundred of small-scale fishers have been anchored in Ko Samui; they do fishing as their major occupation. However, after the tourism was introduced, it has provided various opportunities to small-scale fishers by involving them into tourism-related activities such as providing boats for tourists to diving or fishing sites, operating home stay business, and supplying seafood to restaurants. Besides, some fishers can develop their indigenous knowledge to catch and grow sea urchins that they can sell the sea urchin roe to restaurants. These could be a potentially alternative livelihood which may increase additional income and well-being for local small-scale fishers. However, it’s important to concern that rapid tourism development without proper management may change overall social structure and traditional culture of small-scale fishing communities. The outcomes derived from this study can help us understand more of how tourism development influencing on small-scale fisheries and their adaptation that enhance sustainable communities.

Introduction

Marine and coastal tourism is one of the fastest growing sectors within the world’s tourism industry (Hall, 2001), especially, the island tourism which is growing dramatically and serving as an important source of revenue for many coastal countries (Doiron and Weissenberger, 2014). Like other countries, Thailand has many islands distributing in Thai waters with a total number of 936 islands; 374 of them are in the Gulf of Thailand while the rest are in Andaman Sea (DMCR, 2013). Ko Samui is one of the popular islands attracting millions of both Thai and foreign tourists generating the revenue of over USD 600 million to Thailand each year (Surat Thani Provincial Office 2014). It plays a significant role in economic development, consequently the development of tourism facility have been automatically increased to conform to the growing number of tourists.

However, rapid tourism development without appropriate management may cause changes and concerns about the environmental sustainability (UNEP 2009, Bulleri and Chapman 2010), especially the sensitive marine ecosystem like coral reefs which is an important marine resource for both tourism and fishery sectors (Yeemin et al. 2011). Not only environmental impacts generated by tourism development are concerned, but also the social impacts which tourism may affect the socio-economic structures and native community’s livelihoods. Jurowski, Uysal, & Williams (1997) supported that the community’s livelihoods in the place where is developed with tourism becomes inevitably affected by tourism activities. In terms of well-being and livelihoods, positive and
negative impacts of tourism on tourism communities have been described (for examples: Green 2005, Haley et al. 2005, Kim et al. 2013, Yang 2013, Doiron and Weissenberger 2014).

Since fishing communities are usually found along the coasts and islands, they are inevitably impacted by tourist development introduced to their communities. Approximately 90 percent (about 52,000 households) of the total fishing households in Thailand were small scale (Jantarathe and Chunpagdee, 2011) reflecting a huge portion and importance of small-scale fishing communities anchored along the coasts. However, the study on the impacts of tourism development on small-scale fisheries’ livelihoods is still limited. Knowing on that topic may create opportunities and synergies for mitigating severe impacts on social function and livelihood sustainability. In this paper, we describes a case study aimed to illustrate the influence of tourism development on small-scale fisheries’ livelihoods and illustrates how small-scale fishers adapt themselves in a rising trend of tourism development in Ko Samui, Thailand.

**Study site and methods**

Ko Samui is geographically located in the southern Gulf of Thailand (9°30′N 100°00′E), about 20 kilometers off the coast of Surat Thani Province. It is the third largest island of Thailand (after Ko Phuket and Ko Chang), having a total area of 227 km², surrounded by eighteen smaller islands. (Ko Samui Municipality, 2013). With its beautifullness of terrestrial and marine environments as well as cultural livelihoods, a massive number of tourists has been attracted to visit Ko Samui each year contributing to Ko Samui as a popular tourist destination of Thailand (Figure 1).
In this study, key informant interviews using semi-structured questionnaire and participant observation were employed. All data were analysed to describe the influence of tourism-industry development and small-scale fisheries livelihoods as well as their adaptation that enhance sustainable communities.

**Results, Discussion, and Conclusion**

*From the isolated island to a popular tourist destination*

Moving back to the late 20th century, Samui was an isolated island from outside world. The majority of the island’s area is mountainous with dense tropical rainforest and coconut tree. In the past, the native communities in Ko Samui were firstly anchored by diverse ethnic groups settled such as Malays or Chinese people (Pongponrat 2006) with small connection to the mainland. The local people were involved in subsistence agriculture with coconuts and fishing. The island was even without roads until the early 1970s so trekking was used to travel from one place of the island to others (Ko Samui Tourism Coordination Center 2012).
In terms of the present socio-economic dimension, a total population of 62,506 which is 30,399 of males and 32,107 of females was reported in 2013. The population growth was about 3.83 percent each year, calculated from the population statistics of Ko Samui during 2009-2013 (DOPA, 2013). Furthermore, a latent population of 300,000 was also estimated. The number of registered household reported in 2013 is 43,561 is distributed in seven sub-districts namely Ang Thong, Lipa Noi, Taling Ngam, Na Mueang, Maret, Bo Phut, and Mae Nam. Besides the central governing system which Ko Samui belongs to Surat Thani Province, Ko Samui have been locally administrated by Ko Samui Municipality since 14 September 2012 (Ko Samui Municipality, 2013). Currently, the economy is influenced by different sectors: agriculture, tourism, commerce and services, and household industry. The majority of agricultural products involves coconuts and fisheries, while tourism, commerce, and services are also important for local and national economy. The average revenue from tourism sector during 2005-2011 was about USD 520 million per year. There are various products such as coconut oil, dried coconut, furniture made of coconut tree, ice, etc. producing through agriculture-related Industries in Ko Samui; these products are also domestically consumed and exported to other countries (Ko Samui Municipality, 2013).

In regard with the tourism development, the first backpackers were traveled to Ko Samui in 1970s using a coconut boat. After that, few bungalows were built while the number of tourism to Ko Samui was increasing. Twenty years later, around early 1990s, tourism started growing rapidly turning Ko Samui became the second most popular islands in Thailand (after Phuket) because of its beautfulness and fertility of different kinds of natural resources such as sandy beaches, coral reefs, waterfalls, as well as the local livelihood and culture. (Ko Samui Tourism Coordination Center 2012). With an increasing number of visitors, Thai government by the Tourism Authority of Thailand found that Ko Samui has high potential to be developed as a national tourist destination. The tourism development plan of Ko Samui was firstly established in 1985 in order to develop and promote tourism on the island. Consequently, an expansion of both tourists and tourism facilities development such as transportation system, accommodation, and tourism-related services, have been growing since then (Ko Samui Municipality, 2013).

At present, it can be seen that tourism development in Samui is now reached to the peak. Tourism infrastructures including roads, ferries, airport, accommodations and so on are fully provided for accommodating tourists to visit. According to the tourism statistics, in 2013, there were 2,115,259 tourists staying in Ko Samui consisting 734,523 and 1,380,736 of Thais and foreigners, respectively. Most foreigners were from Europe (Germany, England, France, Israel, Russia, Sweden, Italy, and Switzerland) and Australia. Whilst, 536 accommodations with more than 20,617 rooms available were reported in 2006 (Suratthani Province office of Tourism and Sports, 2014). Hat Chaweng and Hat Lamai are most popular beaches, they are usually overcrowded during high season starting from December to April. Many tourism activities, ranged from the terrestrial to marine environment, are found in Ko Samui including hiking, trekking, kayaking, fishing, snorkeling, scuba diving, etc.
Small-scale fisheries in Ko Samui

Because Ko Samui and its vicinities are abundant with coral reefs, pinnacles, and seagrass beds that are important habitats for fisheries resources where the local fishers do their fishing. As mentioned earlier, before the tourism development was introduced to Ko Samui, fishing in this area had been truly subsistent. Nowadays, the fisheries in Ko Samui are more commercial than previous. However, almost of the fisheries in this area are still classified as small-scale. However, after the tourism was introduced, it has provided various opportunities to small-scale fishers by involving them into tourism-related activities such as providing boats for tourists to diving or fishing sites, operating homestay and guesthouse, and supplying seafood to restaurants.

The interviews with key informants revealed us that around one thousands of small-scale fishing boats were found in Ko Samui; 63% of are outboard powered boats, 35% of them are inboard powered boats smaller than 10 meters in length, and 2% of them are non-powered boats.

Approximately 85.00% of fishing gears are shrimp trammel nets, fish gill nets and crab gill nets, while 25% of them are hook and lines, squid falling net, crab traps, fish traps and long lines. The main target species are shrimp and fish. Fishing takes place mostly within 3-4 km off the coast of Ko Samui. The average income of fishers is about 473 – 800 USD/month. About 30% of fisheries products were household consumed, while another 70% of them were sold to local market and restaurant in Ko Samui. However, those fisheries products are still insufficient for local consumption due to the growth of latent population, visitors, and tourists. Besides, some fishers also catch sea urchin and sell sea urchin roe to restaurants or tourists, having an average selling price of 15 – 20 USD/kg. The smaller size of sea urchins are grown in the designed cage about 6-12 months until they reach to desired size.
Impact of tourism development on small-scale fisheries

It was suggested in earlier section that tourism development may cause both positive and negative impact in regards with environmental and social dimension. In terms of positive impacts on small-scale fisheries in Ko Samui, the fishers may earn economic benefits from tourism. Some small-scale fishers modified their fishing boat to be used for boat tour business by taking tourists to other islands for fishing and diving. Some fishers stated that tourism causes a higher demand of seafood consumption so they can directly sell their fisheries products to restaurants with higher price than selling those to middlemen. Also, tourism provides opportunities and employment to local people. These could help improve their livelihood.

Besides the economic benefits, small-scale fishers also concerned that depletion of fishery resources is highly related to the degree of environmental deterioration, which is mainly caused by tourism activities such as water pollution. For examples, some hotels and resorts sometimes discharge untreated wastewater into the canals and the sea. In the aspects of culture and livelihood, they believed that mass tourism can cause displacement and relocation and further disrupt social cohesion and livelihood. They gave examples supporting this point that many native people sold their land properties to outside business owners or even foreigners for developing as hotels and other tourist facilities. Those people were moved out of Ko Samui and preferred to live in the mainland (the city of Surat Thani Province). One of the fishers felt that before the tourism was developed, all beaches was public and shared by the local people for fishing, socializing and participating other community’s activities. Now, the areas between the beaches the main road are blocked by buildings such as hotels, resorts, restaurants, etc., moreover, some beaches are already owned by private tourism operators where no authorized people are allowed to utilize. This is only one example that represents a major social impact leading to serious implications for social cohesion and livelihoods.
Adaptation

In this section, we describe how small-scale fisheries in Ko Samui adapt themselves to the current tourism development. As in a previous discussion, the groups of small-scale fishers have been established to operate boat tour business by taking tourists to other islands for fishing and diving. Interestingly, in Ban Bo Phut, local fishers and some foreigners who lives in Ko Samui were joined together to operate boat tour business (Pongponrat, 2009). In addition, some fishers can develop their indigenous knowledge to catch and grow sea urchins that they can sell the sea urchin roe to restaurants. These could be a potentially alternative livelihood which may increase additional income and well-being for local small-scale fishers.

References


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On fish and palm oil: influence of landscape change brought about by oil palm plantation development on small-scale freshwater fisheries in Kalimantan, Indonesia

Eny Buchary (Global Economic Dynamics and the Biosphere, Royal Swedish Academy of Sciences, Stockholm, Sweden)
Studies on small scale fisheries have focused on marine fisheries yet freshwater fisheries contribute to sustaining the resilience and livelihood of riverine communities. Land use changes, however, have put additional pressures on freshwater fisheries in addition to fish harvest pressure. Globally-driven commercial plantations, such as oil palm, have played a role in shaping the economic livelihood of nearby communities. Studies have shown that oil palm plantation development has contributed to deforestation and habitat loss, loss of wildlife, and changes in hydrological patterns, yet the influence of oil palm plantations on adjacent freshwater fisheries and the livelihoods of those dependent on them are not well known.

We report preliminary findings on how oil palm plantation development on Kalimantan Island in Indonesia has played a role in shaping the small-scale freshwater fishery. A mixed-method approach is used to collect information on this data-poor fishery. We combine creel survey and interviews with individuals dependent on riverine fisheries with satellite images and spatial analyses on the distribution of oil palm plantations in this riverine system. We describe how fish size and abundance, fish species diversity and the dominance of some species are likely shifting in response to oil palm plantation development.

Conventional Management and Indigenous Fisheries: Lessons from the Tropical Rock Lobster Fishery in Torres Strait, Australia

Annie Lalancette (Concordia University)
Monica Mulrennan (Concordia University)

The tropical rock lobster (TRL) fishery in Torres Strait will soon undergo major changes as the Australian government prepares to introduce a quota management system (QMS). This fishery is particularly complex due to (among other factors) a diversity of fisher groups (indigenous Islanders, fishers from Papua New Guinea and non-indigenous fishers from mainland Australia). Indigenous Islanders’ views as to what constitutes “good fisheries management” do not concur with the dominant discourse of conventional management held by the Australian Fisheries Management Authority. Islander perspectives tend to be informed by a holistic knowledge of the marine environment, customary institutions of marine tenure, and economic values at odds with those of mainstream society. In this presentation we outline the various economic, social and cultural motivations for Islander TRL fishing and explore how local institutions
contribute to social-ecological sustainability. We then discuss how the objective of ‘optimal utilisation’, the focus at a regional scale in terms of stock, economy and centralized management, and assumptions about fishers’ behaviours and motivations underpinning fisheries management in Torres Strait are creating added pressures to increase the economic profitability of the TRL fishery and influencing the upcoming QMS. We argue that under the current framework, proposed fisheries measures have the potential to erode local knowledge, fishing practices and institutions, and threaten equity of access to resources and benefit distribution. We conclude by stressing the importance of meaningful engagement with local indigenous fishers and of tailoring management to the local context by building on current local institutions.

**Indonesia coastal community development project: Small-scale fisheries and lessons learned**

Sapta Putra Ginting, Ph.D., Ministry of Marine Affairs and Fisheries of Indonesia
Marine, Coasts and Small Islands Directorate General, Community Empowerment and Business Development Directorate

Indonesian Context
Indonesia, with over 240 million people, is the world’s fourth most populous country (just behind China, India and the USA). It has more than twice as many people as Mexico and 25% more than Latin America’s largest country, Brazil. Indonesia is an archipelagic nation with 17,500 islands. Indonesia’s geographic scope is also vast stretching over 5,000 km from east to west; and nearly 1,800 km north to south. The country’s total area is 7.9 million sq. km comprised of only 1.9 million sq. km of land mass (25%), surrounding seas (40%) and EEZ (35%). At about 70,000 km, Indonesia is second only to Canada in the length of its coastline. Its warm tropical waters make it home to one of the world’s richest sources of biodiversity. A recent study by the Indonesian Institute of Sciences listed over 2,300 species of fish, 2,500 mollusks, 1,500 crustaceans and 30 marine mammals.

With such a large population, relatively small land mass and enormous sea space, the nation’s food security vitally relies on marine production. In fact, fish consumption at 34 kg/capita represents the most important protein source in the Indonesian diet. To support its food demand, in 2012 the country produced 15.5 million MT of aquatic products of which 9.7 million MT was aquaculture production and 5.8 million capture fisheries. The volume of fish imports is relatively small, equal to only 2% of domestic production. In 2012 Indonesia was estimated to be the world’s number two capture fisheries producer (second only to China) and the seventh largest aquaculture producer. The aquatic sector is also an important source of employment with 4.9 million households engaged in aquatic production (55% marine capture fisheries; 10% inland capture fisheries; 35% aquaculture). At least an equal number are estimated to be working in related subsectors such as seafood processing, transporting and marketing.

Government of Indonesia/International Fund for Agricultural Development Partnership
The Ministry of Marine Affairs and Fisheries (MMAF) is the primary government institution responsible for the fisheries sector in Indonesia. It was established under Presidential Decree No.136 in 1999 with the mandate to ensure sustainable use of Indonesia’s coastal ecosystems. The additional functions related to decentralization under the Coastal Management Law No. 27/2007. The movement towards decentralization was designed to increase democracy, local capacity and foster greater public participation and small scale fishers/coastal community empowerment.

To promote the welfare of fishers and resource sustainability, in response to the National Medium Term Development Plan, MMAF has developed a Strategic Plan for the period 2010 to 2014, and now continue to 2015 to 2019. The aims of the plan are to increase food security; and to improve management of marine resources. Consistent with national and ministry goals, the plan is a pro-poor, pro-job, pro-growth, but also pro-sustainability strategy. Its priorities include: (i) small scale fishers/community empowerment; (ii) aquaculture promotion; (iii) growth and transformation of the fisheries sector; and (iv) preservation of the marine environment and climate change mitigation. MMAF’s challenge is to translate the lofty goals of food security, livelihood development and biodiversity conservation into reality in the country’s 10,000 coastal villages. Many of these coastal villages are reliant on fisheries for their very survival. This is especially so in Eastern Indonesia, where approximately half Indonesia’s fishers are located; and where the poverty rate is over 30 percent, more than double the national average.

To develop a project focused on coastal poverty reduction and enhanced economic growth, MMAF selected as its Executing Agency the Directorate General of Marine Coasts and Small Island’s Directorate of Coastal Empowerment and Business Development (PMPPU). PMPPU rationale’s for a project was that:

(i) Eastern Indonesia’s coastal communities are amongst the poorest in the country;
(ii) Many communities demonstrated commitment to improve their economic position;
(iii) There are good economic opportunities for high value marine products;
(iv) There is a need to address issues of resource degradation and climate change;
(v) The government could gain experience to replicate/scale up project activities; and
(vi) It would be consistent with and directly support key government policies and priorities.

PMPPU, therefore, requested the assistance of the International Fund for Agricultural Development (IFAD). IFAD, a specialized United Nations agency, with a focus on financing rural food production appeared to be an ideal partner. IFAD has a wealth of experience enabling poor rural people to improve their food security and nutrition, raise their incomes and strengthen their resilience. IFAD is well experienced in Indonesia. It has been active in the country since 1980 and has extended loans to Indonesia for 15 programs with assistance totaling over US$400 million. MMAF, for its part, has a high
level of fisheries expertise and an in depth knowledge of local conditions and implementing modalities.

a. Consequently in 2011 and 2012, together MMAF and IFAD cooperated to design the Coastal Community Development Project (CCDP). The design team was comprised of approximately 5 foreign and 5 local experts spread over a wide range of disciplines. The effort was managed on the IFAD side by the Country Programme Manager and on the MMAF side by the Head of PMPPU’s Business Development Division. The design process involved extensive discussions with national, provincial, district and village level government officials, representatives of communities, fishers, NGOs, universities and the private sector.

There are four main elements underlying the CCDP design. These elements represent the core of the project and provide the foundation for project activities. Community empowerment, essentially a demand-driven participatory approach, is the key strategy that underlies CCDP. This approach enables households to participate and decide on their priorities. Community empowerment shapes the way that CCDP is being implemented, provides the main structuring ingredient and is the basis for how project investment activities work and relate to each other. Its application enhances transparency and accountability in the use of project funds and also dictates how project management functions.

Market focused strategy and the related interventions delivers the returns to the fisher/marine households and enable them to raise their incomes by increasing sustainable returns from fish and other marine products. Typically producers only receive about 20% of final retail price. By moving up the value chain, fisher family welfare can be greatly improved without the need for increased pressure on marine resources.

Focus on poverty and targeting the marginal active poor, is a fundamental government policy and the core mandate of IFAD. The pro-poor focus has been one of the main determining factors in selection of the project communities – all selected project villages have at least 20% of households below the poverty line. Within those communities, the focus is on the marginal active poor – those households that can make effective use of the investments made under the project with the market-based approach – and on inclusion of the poor in project activities.

Replication and scaling-up project activities and processes is the fourth element. It has influenced the selection of districts/cities that are located in a range of different marine and social environments. This has resulted in a physical, social and geographic diversity of project areas spread from West Kalimantan to Papua. This concept is designed to enable the dispersed project districts to become regional nuclei testing a range of solutions in diverse, but predominantly poor communities.

The design process culminated with production of a mutually acceptable Design Document and the CCDP was approved by IFAD’s Executive Board in September 2012. The CCDP became effective on the 23 October 2012 and implementation is expected to run for five years.

CCDP Objectives and Geographic Locale
CCDP’s goal is reduction in poverty and enhanced, sustainable and replicable economic growth among the active poor in coastal communities. The Project’s development objective is increased household incomes for families involved in fisheries/marine activities in poor coastal communities. In support of the development objective, the project has three outcomes, each linked to one of the project’s investment components: (i) target households implement profitable marine-based economic activities with no detrimental effect on marine resources; (ii) expansion of economic opportunities for sustainable, market-based, small-scale fisheries/marine operations; and (iii) efficient and transparent management for the benefit of the project’s communities.

CCDP is being implemented in Eastern Indonesia in 12 districts/cities located in 9 provinces, which have a high incidence of poverty. Project implementation at the district/city level is undertaken by 12 Project Implementation Units (PIUs). Since Indonesia contains over 250 coastal districts, the Project concentrates on a limited number of districts/cities, with diverse marine environments and socio/cultural conditions. The district/cities contain communities, which while poor, also have good resource potential and market access. The areas selected for inclusion in CCDP were based on their ability to successfully participate in project activities, including demonstrated political/financial commitment, qualifying numbers of poor coastal communities, potential for increasing incomes from fishing/marine operations, and the scope for scaling up. The areas were selected to represent a broad cross-section of districts/cities. The inclusion of diverse marine environments allows CCDP to introduce different processes for resource management, in combination with sustainable economic development of mariculture, fish capture, processing, marketing and other marine related operations.

In each district/city area up to 15 coastal villages are selected for inclusion under CCDP based on inter alia: (i) poverty level, (ii) demonstrated motivation and successful participation in previous programs, (iii) potential for marine/fisheries production and value addition; and (iv) inclusion of small islands. At full implementation in 2015, a total of 180 villages will be involved. Since there are approximately 660 households within an average project village and approximately 60% are involved in fishing, aquaculture and other marine-based activities, expectation is that a total of about 70,000 households, or 320,000 people, will be CCDP beneficiaries.

CCDP Components

CCDP is comprised of three investment components. The first component – Community Empowerment, Development and Resource Management – is the core of the project. It represents over two thirds of project investment. All its activities are centered on target communities with project implementation driven by participatory processes and village determination of priorities. The second component - District Support for Marine-Based Economic Development - supports village initiatives at the district/city level and aims to strengthen technical, institutional and infrastructure for small-scale fisheries/mariculture; and improve access to and the functioning of markets and value chains. The third component – Project Management - focuses on CCDP implementation support and building the capacity required to scale-up project activities.

Component 1 – Community Empowerment, Development and Resource Management builds on previous MMAF experience and adopts a village participatory planning approach focused on marine-based economic development, primarily working through
groups within the communities. It builds capacity within communities to implement project activities, take control of their own development and facilitate access to technical/financial support from both the government and private sector. The Component comprises three Sub-Components, all of which are community based. The outcome from the component is that: target households implement profitable marine-based economic activities with no detrimental effect on marine resources.

Sub-Component 1.1 – Community Facilitation, Planning and Monitoring provides the basis for implementation of all CCDP activities within the communities and also establishes priorities that guide the allocation of resources. The output is: marine/fisheries households’ development priorities are identified, agreed and documented. The Sub-Component’s investment activities include:

- Recruitment and training of 72 Community Facilitators (6/PIU) and 12 CBM Consultants (1/PIU)
- Information and awareness campaigns, to build an understanding of the Project
- Forming, training and capacity building of Village CCDP Working Groups
- Carrying out CCDP village inventories and assessments
- Community planning and preparation of Village Marine Development Plans

Sub-Component 1.2 – Coastal Resource Assessment, Planning and Co-Management is focused on the sustainability of project interventions for long term economic health of project communities. The Project facilitates effective co-management arrangements. The output is: community-based marine resource management areas are being managed effectively. The Sub-Component involves the following investment activities:

- Coastal Resource Inventories
- Community Awareness Campaigns
- Construction/Equipping of Village Information Centres
- Establishment, Training and Equipping of Co-Management Groups
- Coastal Marine Co-Management Plans
- Small-scale Investments in Support of Coastal Resource Management
- District-Level Support for Village Co-Management Operations

Sub-Component 1.3 – Market Focused Village Development represents the largest project investment, with about 40% of base costs. It aims to stimulate successful investments in small-scale marine-related activities that respond to specific near-term market demand. It is geared to raise the profitability and scale of production of community producers from sustainably managed marine resources. Groups themselves are expected to contribute 30% of investment costs in either cash or kind. There are two outputs: (i) financially sustainable community enterprises, and (ii) community infrastructure supporting marine-based economic activities in project villages. The Sub-Component’s investment activities are:

- Community Enterprise and Infrastructure Fund, totalling US$ 11.25 million, for financing: production/marketing enterprise groups, village-based service enterprises, and community-managed small-scale economic infrastructure
- Training and Technical Support for Enterprises Groups and Community Infrastructure
Component 2 – District Support for Marine-Based Economic Development is applied to support village-level interventions with complementary investments at the district level. The district investments are used to remove constraints faced by the communities to realizing the full benefits from their investments. It also opens up opportunities for communities to improve the productivity of their fishing/marine activities and capture greater benefits from processing and marketing their products. The Component comprises two Sub-Components, the first focuses on infrastructure, innovation and building institutional capacity; the second on markets and value chains. The outcome of Component 2 is: expansion of economic opportunities in project districts for sustainable, market-based, small-scale fisheries/marine operations.

Sub-Component 2.1 – District-Level Investment and Capacity Building aims to:
(i) facilitate investment in district (or city)-level marine infrastructure and services, often through public-private partnerships, in support of the small-scale fisheries and mariculture/aquaculture for the target communities; (ii) provide scope for the district fisheries offices to develop and implement new and innovative approaches on a limited/pilot scale; (iii) improve the capacity of the district/city, civil society and the business community; and (iv) facilitate scaling up of project activities and approaches in other coastal villages in the district/city and in similar and often adjacent districts. The expected output from the sub-component is: improved infrastructure and services supporting small scale fishing and marine activities established in the project areas. Sub-Component investment comprises:
District/City Fund for Supporting Small Scale Fisheries, with two funding windows:
(i) Supporting District/City Infrastructure for Small-Scale Fisheries, and (ii) Supporting District/City Innovation for Small-Scale Fisheries
District/City training and institutional capacity building

Sub-Component 2.2 – Market and Value Chain Support creates opportunities for enterprise groups in target villages to profitably invest in production and first-stage marketing of sustainable, high potential marine products linked to market demand. This is primarily achieved by implementing selected systematic interventions to create mutually profitable win-win opportunities between buyers and producers and remove other critical bottlenecks. The expected output is: increased participation and earnings by small scale fishers and marine producers from prioritized high potential products in each project district/city. Sub-Component investment comprises:
Market Opportunity and Intervention Strategy Identification, Progress Tracking and Capacity Building
Market Linkages, Promotion and Technology Transfer and Cluster Development.

Component 3. Project Management provides for implementation for the range of project activities in each district/city, with national oversight, and lays the foundation for replication and extension of project activities. The expected outputs are: (i) PMO and 13 PIUs (1 PIU is for knowledge management) established and operating effectively, and (ii) replication and scaling up of the Project facilitated. In investment terms, this Component provides for the total cost of managing the project and delivering associated services to the communities.
CCDP Accomplishments
CCDP has now completed nearly 2 years of implementation. It is proceeding in general conformity with its design and time frame. CCDP is nationally coordinated but implemented primarily at the district/city and village levels. As such, it requires operating units at national, district/city and village levels.
A national PMO responsible for overall program coordination, budget processing, financial management, administration and monitoring has been established in the country’s capital, Jakarta. Approximately 25 government staff supported by 10 consultants are assigned to the PMO. At the district/city level, 12 PIUs have been formed for project implementation. PIUs’ staffing varies but averages 10 people. Each PIU is supported by 1 CBM Consultant, 1 Marketing Consultant, 6 Village Facilitators and +/-3 Extension Agents. At the village level there are 1 Working, 1 Infrastructure, 1 Resources and an average 6 Enterprise Groups.
To establish a project baseline, as a first step, CCDP followed IFAD’s standard procedure and undertook a Results and Impact Management Survey (RIMS). The RIMs provides project wide data on household asset ownership and children’s nutritional status of both project households and control groups. At project completion, the same RIMS will be run once again and the results used to determine overall project impact. The standardized RIMS format and procedures is used on all IFAD projects throughout the world. In 2013 project specific Village Profiles were also produced to help tailor village specific interventions. Also to better understand the details of CCDP impact, Annual Outcome Surveys (AOS) that measure more project specific items such as household participation, technology transfer, production methods, income increase and gender issues are run each year. The AOS assist in fine tuning outreach, training and investments.
Most importantly, CCDP is now working in 108 villages (9/PIU). Firstly, Village Facilitators assist each village to form a Village Working Group (VWG) and draft a Village Coastal Resource Inventory. VWGs have been established; and Village Coastal Resource Inventories have been completed in each of CCDP’s 108 villages. The VWGs generally coordinate village level CCDP implementation. After VWG formation and socialization, groups are formed for infrastructure, enterprises and community based coastal resources management (CBCRM). By the end of 2nd Quarter 2014 each village had formed 1 VWG and 1 Infrastructure Group and in addition 92% had a CBCRM Group. The number of Enterprise Groups varies per village with an average of about 6/village. Typically, at least 1 of the Enterprise Groups is for processing; and comprised mostly of women. CCDP has a target of at least 30% women’s participation in Enterprise Groups overall. VWGs have 5 members and Infrastructure, CBCRM, and Enterprise Groups average 10 members.

Enterprise Groups represent about 30 categories of activities generally covering capture fisheries, aquaculture (marine; brackish; fresh), processing, marketing, boat repair, ecotourism and salt production. As seen in Table 1, up to 30 June 2014, a total of 1,019 groups had been formed. On average there are 85 groups/PIU. Each village has already donated land and constructed a Village Information Center. An estimated 10,000 community members are being reached under CCDP.
Table 1: CCDP Village Groups
Up to 30 June 2014

<table>
<thead>
<tr>
<th>No.</th>
<th>District/City</th>
<th>Village Groups</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>VWG Infrastr're</td>
<td>CBCRM</td>
</tr>
<tr>
<td>1.</td>
<td>Merauke</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>Yapen</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>3.</td>
<td>Ternate</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4.</td>
<td>Ambon</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Maluku</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Tenggara</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>6.</td>
<td>Kupang</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>7.</td>
<td>Lombok Barat</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>8.</td>
<td>Makassar</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>9.</td>
<td>Parepare</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>10.</td>
<td>Gorontalo Utara</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>11.</td>
<td>Bitung</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>108</td>
<td>108</td>
</tr>
</tbody>
</table>

Each Infrastructure, CBCRM and Enterprise Group is eligible for CCDP funding. For groups wishing financial support, the group with the assistance of the Village Facilitator first drafts an investment proposal. The proposal review and funding procedures follow detailed protocols outlined in the Project’s Lending Guidelines. The group proposals are reviewed and revised, if needed, by the local Consultants and the PIUs. The PIUs then pass the improved proposals on to the local Fisheries Department, which in turn provide the proposals to District Oversight Boards. Each Enterprise also needs to open a bank account. Once all the authorizing agencies agree, funds are released to the group’s bank account. Up to the 2nd Quarter 2014, 90% of eligible groups had completed investment proposals. To date CCDP has funded approximately 700 community groups; and nearly all have already utilized the funds and made appropriate investments. The remaining groups are in process of refining and improving their proposals.

At the district/city level, investments are made in support of small-scale fisheries/aquaculture for the target communities. Investments are made for infrastructure, facilities and services. The maximum use of public-private partnerships is sought. The initial step in the process was to conduct a Market/Value Chain Study in each of the CCDP’s 12 project areas. The Village Facilitators and Extension Agents identified the principal commodities available at the village level. The PIU Market Consultants working with the PIUs provided additional details about district/city market value chain opportunities and likely private sector partners. Based on their wide experience the PIUs and DOBs also had insights as to the most effective district/city level investments in support of coastal communities. The PMO consolidated and synthesized input from the Market/Value Chain Studies, PIUs, Government staff, Consultants and the private sector. The PMO then scheduled workshops in each PIU; and selected 3 target commodities and
priority investments. A list of the Priority Commodities and Proposed Investments under consideration is shown as Table 2.

Table 2: Priority Commodities and Proposed Investments

<table>
<thead>
<tr>
<th>No</th>
<th>District/City</th>
<th>Priority Commodities</th>
<th>Proposed Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kupang City</td>
<td>Fish Floss, Smoked Fish, Fish Balls, Fish Nuggets</td>
<td>Seafood Showroom and Packing Facility</td>
</tr>
<tr>
<td>2.</td>
<td>Bitung City</td>
<td>Squid, Fish Balls, Fish Siomay, Fish Flakes</td>
<td>Equipment (Processing; Packing), Kios Showroom, Temporary Showroom</td>
</tr>
<tr>
<td>3.</td>
<td>Ambon City</td>
<td>Smoked Tuna, Smoked Fish, Tuna Floss, Tuna Balls</td>
<td>Seafood Showroom, Processing Facility, Cold Chain Transport</td>
</tr>
<tr>
<td>4.</td>
<td>Yapen District</td>
<td>Fish Floss, Dried Fish, Seaweed</td>
<td>Ice Plant, Seafood Processing Facility, Smoked Fish Production Facility</td>
</tr>
<tr>
<td>5.</td>
<td>Lombok Barat District</td>
<td>Shrimp Paste, Shrimp Tortilla, Clam Sticks, Crispy Seaweed</td>
<td>Seafood Packaging Facility and Equipment</td>
</tr>
<tr>
<td>6.</td>
<td>Ternate City</td>
<td>Smoked Fish, Fish Floss</td>
<td>Seafood Packaging Facility</td>
</tr>
<tr>
<td>8.</td>
<td>Gorontalo Utara District</td>
<td>Smoked Fish, Fish Floss, Seaweed, Seaweed Crackers</td>
<td>Ice Plant and Related Equipment</td>
</tr>
<tr>
<td>9.</td>
<td>Merauke District</td>
<td>Fish Meal</td>
<td>Fish Meal Plant</td>
</tr>
<tr>
<td>10.</td>
<td>Parepare City</td>
<td>Tuna Floss, Tuna Balls, Dried Fish</td>
<td>Seafood Packaging Facility</td>
</tr>
<tr>
<td>11.</td>
<td>Makassar City</td>
<td>Dried Shrimp, Boneless Milkfish, Fish Floss, Fish Balls</td>
<td>Seafood Showroom and Packaging Facility, Processing Facility</td>
</tr>
<tr>
<td>12.</td>
<td>SE Maluku District</td>
<td>Seaweed Syrup, Crispy Seaweed</td>
<td>Processing Facility</td>
</tr>
</tbody>
</table>

Based on the selection of Priority Commodities and Proposed Investments, further steps are taken to insure investment viability. Typically these actions include the need to: (i) confirm commodity selections; (ii) draft infrastructure investment proposals; (iii) confirm infrastructure investment proposals by PMO; (iv) draft detailed business plans; (v) confirm business plans by PMO; (vi) execute Memorandum of Understandings (MOUs) with private sector partners for operational support; (vii) acquire land; (viii) tender for facilities; (viii) make appropriate PIU infrastructure investments; and (ix) operate facilities.

Considerable progress has been made in advancing CCDP’s district/city level investment process. By 30 June 2014, all 12 PIUs had submitted proposals for infrastructure investments. All 12 have also identified private sector partners and signed preliminary MOUs. Half of the PIUs have advanced to the stage of acquiring land and preparing
tenders for infrastructure facilities. By year end 2014, expectation is that all 12 PIUs will have completed tendering for facilities and be ready to initiate construction. Full utilization of the facilities will begin in earnest in late 2014 or early 2015.

CCDP Lessons Learned

CCDP implementation is now only at its midway point. However, even at this early stage, there have been many useful lessons learned. Interesting findings include:

Small Scale Fisher Household Welfare: The basic premise underlying CCDP design that small scale fisher household welfare can be significantly improved by moving up the value chain has been confirmed. Relatively simple steps are being undertaken in CCDP at the producer level to boost income. Examples include seaweed cleaning/drying, artisanal production of smoked fish, small scale manufacture of fish feeds and provision of cold boxes for fresh fish transport. In many cases, a relatively limited investment has led to an up to 50% gain in incomes. This has especially been the case where village women without a previous source of cash income now work as a group to produce and market simple seafood productions like fish crackers and fish paste. Their extra income has led to a real improvement in household welfare helping with family expenditures for food, education, electricity and communications. No doubt next year, when supporting investments begin at the district/city level, even greater gains can be made in fisher household incomes.

Public Private Partnerships: The Project has been able to couple the Government’s access to land, donor resources and community fisheries with the private sector’s dynamism and access to markets and finance. The Government is well able and qualified to make infrastructure investments but often has difficulty guaranteeing continuous operating funds and business management expertise. For its part, the Private Sector understands the business world but lacks the knowledge and patience to work with local communities. CCDP has bridged the two worlds by having the Government make land and infrastructure investments; and then allow the Private Sector to utilize the public facilities at a reasonable rates provided defined conditions are met to purchase product from small scale fishery producers at favorable prices.

Local Human Resource Support: Although technical expertise is lacking at the village level, in Indonesia at least, there is an excellent reservoir of local talent at the nearby district/city level. CCDP has learned that a very strong skill base exists within both the public and private sectors at the local level. By tapping into this talent pool, the Project has been able to provide high quality effective support to villages at a reasonable price. In addition, provision of local technical support has the advantage of relatively easy access to even remote locations, familiarity with product availability, knowledge of specific market preferences and cultural sensitivity.

Knowledge Management dan Communications: Although CCDP covers 180 rural coastal villages spread over an area 4,000 km long and 1,000 km wide, fortunately almost all have mobile telephone coverage. In addition, all of the PIU’s have both telephone and Internet access. The CCDP’s PMO has taken advantage of this situation by designing communications protocols for both smartphone and Internet. Consequently through mobile applications like WhatsApp and the Project’s website constant information exchange and knowledge management sharing can be conducted not only between the PMO and PIU but between all project stakeholders. All project staff are in easy reach of
each other and all the various offices. The benefits for team building and knowledge management sharing have been very significant. In addition, the formally onerous task of project monitoring and evaluation has been considerably improved and the cost greatly reduced.

The Coral Triangle Initiative on coral reefs, fisheries and food security: Progress towards the establishment of effective marine protected areas for improved fisheries management

Alan T. White, Indo-Pacific Division, The Nature Conservancy, Honolulu, Hawai‘i, USA; alan_white@tnc.org

Abstract

The six Coral Triangle countries—Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste—each have evolving systems of marine protected areas (MPAs). More than 1900 MPAs covering 200,881 km$^2$ (1.6% of the exclusive economic zone for the region) have been established within these countries over the last 40 years. The focus of protection has been primarily on critical marine habitats and ecosystems, with a strong emphasis on maintaining and improving the status of near-shore fisheries. This paper highlights progress towards the MPA goal to establish a “Coral Triangle MPA System” within the Regional Plan of Action endorsed by the six countries in 2009 through the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security. It brings together for the first time a consistent set of data on MPAs for the countries and reviews progress towards the establishment of MPAs in these countries with regard to (i) coverage of critical habitat (17.8% of the coral reef habitat within the region lies within an MPA), (ii) areas under effective management, and (iii) actions needed to improve the implementation of MPAs as a marine conservation and resource management strategy. A key point is the need to improve MPA design, the effectiveness of existing MPAs, and the need to move towards ecosystem-based management that is fully integrated with fisheries management objectives.

Introduction

Coastal habitats are being exploited beyond their capacity to recover as overfishing and destruction of coral reefs, mangroves, seagrasses and estuaries continues in the Coral Triangle (CT) Region (Burke et al. 2012; Stobutzki et al. 2006). In response to a growing recognition of the loss of these valuable marine ecosystems, marine protected areas (MPAs) are being established in the six countries that comprise the Coral Triangle: Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor Leste.

MPAs throughout the CT in their various forms (e.g. no-take marine reserves, sanctuaries, local marine managed areas, national parks, and others) have been established to protect well-defined areas that contain critical habitats, productive fisheries and other important
socioeconomic and cultural values. The model MPA in this region varies by country and ranges from large MPAs zoned for multiple uses to small locally managed marine areas (LMMAs), all of which should be consistent with the specific conservation and management objectives set for the area. In addition, empirical evidence suggests that every MPA design should include no-take zones and consider factors important for fisheries management and climate change to be effective in the long term (Green et al. 2013; Green et al. 2014).

Since MPAs and networks of MPAs are considered one of the most effective tools for biodiversity conservation and natural resource management in the CT, the third of five goals of the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) Regional Plan of Action (CTI-CFF 2009) is “MPAs established and effectively managed.” In 2010, the CT6 developed indicators and targets for tracking progress against this goal (Table 1). This paper reviews the status of MPAs in the Coral Triangle region and progress towards the targets in Table 1. This data and analysis supports the CTI-CFF (www.coraltriangleinitiative.org) in the development of a framework for the Coral Triangle MPA System (CTMPAS)4 called for in the CTI-CFF Regional Plan of Action (CTI-CFF 2009).

Table 1. Indicators and targets for Goal 3 on MPAs in the CTI-CFF Regional Plan of Action1

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Description</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall MPA Result/target</td>
<td>Regional-wide Coral Triangle MPA System (CTMPAS)2 in place and fully functional</td>
<td>Completed by 2020</td>
</tr>
<tr>
<td>Indicator 1</td>
<td>CTMPAS Framework developed and adopted by Coral Triangle Countries</td>
<td>Adopted and launched in 2013</td>
</tr>
<tr>
<td>Indicator 2</td>
<td>Percent/area of total marine habitat area in CT region in marine protected or managed areas</td>
<td>20 percent3</td>
</tr>
<tr>
<td>Indicator 3</td>
<td>Percent/area of each major marine and coastal habitat type in protected “no-take replenishment zones”</td>
<td>10 percent3</td>
</tr>
<tr>
<td>Indicator 4</td>
<td>Percent/area of MPAs under “effective” management</td>
<td>25 percent applying criteria in CTMPAS2</td>
</tr>
<tr>
<td>Indicator 5</td>
<td>Percent/area of MPAs included in CTMPAS</td>
<td>All MPAs to be included by 2020</td>
</tr>
</tbody>
</table>

1 Indicators determined by CTI-CFF MPA Technical Working Group in coordination with the CTI-CFF Monitoring and Evaluation Working Group in workshops in 2012 and 2013
2 For full description of CTMPAS, see Walton et al. (2014)
3 The CTMPAS Framework and Action Plan was endorsed by the CTI-CFF Senior Officials in 2012 and launched in May 2014 and is in early stages of implementation (CTI-CFF 2013) through the efforts of the CTI-CFF MPA Technical Working Group comprised of members from each country as well as partners and scientists.
Targets are consistent with CBD (2010) but set a higher bar for area protected by any type of MPA

**Status of MPSs in the Coral Triangle and Pending Issues**

A consistent and accurate count and area of MPAs are recorded through various sources of information (Figure 1 and Table 2). The 1,972 MPAs (599 have known boundaries in the CT Atlas database) cover at least 200,881 km$^2$ of marine area and include 7,757 km$^2$ of coral reef habitat or 17.8% of the regional total (Cros et al. 2014). At face value, this suggests that the regional target for critical habitats under some form of marine protected area (20%) is nearly achieved (Table 1). The reality is that this figure of 17.8% of coral reef habitat within MPAs is misleading and needs qualifying, since, for example, as shown for the Philippines, only about 1% of its reef area is under truly effective protection. The gap between nearly achieving 20% and only 1% of area effectively protected is the lack of “effectively managed MPAs”. The other cause for this gap is the range of forms and sizes of MPAs in the region, many of which do not achieve their management objectives, and the small area covered by “no-take marine reserves” for which the regional target is 10% of critical habitat. Overall progress towards the 5 CTI-CFF MPA indicators using data in Table 2 is estimated in Table 3.

![Map of MPAs within the Extended Economic Zones of the six CT countries.](image-url)
Table 2. Summary data for coverage of all recognized MPAs in the Coral Triangle countries

<table>
<thead>
<tr>
<th>Marine Protected Areas (MPAs)</th>
<th>INDO - NESIA</th>
<th>MALAY-SIA(^a)</th>
<th>PAPUA New G.</th>
<th>PHILIPPINES</th>
<th>SOLOMON IS.</th>
<th>TIMOR-LESTE</th>
<th>REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of MPAs (reported by government)(^b)</td>
<td>108</td>
<td>51</td>
<td>59</td>
<td>1653</td>
<td>100</td>
<td>1</td>
<td>1972</td>
</tr>
<tr>
<td>Total MPA area (km(^2)) (reported by government)(^b)</td>
<td>157,841</td>
<td>15,661</td>
<td>4,558</td>
<td>20,940</td>
<td>1,325</td>
<td>556</td>
<td>200,881</td>
</tr>
<tr>
<td>Number MPA records in CT Atlas (point or polygon format)</td>
<td>83</td>
<td>51</td>
<td>59</td>
<td>627</td>
<td>100</td>
<td>1</td>
<td>920</td>
</tr>
<tr>
<td>Number of MPAs with known boundaries in CT Atlas(^c)</td>
<td>83</td>
<td>50</td>
<td>35</td>
<td>348</td>
<td>82</td>
<td>1</td>
<td>599</td>
</tr>
<tr>
<td>Total area of MPAs (km(^2)) with known boundaries</td>
<td>170,841</td>
<td>13,653</td>
<td>4,558</td>
<td>17,164</td>
<td>1,325</td>
<td>557</td>
<td>208,152</td>
</tr>
<tr>
<td>Percent MPA areal cover in EEZ(^d)</td>
<td>2.7%</td>
<td>3.5%</td>
<td>0.2%</td>
<td>1.1%</td>
<td>0.1%</td>
<td>1.3%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Percent MPA areal cover in territorial waters (12 n. miles)</td>
<td>13.1%</td>
<td>12.7%</td>
<td>1.3%</td>
<td>4.2%</td>
<td>0.9%</td>
<td>3.4%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Average size of MPAs (km(^2))</td>
<td>1461.5</td>
<td>270.4</td>
<td>130.2</td>
<td>12.7</td>
<td>16.0</td>
<td>556.0</td>
<td>407.80</td>
</tr>
<tr>
<td>Size range of MPAs (km(^2))</td>
<td>Minimum</td>
<td>0.9</td>
<td>11.83</td>
<td>0.04</td>
<td>0.02</td>
<td>0.02</td>
<td>-</td>
</tr>
<tr>
<td>Maximum</td>
<td>35,211</td>
<td>10,200</td>
<td>2334</td>
<td>2789</td>
<td>823</td>
<td>-</td>
<td>35,211</td>
</tr>
<tr>
<td>Coral Reefs(^e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coral reef area (km(^2))</td>
<td>19,868</td>
<td>1,698</td>
<td>7256</td>
<td>12,021</td>
<td>2,804</td>
<td>35</td>
<td>43,682</td>
</tr>
<tr>
<td>Reef area in MPAs (km(^2))</td>
<td>6,208</td>
<td>661</td>
<td>357</td>
<td>471</td>
<td>113</td>
<td>10</td>
<td>7,757</td>
</tr>
<tr>
<td>Reefs in MPAs (%)</td>
<td>31.2%</td>
<td>38.9%</td>
<td>4.9%</td>
<td>3.9%</td>
<td>4.0%</td>
<td>29.5%</td>
<td>17.8%</td>
</tr>
<tr>
<td>Mangroves(^f)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mangrove area (km(^2))</td>
<td>31,894</td>
<td>7,097</td>
<td>4,265</td>
<td>2,568</td>
<td>603</td>
<td>18</td>
<td>46,445</td>
</tr>
</tbody>
</table>

\(^a\) Malaysia MPA number and area, as well as all the calculations made include the Tun Mustapha Marine Park (10,200 km\(^2\)) which will be fully gazetted by 2015. Pulau Yu Besar, Pulau Yu Kecil and Pulau Sipadan still have no official area reported.

\(^b\) Sources for MPA data: Indonesia: Ministry of Marine Affairs and Fisheries (2013); Malaysia: Department of Marine Parks (2009), Sabah Parks (2011), Sarawak Forestry Commission (2012); Philippines: Protected Areas and Wildlife Bureau (2013), University...
of the Philippines Marine Science Institute database; Timor Leste: Ministry of Agriculture and Fisheries (2011); no official government numbers were found for Solomon Islands and Papua New Guinea so data used is from the Coral Triangle Atlas (2013) and may underestimate the number and area of MPAs in those countries.

Boundaries available through Coral Triangle Atlas (2013). These boundaries were used for the rest of the calculations presented in this table.

Source of EEZ boundaries VLIZ (2012).


Source of mangrove data UNEP-WCMC (2010) and Spalding et al. (2010). Mangroves in the Coral Triangle are not managed as MPAs, therefore the extent of this habitat within MPAs is not reported.

Table 3. Progress towards CTI-CFF MPA indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Target</th>
<th>Status of Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CTMPAS Framework developed and adopted by CT Countries</td>
<td>Adopted and launched in 2013</td>
<td>Completed</td>
</tr>
<tr>
<td>2 Percent/area of total marine habitat area in CT region in marine protected or managed areas</td>
<td>20 percent</td>
<td>17.8 percent of coral reef habitat, 9.4 percent of territorial waters and 1.6 percent of EEZs</td>
</tr>
<tr>
<td>3 Percent/area of each major marine and coastal habitat type in protected “no-take replenishment zones”</td>
<td>10 percent</td>
<td>Approximately 2 percent</td>
</tr>
<tr>
<td>4 Percent/area of MPAs under “effective” management</td>
<td>25 percent applying criteria in CTMPAS</td>
<td>Approximately 1 percent</td>
</tr>
<tr>
<td>5 Percent/area of MPAs included in CTMPAS</td>
<td>All MPAs to be included by 2020</td>
<td>None, CTMPAS launched in 2013</td>
</tr>
</tbody>
</table>

1 Data on percent coverage of no-take reserves is lacking for most countries except the Philippines where most of the local government MPAs are no-take and parts of national MPAs are no-take.

2 Burke et al. (2012) report that 1% of coral reefs in the region are effectively managed and 5% are under partially effective management. These estimates were derived through a simple rating system and survey. A recent Philippine study (Maypa et al. 2012) found about 30% of the MPAs effective at level 3 in a system with 4 levels.

Conclusion and Recommendations for Improving MPAs in the CT

An ongoing challenge for MPAs, and especially no-take MPAs, is that they are often seen as incompatible with the traditional use patterns and for marginalizing people dependent on these areas for food and income. Thus, the planning, implementation and management of MPAs, regardless of the level or type of management, must consider the human communities and institutions that are usually the default decision makers for resource utilization and protection. The CTI-CFF has confirmed that planning for MPAs needs to be sensitive to context (social, cultural and environmental) and has identified interrelated
factors essential to improve the overall capacity and effectiveness of MPAs in the region including:

- Monitoring, evaluation, and response-feedback systems;
- Integration of socio-economic factors supporting MPAs;
- Sustainable governance and financing mechanisms in place;
- Scaling-up to resilient networks of MPAs; and,
- Filling ecological gaps by increasing resilience and coverage of protection.

While a significant marine area is under protection as measured by the CTI-CFF MPA indicators, much work remains to augment the area of critical marine habitat under no-take marine reserves and under effective management regimes. A tool to assist in tracking progress is the CT Atlas database and information system. Lastly, scaling-up the implementation of the existing MPAs so that they will achieve their resource management objectives can be accomplished through improved networking (ecological, governance and social) and the use of consistent, functionally effective and interoperable regional monitoring and evaluation criteria.

REFERENCES


UNEP and WCMC 2010. World Database of Protected Areas.


The use of destructive drag nets in Zanzibar: user perceptions and willingness and capacity to change

Sieglind Wallner (Stockholm University)
Sofia Molander (Stockholm University)
Maricela de la Torre-Castro (Stockholm University)
Narriman S. Jiddawi (University of Dar es Salaam)

Due to their harmful effects on habitats like coral reefs and seagrass beds, as well as catches of juvenile fish, beach seines are considered to be among the most destructive gears in small-scale fisheries. In countries of the Western Indian Ocean region, like Tanzania or Kenya, these gears are forbidden, but in places, their use is still common. Earlier studies have shown that elder fishers with a traditional fishing background often
choose traditional gears like basket traps or hook and line, while younger generations or newcomers tend to use e.g. pull seines or spear guns, which are less sustainable. In Zanzibar, contrasting views have even led to conflicts between fishers using more traditional gears (e.g. basekt) traps and pull seine users.

The objectives of this study are to gain a deeper understanding of the reasons why fishers choose to use pull seines, as well as their willingness to change to more sustainable methods in Zanzibar. The aims of these study are i) to investigate why fishers choose to use pull seines as their main gears, ii) to assess the pull seine fishers’ degrees of awareness concerning the destructiveness of their gears, as well as forbidden fishing techniques on Zanzibar, iii) to assess their perceptions of the economical and ecological advantages and/or disadvantages of pull seines compared to other gears, and iii) their readiness and capacity to change less destructive, gears as well as to invest into more sustainable gears.

Collaborative Fisheries Management Planning for a Sustainable Fisheries Future:
The Sardinella Fishery in Senegal

Khady Sané Diouf (USAID/COMFISH project director)
James Tobey, University of Rhode Island/GSO/Coastal Resources Center/USAID
Senegal COMFISH project

Small-scale fisheries play a key social, nutritional and economic role in Senegal. They now provide 94% of fish landed, direct and indirect employment to about 600,000 people, 75% of animal protein in the Senegal diet, and 12 percent of export earnings. Small pelagics constitute the bulk of fish landings with an estimated 70% of all landings being sardinella. The average annual catch of sardinella by the small-scale fishery is 260,000 MT.

This fishery is all the more important since Senegal experiences chronic food insecurity and relies on imports for 70% of its food supply—one of the highest rates in Sub-Saharan Africa. Despite catch levels that are not declining, this is not indicative that sardinella is not over-exploited. More and more fishing boats have been entering the fishery and in recent years a large proportion of the catch is now being harvested from outside Senegal’s EEZ.

This paper describes efforts to establish a collaborative fisheries management plan for sardinella in Senegal. The process includes collecting, analyzing and validating scientific information and local knowledge on the sardinella fishery and stocks, mapping the stocks (there are 2 distinct sardinella species), capacity building of multiple local fisheries governance bodies at the major sardinella landing sites, coordination between local and national governance bodies, and formulation, validation and implementation of the Plan at all levels. Progress to date and challenges are described.
A review of the ecological, social and economic challenges in sustainable inland fisheries in Nigeria: problems and solutions

Afatami Anene, Animal Nutrition Laboratory, Department of Animal Science and Fisheries, Abia State University, Umuahia Campus, afamanene31@gmail.com, +2348037107726

Abstract:
This paper examined the status of inland waters and inland fisheries in Nigeria with a view to identify encumbrances to artisan fisheries production and proffer possible solutions that will enhance fish production in the country. Inland fish production is dominated by activities of small scale/artisan fishers. These operate within the eleven river basin systems that empty either into Lake Chad or into the dominant Niger-Benue River complex that drain the country. This paper identified soil erosion/sediment loading/siltation, infestation by aquatic plants, urbanization/dump sites/leachates, over fishing, unconventional fishing methods, desertification and backlash in fossil oil production activities as some of the ecosystem specific factors limiting fish production in Nigeria. Socio-economic encumbrances to fish production include inconsistent legal/policy framework, inadequate infrastructure. This paper recommends a responsible housekeeping that ensures the stability of ecosystems, accurate and timely fish stock assessment surveys, provision of credit facilities to artisan fishers, legislation and or limitations on gear size, off and on-season, a bottom-up community based management of fisheries resources as some of the mitigation measures that will boost and sustain fish production in Nigeria.

Introduction
Nigeria lies between Longitudes 2° 49'E and 14° 37'E and Latitudes 4° 16'N and 13° 52' North of the Equator and is blessed with numerous marine, brackish water and freshwater resources. The climate is tropical, characterized by high temperatures and humidity as well as marked wet and dry seasons, though there are variations between South and North. Total rainfall decreases from the coast northwards. The South (below Latitude 8°N) has an annual rainfall ranging between 1,500 and 4,000 mm and the extreme North between 500 and 1000 mm.

Aquatic resources in Nigeria serve a multiplicity of functions which include recreation, domestic/municipal purposes, storage of sediment, flood and storm buffering, recharge of underground water, recycle soil nutrients, irrigation of farmlands and provide a habitat for a wide variety of flora and fauna including fin and shellfish, the most cherished of living aquatic resources. Perhaps the most important nutritional function of aquatic ecosystems is in the provision of fin and shell fish that supply some of the protein requirements of the Nigerian populace.

The primary aim of this submission is to review the dynamics of fish production freshwater systems in Nigeria with emphasis on those ecological, social and economic challenges that encumber inland fish production in Nigeria. It also suggests measures to boost and sustain fish production.
Hydrology of Nigeria

Freshwater ecosystems in Nigeria are dominated by two great aquatic systems, namely the Chad system and the Niger-Benue system. Holistically aquatic ecosystems in Nigeria are distributed within 11 river basins (Fig 1). It also includes numerous wetlands, ponds, lakes and reservoirs, ponds, mining and stagnant pools. Some of these were created by sand/laterite mining, damming (e.g. Kanji Lake) of seasonal and perennial rivers and streams. These add up to 14 million hectares of inland waters, much of which is not maximally utilised for fish production (Ita et al. 1985).

Figure 2: Hydrology of Nigeria

Species Richness

Welman (1948) identified 148 species of fish in freshwater systems in Nigeria and since then various researchers have identified 139 – 160 species (Banks et al. 1965, Reed et al. 1967). However, a more detailed report by Ita (1993) listed 230 fish species in most rivers of Nigeria exclusive of Imo, Qua Iboe, Benin, Owena and Calabar, all of which interface directly with the Atlantic ocean. According to (Olaosebikan and Raji 1998; Idodo-Umeh 2003) the list may include as many as 311 species of fish.
Methods of Fish Production in Nigeria

Fish production in Nigeria is either by;
- Trawl/commercial fishery
- Artisan/small scale fisheries/Fish Farming
- Importation from distant lands

Trawl/commercial fishery is highly mechanized and involves the towing of large cone-shaped nets by fishing boats (trawler).

Artisan/small-scale fisheries on the other hand can be categorized into coastal mechanized and canoe fisheries brackish water/lagoon subsistence fisheries and the capture fisheries of man-made lakes, natural lakes, rivers and flood plains. Inland fish production in Nigeria is largely by capture (capture fisheries) and involves the harvesting of naturally existing stocks of wild fish. Inland fish production is achieved by individual or by small groups by the use of labour intensive gears. Characteristically artisanal fishers operate from dugout wooden canoes that are more often than not unmotorized (Coates 2000). A common feature of this type of fishery is the participation by significant number low-income or resource poor groups. The main fishing grounds for this category of fishermen are rivers in major basins, lakes, reservoirs (inland capture) and in relatively shallow (0 - 20m) portions in the continental shelf. Subsistent fishers dominate this category.

Fish Landings

Fish landings in the Nigeria beaches are mainly from industrial and artisanal fisheries sectors. Nigeria's total domestic fish production stands at 640,000MT from both marine and fresh water bodies with a current national fish demand of about 1.6 million MT/year (Fish Network, 2009). This quantity is grossly inadequate for domestic consumption, thus Nigeria imports 700,000MT of fish per year to cushion the supply-demand gap (Ibru, 2005; Fish Network, 2009). Even though inland fish production constitutes about 30% of demand, it actually contributes about 60 – 70% of the domestic fish production (Abiodun et al. 2005, Fish Network 2009, Ibru 2005; Atanda 2009).

Ecological Challenges and Status of Aquatic Systems in Nigeria:

In addition to climate change and other global environmental issues, aquatic systems in Nigeria are bedeviled by a number of ecological problems which include;

1. Soil erosion/sediment loading/siltation: The accelerated accumulation of sediments in aquatic ecosystems leads to a decline in surface water quality and biodiversity.

There are many problems associated with sediment in the aquatic environment and difficulties with the study of aquatic systems. They are complex interactive systems. Isolation of sedimentation effects on an aquatic system has not been effectively accomplished and is probably not a reasonable expectation for research in a natural interactive and responsive system. Many studies have been conducted
in laboratories, but questions can be raised as to their applicability to natural systems.

2. Infestation by aquatic plants: Aquatic vegetation in ditches and canals not only reduce the cross-sectional area of the channel, they also reduce the velocity of water flow. As a result, aquatic vegetation in waterways may dramatically increase the time required to drain a specific storm compared to clean ditches that allow free-flow of runoff water.

3. Urbanisation/Dump sites/leachates: Solid wastes taken to a dumpsite for disposal yield reduce the aesthetic value of the sites and produce leachates which cause serious problems through contaminating the land and water resources nearby. Depending on the phase of degradation, leachates from dump sites have been shown to contain ammonia (Okorie and Acholonu 2008). These systems are reported to have a high load of microbes (Akubugwo and Duru 2011) and this may be a reflection of the input of microorganisms from extraneous sources, and availability of growth supporting organic matter. Most of the faecal coliforms identified in confirmatory testing in water samples in north-eastern Imo State were *Klebsiella pneumonia* and *Escherichia coli* with the former being more dominant than the later (Blum *et. al*. 1987). These organisms are capable of impacting negatively on the health of artisan fishers with an additional disadvantage of reducing the aesthetic and economic value of fish.

4. Over fishing, unconventional fishing methods, desertification and backlash in fossil oil production activities as some of the ecosystem specific factors limiting fish production in Nigeria.

5. Heavy rainfall and flooding may result in sedimentation, and dam collapse with subsequent negative effects on the fisheries of such dam. The synergistic effects produced by heavy rains and flooding on food webs, stratification, runoff, flow, and anoxia etc. will affect fish assemblages in the lake or river ecosystems bringing changes in the distribution of pelagic fisheries.


7. Oil spills very frequent in the Niger delta, pollute aquatic ecosystem and also kill fish. Consequent on the increased activity in the oil and gas sector in Nigeria, transportation of goods and services in outboard engine, tug boats, barges and ocean going vessels interfere with fishing operations and sometimes result in damage of fishing gears.

**Socio-economic problems:**

Chronic socio-economic problems that face artisanal fishermen include inadequate finance and credit facilities, inadequate storage facilities, ineffective co-operatives, high risk, low seasonal catch, and seasonal under-development, migration of fishermen into the oil industry and high cost of fishing inputs. In recent times, to further aggravate the problem, recruitment of able bodied men and women for purpose of communal strife and youth restiveness has distracted fishermen amongst coastal communities. Other socio-economic constraints to increased fish production in Nigeria include,

i. Level of educational attainment of fishers.
ii. Age of fisher, educational attainment and duration of fishing experience are some of the socio-economic consideration for a sustainable inland fishery in Nigeria. Ages of fishers involved in fish production in Nigeria have been reported to range from 25 – 60 years. Younger fishers are known to be more energetic and this can translate to higher production rates while older fishers have the experience that in

iii. The costs of procuring inputs such as nets and out board engines are exorbitant and most times out of the reach of the artisan fishers.

Conclusions and Recommendations

A robust forestation programme in erosion prone areas will reduce erosion and protect aquatic habitats form sedimentation. High fishing pressure resulting from high number of fishers can be minimized by establishing a catch per unit effort for each of the aquatic systems. Adequate baseline scientific data backed by a focused legislative instruments will help in this direction. The functions of the river basins should be made to include management of fisheries resources within their respective areas of jurisdiction. Fishers in each fishing locality require a comprehensive programme for their socio-economic improvement and development so as to achieve increased and sustained inland fish production.

It is evident that rural littoral communities have a predominant role in ensuring a sustainable production of fish and fisheries products. For domestic fish production to exceed its present level efforts should be made to promote rural industry in general and measures should be specifically oriented towards small-scale artisanal fisheries.

It is believed that there is a low level of co-operatives amongst fishermen and fish farmers and his may be responsible for the low volume of credit facilities in the sub-sector. Fishermen should be encouraged to form co-operatives and through such organizations, members could undergo basic management and technical training as well as obtain other support services including the provision of credit and assistance in the procurement of various materials and equipment

Increasing local production by increasing capture fisheries will involve improved fisheries management options such as allowing depleted stocks to recover and utilizing other stocks wisely. The establishment of fisheries reserve (no-take reserves)where all forms of fishing prohibited is prohibited is commendable. Protected stocks inside reserves contribute to stocks inside fishing grounds through the export of eggs that are carried by water current or those that simply migrate to such grounds. However, fishing outside such reserves must be within sustainable limits.

References


Conditions for sustainability of the Elephant Marsh Fishery in Malawi

Ishmael B.M. Kosamu, The Polytechnic, Department of Physics and Biochemical Sciences, University of Malawi, Private Bag 303, Chichiri, Blantyre 3, Malawi; ikosamu@poly.ac.mw +265-187-0411; Fax: +265-187-0578; Institute of Environmental Sciences (CML), Leiden University, P.O. Box 9518, 2300 RA Leiden, The Netherlands; kosamu@cml.leidenuniv.nl

Abstract
The Elephant Marsh, a wetland in Southern Malawi, is important for small-scale fisheries. It is managed by local institutions, which are not formally linked to any state institutions. This paper uses qualitative comparative analysis (QCA) to examine factors for sustainability at 24 fishing villages around the wetland using a hypothesis that “If strong local institutions (with or without government support) exist in an environment where resource users take collective action, and there is no or minimal conflictive interference, small-scale fisheries become sustainable”. It was revealed that the sustainability of small-scale fisheries management at Elephant Marsh relies heavily on the strength of local fisheries’ committees. Future interventions on fisheries management at the resource should, therefore, pay particular attention to protecting and (re)building collective social capital, especially in the leadership of fisheries committees.

**Keywords:** small-scale fisheries; wetland; sustainability; local institutions; Elephant Marsh; conditions; governance; Malawi

1. **Introduction**

Small-scale fisheries (SSF) support the livelihood of over 180 million people in developing countries (Evans and Andrew 2011). Despite their relative importance, studies on the management constituency of SSF in developing countries are limited. Most of the well-known studies have been done in developed countries where SSF are scarce (Ratner et al. 2012; Blaikie 2006). The deficiency in downscaled studies has led most decision makers in developing countries to manage SSF using more generalized blueprint panaceas generated in developed countries.

For developing countries, the institutional design dilemma is compounded by the stratification of the social, economic, political and biodiversity landscapes. Several scholars (Hara and Nielsen 2003; Ribot et al. 2008; Jentoft et al. 2003; Béné et al. 2009) have questioned the rationale behind the adoption and implementation of “imported” institutions in systems that have been poorly understood. Nevertheless, most efforts in small-scale fisheries management in developing countries have put a lot of emphasis on setting up co-management arrangements. The approach in Africa, for example, has been a hasty, ceremonial, top-down devolution of some aspects of management from central states (which are usually weak) to local communities resulting in an imbalance of power and interests.

The Elephant Marsh, a wetland in southern Malawi, is important for SSF and the management arrangements are quite informal. The wetland, with some 24 fishing villages, is managed by local institutions, which are not formally linked to any strong state institutions. Malawi also lacks a management framework strong enough to enforce a balanced and sustainable wetland development under rising pressures, such as overexploitation and agricultural conversion, which are mainly driven by population growth, rural poverty, climate change and market growth. In the Elephant Marsh, additional drivers include fluctuation in water levels caused mainly by hydroelectric
power generation at Kapichira Dam and the abstraction of water for irrigation by Illovo sugar estate; both located upstream. Moreover, the coordination of the roles of the various stakeholders in wetland management at Elephant Marsh is not very clear or stable (Kosamu et al. 2012). It is therefore important to determine factors of success for these locally-based management arrangements in order to achieve long-term sustainability of the fishery at Elephant Marsh and reflect upon optimal roles of the state.

From the literature reviewed, it seems the management constituency of the Elephant Marsh fishery is built around collective social capital (which may depend on the leadership of the local fisheries committee or village chief), and the presence of a central state, which might be supportive (recognizing, helping, educating, informing, power sharing) or conflictive (imposing alien regulations). This paper seeks to provide some preliminary contribution to the importance of four factors namely: collective social capital at village level (CSC_V), collective social capital at local fisheries committee level (CSC_C), presence and influence of government agents (GOV), and the role of chiefs (CHF) in the success of local SSF management at Elephant Marsh in Malawi.

2. Study Area

Elephant Marsh is located on the East African Rift Valley floor in the southern part of Malawi, see Figure 1.

Figure 1: Map of the Elephant Marsh showing the location of the fishing villages.
It covers an average area of about 600 km\(^2\), although actual size varies from about 2700 km\(^2\) in the wet season to 500 km\(^2\) in the dry season. The variation creates season-oriented pressure on the ecosystem goods and services that communities can draw from the wetland. The Elephant Marsh straddles the administrative districts of Chikhwawa and Nsanje, which fortunately follow similar institutional arrangements and therefore no major trans-district problems arise. The region has an average altitude of 500 m above sea level and an annual precipitation range of 560 to 960 mm. The mean annual precipitation in Malawi is 1180 mm and the altitude ranges from 50 to 3000 m asl. The marsh is fed by the Shire River, the only outlet of Lake Malawi, which flows through it in a southerly direction before joining the Zambezi River in Mozambique.

The marsh has relatively grassy margins but the bulk of its surface is formed by a mosaic of rooted swamp vegetation (sudd), floating vegetation and open water. In the southern part, this pattern is interspersed with islands with saline soils and palm trees. The Elephant Marsh is also home to several species of fish, out of which *Clarias gariepinus* (locally known as *mlamba*), *Oreochromis mossambicus* (*chambo*), *Oreochromis placidus* (*makumba*), and *Barbus ssp.* (*matemba*) comprise over 90\% of the commercial catch (Kosamu et al. 2012).

The International Union for Conservation of Nature (IUCN) red list identifies *Rynchops flavirostris* (African skimmer) and *Oreochromis mossambicus* (*chambo*) as species under threat in its natural range while the Convention on International Trade in Endangered Species (CITES) list includes *Crocodylus niloticus* (Nile crocodile) and *Hippopotamus amphibius* (hippopotamus). The Elephant Marsh is therefore a very important habitat for these species.

The annual fish production from around the Elephant Marsh has been estimated at an average of 8500 tons (Kosamu et al. 2012). This figure possibly includes the lower sections of the Shire River downstream from Elephant Marsh but generally indicates an annual production of 140kg/ha. There are no recent data on the trends of fisheries exploitation at the Elephant Marsh partly due to lack national interest in carrying out research on common pool resources such as the Elephant Marsh. Unfortunately, such data is very important for future impact assessment studies.

Management arrangements at Elephant Marsh are guided by customary law. At village level and under guidance of a traditional chief, each development sector is represented in the form of an executive committee that is responsible for coordination of specific activities. In the fisheries sector, the village level committee is called a Beach Village Committee (BVC), which also controls access to the Elephant Marsh through Beach Chairs. Some twenty-four fisheries committees are found around Elephant Marsh. Based on our field visits in 2013, the arrangement appears to be working well based on community membership of the wetland users. Immigrants are restricted from access to the wetland but are allowed, for example, as fish traders and processors. In most cases, they are easily identified and referred to as “*Angoni*” meaning “outsider” (although *Angoni* is a name of an ethnic group).
3. Methodology

The present study focuses on analysis of success and failure factors for sustainable SSF in the Elephant Marsh Fishery using crisp set qualitative comparative analysis (csQCA). Data were collected between April and November, 2013. From literature review it has been established that the success and failure factors in SSF should at minimum include: (i) the collective social capital of the fisheries committee; (ii) the collective social capital of the fishing village; (iii) the presence of government agents and their influence; (iv) how the chief of the village is involved in fisheries management (conflictive or supportive role); and (v) the overall status of the fishery (outcome) in terms of sustainability. Sustainability in this respect is looked at with the assumption that it is not attributable to variations related to climate, river discharge, or decline from original to sustainable yield levels. Data for all the five variables were collected through focus group discussions, interviews, and observations. Triangulation was attained by using emic (insiders’ view) and etic (researchers’ impression) approaches.

Crisp set QCA is done in six steps (Rihoux and de Meur 2009; Rihoux, 2013; Marx, 2010) using TOSMANA (Tool for Small-N Analysis) version 1.3.2.0 (Cronqvist, 2005). It allows a direct conversion of hypotheses into variables, which are relevant for all the cases, followed by building of a raw dataset for the cases and construction of a truth table. The third step involves resolving contradictory configurations (outcomes that lead to 0 for some observed cases and 1 for other cases) before performing Boolean minimization (Step 4), which helps to clarify and simplify complex expressions of causal configurations. Step 5 identifies the logical remainders (combinations that are possible but have not been observed among the cases). The truth table and overall result of the analysis (Box 1) are automatically generated by TOSMANA (Step 6).

4. Results

From Table 1, one can easily deduce that the dataset is simple enough to manually analyze the trends without the use of csQCA.

Table 1. The dataset for the 24 fishing villages.

<table>
<thead>
<tr>
<th>Case ID</th>
<th>Name of Beach</th>
<th>Location</th>
<th>CSC_C</th>
<th>CSC_V</th>
<th>GOV</th>
<th>CHF</th>
<th>OTM</th>
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<td>Region</td>
<td>CSC_C</td>
<td>CSC_S</td>
<td>Group</td>
<td>Conflictive Chief</td>
<td>Government Agent</td>
</tr>
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<tr>
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<td>1</td>
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<tr>
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<td>Mchesi</td>
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</tbody>
</table>

For example, in all cases where CSC_C = 0, there is no sustainability irrespective of a positive score for a good collective social capital of the village, presence and influence of government agents or a conflictive chief but when CSC_C = 1, there is always sustainability. The csQCA is still used however to have more formal certainties. Using csQCA, the truth table of the 24 fish landing sites at the Elephant Marsh generated in the TOSMANA Analytical Report (Box 1) shows that different configurations (sustainability and non-sustainability) could be found among the empirical cases.

**Box 1:** The overall output of the analytical process.
The output is read as: sustainable small-scale fisheries management at Elephant Marsh is observed in fishing villages (II, III, XI, XIX, IV, VIII, XV, XVII, XXII, X, XIV, XX) that have a strong collective social capital at fisheries committee level (COLLECTIVE SOCIAL CAPITAL_ COMMITTEE {1}).

The overall result from this study has revealed that a good collective social capital at the fisheries committee level is the key factor in determining sustainability of locally-based wetland fisheries management at the Elephant Marsh.

5. Conclusion

The sustainability of small-scale fisheries management at Elephant Marsh in Malawi depends on building strong local institutions with motivated leadership that can safeguard the interests of resource users. Future practice and policy directions on fisheries management at Elephant Marsh should understand the relevance of concrete local community trust, networks, norms plus values and strive to streamline them in decision making and policy formulation. The government of Malawi should begin to take a more participatory position in designing locally-crafted working institutions for the sustainability of common pool resources, such as small-scale fisheries at Elephant Marsh. In villages where fisheries fail due to weak local institutions or conflictive chiefs, the imposition of fishing rules is futile. Feasible government reaction seems to lie in
(re)building collective social capital, especially the leadership of a fisheries committees and formally linking the established local institutions to the central government structure.

6. References


LMMA networking for improved governance in small-scale fisheries in Madagascar

Brian Jones, Blue Ventures Conservation, Madagascar brian@blueventures.org
Shawn Peabody, Blue Ventures Conservation, Madagascar shawn@blueventures.org

Abstract
Small-scale fisheries are estimated to contribute 72% of Madagascar’s national catch. In coastal communities in the Velondriake locally-managed marine area (LMMA), southwest Madagascar, fishing accounts for 82% of household income and fish provides the sole protein source in 99% of household meals. Despite their importance, the Government of Madagascar lacks the financial and human resources to effectively manage these fisheries.

The first LMMA in Madagascar was set up in 2004 in response to declining catches. Since then fisher communities have created a total of 34 LMMAs, encompassing approximately 3,922 km² or 4.3% of Madagascar’s continental shelf. Management measures include spatio-temporal closures of discrete octopus and mangrove fishing grounds (3-7 months duration), permanent coral reef and mangrove no-take zones, locally-enforced bans on destructive fishing practices, and development of community-based aquaculture and ecotourism. Key to the rapid spread of the LMMA approach in Madagascar has been peer-to-peer learning between coastal communities and support organizations.

National networks of LMMAs in other Indo-Pacific countries such as Fiji and the Solomon Islands have proven effective in promoting the approach by encouraging collaboration between communities, private sector and governmental stakeholders, sharing best practices, and standardizing monitoring methodologies.

Here we document work towards the creation of a Madagascar LMMA network, aimed at facilitating the expansion of local management, and improving its overall effectiveness. Key steps include the first Madagascar LMMA forum held in June 2012, the drafting of a collaboration agreement between LMMA-support organizations, and a second national LMMA forum held in April 2014.

Background
Small-scale fisheries support the livelihoods of around 500 million people globally, 97% of whom are found in developing countries (FAO 2008, 2010). While exact measurements of the contribution of small-scale marine fisheries to global catches have proven difficult, recent estimates have placed their production at around 30 million tons annually, accounting for approximately 30% of total marine fisheries landings (FAO 2008...
In addition to supporting coastal economies, an estimated 90 - 95% of small scale fisheries captures is destined for domestic human consumption, underscoring their importance for food security (FAO 2008).

The FAO estimates that, as of 2011, 29% of assessed fish stocks were overfished, and a further 61% were fully fished (FAO 2014). Due to the fact that many small-scale fisheries are data deficient and remain unassessed, it is difficult to determine their current status. A recent study, however, has shown that, in general, small, unassessed stocks fare worse than assessed stocks, suggesting that overfishing is very likely to be a serious problem for small-scale fisheries as well (Costello et al. 2012). Such findings are consistent with remarks and observations made by small-scale fisher communities throughout much of the tropical coastal developing world, where unprecedented declines in catches are commonplace.

The importance of managing small-scale fisheries has been repeatedly recognized internationally, most recently at the Rio+20 Global Summit (United Nations 2012). An ecosystems-based approach to management has been suggested, as reflected in ambitious targets for protection of the coastal and near-shore marine environment, such as the Convention on Biological Diversity’s Aichi Target 11 for 2020, which aims for the effective protection of 10% of the near-shore environment. While encouraging progress has been made towards achieving Aichi Target 11 in terms of spatial coverage, the effectiveness of these MPAs remains at best variable (Spalding et al. 2013).

Challenges facing the management of small-scale fisheries include a lack of capacity on the part of governments to enact and enforce fisheries regulations – particularly in developing coastal states - as well as a dearth of reliable data on which to base management decision-making. Perhaps most critically, however, restricting access to fishing grounds as part of conservation efforts can pose severe challenges to highly resource-dependent coastal communities who lack viable livelihood alternatives to fishing.

**Community-based management in Madagascar**

The challenges of small-scale fisheries management are especially acute for the western Indian Ocean nation of Madagascar. The world’s fourth largest island, Madagascar is known for its unique terrestrial biodiversity, of which 70% of animal and 80% of plant species are endemic (Dewar 2013, WWF 2011). In addition to its unique terrestrial fauna and flora, Madagascar has a coastline of approximately 5,000 km, including some of the Indian Ocean’s largest coral reef systems.

If Madagascar is one of the world’s richest nations in terms of biodiversity, it is also one of it’s poorest economically, with 92% of the population living below $2 per day (Dewar 2013, World Bank 2013). Economic growth has been further stunted by political upheaval, first in 2002 and then again in 2009. This has left the Government of Madagascar seriously underequipped to deal with the challenge of managing its extensive coastal zone and associated fisheries (Le Manach et al. 2012).
Madagascar’s southwest coast is characterized by an arid climate and is largely inhospitable to agriculture. Coastal Vezo fishing communities rely almost exclusively on the sea for their survival, with one recent study indicating 82% of household income and 99% of dietary protein come from marine fisheries (Barnes-Mauthe et al. 2013). The combination of broad-scale degradation to coral reefs, due in large part to El Nino related mass bleaching in 1998, rapid population growth and the proliferation of destructive fishing practices has lead to sustained decline in the region’s fisheries.

In 2004, community-based fisheries management in southwest Madagascar began to take hold in the isolated fishing village of Andavadoaka, located 150km north of the regional city of Toliara. Commercial seafood export companies had recently begun buying grey octopus (*Octopus cyanea*), providing an important source of cash income for coastal communities. Within a few years, however, fishers began to notice a decline in catches. With support from conservation NGOs Blue Ventures and the Wildlife Conservation Society (WCS), the fishing community of Andavadoaka created an experimental closure of a 200 hectare reef flat used primarily for octopus gleaning. The seven-month closure period, from November 2004 to May 2005, constituted approximately 20% of the village’s octopus fishing grounds, and was deemed a success upon reopening, with fishers observing dramatic increases in octopus size in the reopened fishing ground. Word spread quickly, and soon surrounding villages were requesting support in setting up their own octopus closure areas (Harris 2007).

Within two years, 25 villages from the surrounding area had come together to form the Velondriake (meaning “to live with the sea”) locally-managed marine area (LMMA), an area of coast and ocean of approximately 650 km$^2$ managed collaboratively by the local villages. In addition to coordinating octopus closures, the communities of the Velondriake LMMA enacted bans on destructive fishing practices and established a network of permanent marine no-take zones. These management measures were formalized through traditional local laws, known as a *dina*, which can be ratified by regional courts and granted the weight of national law (Andriamalala and Gardner 2010).

Beginning in 2007, Madagascar’s Ministry of Fisheries, with funding from the African Development Bank, began an ambitious five-year project called the “Project to Support Fishing Communities” (*Projet d’Appui aux Communautés des Pêcheurs*). A core objective of this project was replication of the octopus closure model developed by the Velondriake LMMA along the greater southwest coast. Central to this replication effort was the facilitation of peer-to-peer learning between fishers via community exchange visits to the villages of Velondriake. The approach proved successful, and soon fishing villages along a 250km stretch of coast were implementing temporary octopus fishery closures. Subsequent analysis of octopus landings data has shown that these short-term closures provide real benefits to fishing communities, resulting in sustained increases in octopus fishing yield (Benbow et al. 2014). This model has now been replicated over 190 times throughout Madagascar.
**Expansion beyond the southwest coast**
Recognizing the effectiveness of peer-to-peer learning through fisher exchanges at spreading community-based fisheries management, Blue Ventures began to reach out to other partner NGOs and fishing communities throughout Madagascar and the greater western Indian Ocean region to organize similar exchange visits.

To date, a total of 16 exchange visits have been hosted by the Velondriake LMMA, including visitors from Belo-sur-Mer (western Madagascar), Ambodivahibe (north Madagascar) and the island of Rodrigues (Republic of Mauritius). In most instances, support organizations were already active within the partner community and planning to engage with fishers on small-scale fisheries management. These exchange trips provided the impetus that kick-started management efforts within these new communities. Participants frequently cited what they learned from the trips during community consultations, and the exchange visits proved highly effective in building community support for fisheries management measures (personal communication with NGO practitioners and personal observation).

Community based fisheries management through the LMMA model has also taken hold in areas in Madagascar which have not participated in exchange trips to the southwest coast. Most notably, a network of no-take zones has been created by fishing communities in Antongil Bay, northeast Madagascar, with support from WCS. In these communities, experimental temporary closures of coral reef sites, aimed at increasing local fish populations, have evolved into permanent closures, as fishing communities have seen the increase of biomass within the reserve areas and spillover to surrounding fishing sites (personal communication with community members and WCS staff). These communities have also partnered successfully with regional authorities to eliminate the use of beach seine nets, a destructive fishing gear whose ongoing use continues to threaten marine management efforts along Madagascar’s southwest coast, despite local *dina* banning their use.

To date, a total of 34 LMMAs has been established in Madagascar, covering approximately 6.9% of Madagascar’s continental shelf (Rocliffe 2014). A majority of these LMMAs have been based around short-term closures, like those for octopus in southwest Madagascar, proving the usefulness of the model as a catalyst for engaging communities in broader fisheries management.

**The Birth of a Network**
Similar rapid expansion of community management efforts took place in the Pacific in the 1990s (LMMA Network 2004). In 2000, practitioners created a learning network, with the aim of establishing a common strategy and evaluation process to improve collective learning and adaptive management in LMMAs (*ibid.*). In addition to standardizing approach and evaluation methods, the Pacific LMMA network has proved useful in bringing together community representatives to share their experiences and lessons learned (LMMA Network 2008), as well as promoting the approach further afield.
In Madagascar, informal quarterly meetings between NGOs working in marine conservation began in the capital city of Antananarivo in 2011. These meetings served as an opportunity to exchange important information, coordinate activities and fundraising efforts, and discuss areas where collaboration was needed to raise national attention of local marine management challenges. Though not referred to as such, these round-table meetings were essentially the precursor to a more formal LMMA network, and provided a medium for planning Madagascar’s subsequent national LMMA forums, as well as formulating a memorandum of understanding between partner organizations.

A first national LMMA forum was hosted by the village of Andavadoaka in 2012, with 55 representatives from 18 LMMA communities and partner organizations from throughout Madagascar coming together to share experiences and best practices, and further explore the potential utility of a formalized network. From this meeting, participants chose the name MIHARI (Mitantana ny HArena an-dRanomasina avy eny Ifotony or “local marine resource management”) for the network, and agreed that the network would aim to facilitate peer-to-peer learning and information exchange, raise the profile and promote the expansion of LMMAs in Madagascar, and serve as a platform for concerted lobbying efforts for traditional fishers’ interests (Mayol 2013).

A second national LMMA forum was organized by Conservation International in April, 2014, in Diego-Suarez, north Madagascar, and was attended by 81 community representatives from more than 20 LMMA communities. Representatives shared updates on their respective LMMAs’ progress, and participated in focused discussions around themes of marine reserves and dina enforcement; financial and technical autonomy; alternative livelihood activities and policy needs for supporting LMMAs. A Malagasy specialist on the use of dina was present for this forum, and contributed considerably to discussions on how to improve enforcement.

Currently, the MIHARI LMMA network in Madagascar remains informal, however short term funding has been secured to formalize the network, with a full-time coordinator appointed in August 2014. A Declaration of Collaboration has been agreed upon by all prospective members, and states the aims of the network as (i) creating links between LMMA communities and leaders as well as support organizations; (ii) enhancing LMMA management capacity through information exchange; (iii) improving visibility of local marine resource management; (iv) providing a platform for liaising with government on LMMA-related issues, and; (v) creating a coordinated voice for LMMA actors at the regional and national levels.

Lessons Learned and Next Steps
The experience from Madagascar has shown that fisheries management models that provide clear economic benefits to resource dependent fishing communities within short timeframes can be an effective catalyst for broader community-based fisheries management. The MIHARI network has also demonstrated the huge value of peer-to-peer learning, highlighting exchange trips and face-to-face community networking as an effective way of driving replication on a significant scale to reinforce this peer-to-peer
learning. Additionally, this approach can help to create a sense of community, with fishing communities gaining a sense of being part of a broader movement as opposed to working in isolation.

The nascent MIHARI network has taken a considered approach in its establishment, allowing buy-in to be built up among potential members without requiring any significant financial commitment. While Blue Ventures leads much of the networking activity, hosting of national forums is rotated through supporting NGOs.

Next steps for the MIHARI network include a formative workshop, where network objectives will be finalized, standardization of monitoring and evaluation methodologies, and development of government engagement and financial sustainability strategies.

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Regional Session 4.4: Europe

Fisher’s knowledge, power and regulations in Baltic Sea region: Mobile fisheries and shifting livelihoods in Kihnu Island, Estonia

Joonas Plaan, Memorial University of Newfoundland, PhD Candidate, Canada, jp4136@mun.ca

Abstract

This paper examines the ways in which national and international policies regulating trade, labor, and the environment have influenced the lives of fishers and their families in
Kihnu Island, Estonia. As populations of many fish species in the Baltic Sea have declined, international policies regulating the use of the environment and marine resources have restricted access to natural resources in such a way that fishing communities have needed to supplement fishing incomes with tourism and seasonal migration. In this context, Kihnu women have demonstrated astute political and organisational skill in obtaining designation for Kihnu cultural space as part of UNESCO’s list of Intangible Cultural Heritage, seeking to enhance the tourism potential of the region. Furthermore, men, who traditionally made up the majority of fishers, have skilfully turned EU legislation to their advantage and used their knowledge of fishing Baltic herring in Finnish waters to continue to practice their livelihoods. Despite the fluidity of their social and economic system, the Kihnu community has managed to maintain its particular identity and traditional involvement in fishing. The paper has three aims. Firstly, it demonstrates how community histories are interwoven with global and regional histories. Secondly, it explains international and local policies and their effects on the lives of the Kihnu community. Finally, it shows how different regulations have influenced the development of small-scale fisheries in Baltic Sea region.

Introduction

This paper examines anthropologically the ways policies regulating trade, labor, and the environment have influenced the lives of fishers and their families in Kihnu Island, Estonia. Kihnu is a small island off the western coast of Estonia. Kihnu Island, and the neighbouring Manija Island is inhabited approximately by 700 people, who comprise Kihnu community, listed by UNESCO as Intangible Cultural Heritage. The community has lived through history lifestyle which is strongly linked with the surrounding seascape. As populations of many fish species in the Baltic Sea have declined, international policies regulating the use of the environment and marine resources have restricted access to natural resources in such a way that fishing communities have needed to supplement fishing incomes with tourism and seasonal migration. The paper first gives a brief overview of the method used for the research. It will then give a short overview of the local history and practices used in Kihnu. Next the work will demonstrate how women have enhanced the tourism potential of the region. Finally, the essay addresses Kihnu men, who have skilfully turned EU legislation to their advantage and used their knowledge of fishing Baltic herring to continue to practice their livelihoods in Finnish waters.

Methods

The paper will include data gathered from two longer fieldworks and several short visits to Kihnu Island, Estonia and a fieldwork among Kihnu fishermen working in Bothnia Gulf, Finland. The research includes data from two longer fieldworks, from interviews, conversations and observations made on several short visits to Kihnu from spring 2011 to summer 2013. Moreover, in the spring 2014 fieldwork was done in Bothnia Gulf on a trawler Amazon. It includes two-week period of participant observation and semi-
structured interviews with crew members on the ship and their family members at Kihnu Island.
Although I was primarily interested in fishermen and their traditional environmental knowledge and how it has and is been influenced by scientifically produced knowledge and vice versa, my conversations with fishermen and their family members revealed also changes in their fishing practices and labor.

Analysis and results

“We have always fished” was a sentence I kept hearing in different forms from the Kihnu people, when I asked them to explain Kihnu culture: “It is a cornerstone of our culture. Without fishing there would be no Kihnu culture” (Enn, fishermen 2013). Fishing in Kihnu is considered to be a traditional activity that needs to be protected and supported: “Fishing, together with seal hunting, are traditional practices. It is our culture… Without support from the state these practices and the knowledge that they carry will be lost.” (Mare, fishermen wife 2012)
In this chapter I will show how Kihnu culture, as Mare and many others community members tended to articulate themselves, and local and international regulations have helped Kihnu men to continue with traditional fishing activities, while women supplement the income with tourism.
The Kihnu community has a long history on the island, which links them closely to the seascape and surrounding natural resources. The Kihnu community has always been more connected to the sea than to the land. The sea surrounding the island has distanced it from the state power but also connected it to rest of the world. The sea has been a place where the local practices encounter the state and regulations, other communities and their practices thereby affecting and transforming the fishing practices. Most importantly, the sea has been the route that connected Kihnu to the rest of the world. While the women stayed on the island and worked the land, the men were active seafarers (Rüütel 2013: 32). The marine resources and knowledge about the sea have connected the community to rest of the world, saved the islanders from repressors, and always played a major role in Kihnu’s economy (Kalits 2006; Rüütel 2013). Kihnu men as seafarers imported and probably also exported their knowledge about the ecology and fishing techniques. Kalits describes how many aspects of seal hunting and fishing, including equipment, were imported from Finland, where Kihnu fishermen used to seafare for trade (2006: 102-103). In the early 20th century the sea and its resources were the means by which the men encountered their neighbours – the sea provided them income and the cultural influences were carried back across the sea.
During Soviet Era, thanks to cold war, those connections were temporarily lost while at the same time fishing intensified. Kihnu community turned from small-scale fisheries into industrial fishing. From that time Baltic herring and European sprat have stayed the main catch. Fishing becomes a main activity in the island and 90% of the income came from fishing (Kalits 1997: 78).
By the beginning of the 1970s, Baltic Sea fish population was in decline and the Soviet Union was forced to reduce their quotas. In 1975, the Soviet Union ratified the Gdansk Convention (1973) and issued a new Fishery Law. The Kihnu fishery management was
moved away from the island and the Kihnu fishers, as a small unit, lost their importance and influence in the making of decisions about fisheries (Kalits 1997: 26-27). Since 1975, the regulations have become more internationalised and fishery management has started shift away from local fishers to external institutions.

With the collapse of the Soviet Union, the island’s economic system also collapsed and this had a devastating effect on the social life in Kihnu. The inhabitants started looking back to traditional subsistence hunting techniques. This happened throughout the former Soviet Union: the vessels from the Soviet times were too expensive to run, but nobody remembered how to hunt traditionally (Nuttall 2005: 84). The locals had to start rebuilding their life in a new open and more connected capitalist world, which left many islanders unemployed and forced them to adapt with new system and regulations.

In 2004 Estonia was acceded to the European Union, and in 2008, the Kihnu community was included on the UNESCO List of Masterpieces of Oral and Intangible Heritage of Humanity. It listed the cultural aspects that need protection and the islanders started received financial support to promote and protect their culture. The area under protection is identified as the Kihnu Cultural Space:

“An insular place with distinct nature defined by the surrounding seascape, and the livelihood activities of the local community that in the course of history has imminently adjusted to and depended on the natural environment” (KCSF 2001: 9).

As we saw in the above, the Kihnu community has evolved through the centuries with constant interactions with the natural environment on the island and its seascape.

Furthermore, on the island, the islanders have lived in a certain isolation compared to the mainlanders. The power of the state has not always extended to the island and the Kihnu people were often privileged in that regard. At the same time, the sea that isolates the island has also connected the community to the rest of the world.

Tourism is one way how Kihnu community connect the island with rest of the world today. In the end of 1990s Kihnu women started to use traditional culture to come out from the economical crisis and hold the community together. They formed two local institutions - Kihnu Cultural Space Foundation (KCSF) and Institute of Kihnu Culture, and started to promote the local culture, which had kept its uniqueness thanks to its insular characteristics. Maie, a cultural activist, states that in times of crisis women have been the ones who start to rebuild local life in Kihnu. Women have always been on the island, usually spending long periods by themselves. Most of the celebrations, songs and dances that the candidature file to UNESCO lists are practiced by women (KCSF 2001). These traditions have evolved through centuries of living and working on the island.

Today those practices are used to supplement men activities on the sea. Men, on the other hand, have created their culture by working and spending most of their time at sea. Compared to women practices, which are supported, men practices are regulated and depend on ecological situation of Baltic Sea and political environment surrounding it. Thus, men have had to be innovative in order to adapt ever changing climate of Baltic Sea fisheries.

After Estonia regained its independence, the state kept internationalising the fishery regulations. This also meant that the regulations were modified and changed very often.
Today the fisheries management observes international regulations that originate outside Estonia. After the accession to EU in 2004, administration of fisheries is regulated by Common Fisheries Policy (CFP), a policy that applies to all states in the European Union. It covers four tightly connected fields: usage and protection of fish stocks, structure and market organisation policy and fisheries foreign policy. Correspondingly to this policy, the Estonian fisheries strategy is to preserve the diversity of the fisheries sector and in most cases Estonia adopt the CFP regulations concerning fisheries (Estonian Ministry of Agriculture 2007).

The CFP was created in the 1970s when the United Nations Convention on the Law of the Sea was prepared. Under this Convention the states established fishing or economic zones extending to a distance of 200 nautical miles from their coast. This applied to the EU Member States of that time, which also agreed that, subject to certain conditions, the fishing vessels of the Member States were allowed to enter and fish in each others’ zones. In 1983 and 1994 and, most recently, in the context of the enlargement of the EU in 2004, decisions were made on the so-called relative stability, which also sets the foundation for the allocation of fishing quotas between the Member States. Relative stability and free access to the EU zone constitute one of the basic elements of the resource policy under the CFP. Thus, thanks to all those events, the fishing regulations in Baltic Sea states have became more similar and fishing area has expanded to other member states.

In times when fish population is declining and Kihnu men find it hard to get enough quotas to catch enough fish to feed their families, many of them migrate with other Estonian fishermen to Finnish waters in spring. In 2013 almost half of the Baltic herring trawlers in Bothnia Gulf, Finland were owned by Estonian fishermen, accompanied with Estonian crew members (Figure 1.). Thus, CFP has allowed Kihnu men to continue with their traditional involvement in fishing by moving their activities into Finland.

This movement has occurred because of several reasons. First, CFP allows fishermen in every member state allocate and purchase the fishing quotas from neighbour member state. Second, Finnish fisherman happily sold their quotas and vessels to Estonians, who were more willing to work for the low income that Baltic herring and European sprat catch provided. Last but not least, when Finns sold their catch for animal feed, then Estonians used their post-soviet connections to sell their fish to other post-soviet countries. Mainly to Ukraine, Belorussia, and Russia, where Baltic herring and sprat is a

Figure 1. The ownership of Baltic herring trawlers in Finnish waters (Nylander 2013)
loved dish. This allowed Estonian fishermen to add more value to their catch. Nevertheless, with recent events in Ukraine, there are yet many unpredicted matters at the moment. Russia has set an embargo for EU member states to export their fish products to Russia. In the same time Ukraine is in economical difficulties, which has lowered the demand for Baltic Sea fish. As the two main markets have dropped out, the representatives of fishermen are already predicting that there will be too much fish in the market next spring. Despite the fact that fishers, fishery officials and merchandisers are looking for new markets, it is clear that large amount of fish in the market will drop the price. Thus, it is yet unclear how many fishing fleets from Estonia will be catching Baltic herring in Finnish waters in the coming spring.

Conclusion

Anthropological research with Kihnu community has shown how a small community has moved from small-scale fisheries into industrial fisheries under communist regime and back to small-scale fisheries in capitalistic world by adapting with new international policies and supplementing their income by enhancing the tourism potential on the island. Kihnu women have managed to get their culture listed in UNESCO’ List of Masterpieces of Oral and Intangible Heritage of Humanity, which has given them great potential to develop tourism on the island. Supplementing fishing incomes is needed among fisheries, where “managing the commons” of the open sea results in restricting access to natural resources (McCay and Acheson 1987). Men, on the other hand, have learned to adapt with EU policies and supplement their catch by migrating between Finnish and local waters. Thanks to those movements Kihnu community has managed to maintain its particular identity and traditional involvement in fishing. Kihnu Island, nearby islets and seascape still comprises a space were the Kihnu people feel at home.

References


“As Long as there are Glaciers there will be Fish?” Investigating the social impacts of ITQs on Greenland’s small-scale Coastal Halibut Fishery

Alyne Delaney (Aalborg University)
Rikke Becker Jacobsen (Greenland Institute of Natural Resources, Climate Research Centre; Aalborg U.)

In 2012 an individual transferable quota (ITQ) system was introduced into the Greenlandic coastal halibut fishery to replace an open Olympic system newly introduced in 2006. The vast majority of halibut fishers in Greenland are small-scale, dinghy fishermen. Fishing is extremely important for its role in the local, mixed economy, providing the cash needed for materials needed for work (hunting and fishing equipment such as bullets, nets, snowmobiles, etc.) and daily living (e.g., housing, transport, television, food). Fishing also supports the important local cultural practice of meeting social obligations and reciprocity such as through kødgaver (gifting of meat), a practice which remains both culturally and economically important in the smaller settlements.

Yet Greenland’s Home Rule government introduced the ITQ system in 2012 with administrative and political arguments that restructuring was needed in order to not only make the fishery a profitable one, but also to end political pressure for raising the quota at the end of each season. It was felt that raising the quota each year when it used up is biologically unsustainable.

In 2011, a social impact assessment was undertaken to assess potential social impacts to one community in the face of the introduction of ITQs. This paper compares the pre- and post-ITQ period, examining what has changed for coastal halibut fishermen two years after the introduction of ITQs. The authors also ask whether, and if so, for whom, the change in the resource rights could be considered successful.

The times they are a-changin´: the radical and successful transformation of the Galician (NW Spain) artisanal shellfisheries

Gonzalo Macho (Universidade de Vigo / University of South Carolina)
Sebastián Villasante (Universidade de Santiago de Compostela / Stanford University)
Inés Naya (Universidade de Coruña)
Juan Freire (Teamlabs, Impact Hub)
Emilio Abella (Cofradía de Vilanova de Arousa)
José Manuel Parada (O Canto da Balea, S. Coop.)
Shellfisheries in Galicia (NW Spain) have undergone profound changes in the last 25 years, from a history of underdevelopment and overexploitation, towards a new more resilient and sustainable marine social-ecological system. A particular group, the S-fisheries (small-scale, spatially-structured and targeting sedentary stocks), have developed in Galicia a unique management model. In this study we have identified and analyzed the factors involved in the transformation of the Galician S-fisheries in several areas: (i) governance and institutional framework, (ii) management plans, (iii) access rights, (iv) fishers’ organizations and the role of women, (v) technical-scientific support, (vi) surveillance and enforcement, and (vii) seafood markets. Before the 90s, S-fisheries were weakly regulated, even more poorly enforced, and had no management plans for the few species harvested that were sold in local seafood markets. In the last three decades Galician S-fisheries underwent profound transformations that involved a co-management system and territorial rights that allowed the development of professional fishers’ organizations in a collective decision-making process. Radical shifts in regulations, enforcement, fishers’ professionalization, monitoring and technical support seem to be the key agents of change responsible for the good health of most of the S-fisheries, which has ultimately lead to high economic revenues and social benefits for coastal communities. We analyze these positive changes, but also point to several weaknesses of the system, some of them chronic problems and other emergent, that need to be addressed (e.g. cases of overexploitation and serial depletion, weak governance and management systems of the fishers’ organizations, scale mismatches, …).

Assessing the sustainability of small-scale fisheries

Sophia Kochalski, University of Liverpool, UK, sophiako@liverpool.ac.uk
Bryony Caswell, University of Liverpool, UK, bac@liverpool.ac.uk
Chris Frid, University of Liverpool, UK, cljfrid@liverpool.ac.uk

Abstract

Small-scale fisheries make a substantial contribution to food and employment in many coastal areas. Their occurrence in, often, vulnerable coastal waters means that sustainability is a key factor for management decisions. International agreements and national legislation demand sustainable small-scale fisheries management that strives to achieve a balance between socioeconomic benefits and environmental protection. The
development of pragmatic management strategies has to date been hindered by the fear that approaching one sustainability target will lead to the deterioration of the other targets.

We provide an assessment framework based on the state, adaptability and vulnerability of the fishery components (SAV-assessment). A Bayesian network model has been developed that considers the ecological, economic and social criteria to assess the sustainability of small-scale fisheries and their impacts on the wider environment and society. The framework is an adaptable tool that uses inshore fisheries assessment to inform management and stakeholders. The new framework is applicable to a wide range of small-scale fisheries and permits a semi-quantitative comparison between them. It can be transformed into a holistic fisheries eco-certificate to promote sustainable small-scale fisheries.

**Two perspectives on fishery sustainability**

Increasing food demand, environmental degradation, overfishing, climate change, and diminishing coastal communities represent major threats for the sustainability of fisheries resources. There are two main perspectives on sustainability within the paradigm of resource utilization: (i) prescriptively, sustainability as a set of predefined goals and (ii) descriptively, sustainability as the ability to satisfy goals or as the ability to continue (Hansen 1996). The set of goals includes the supply of food and other ecosystem services as well as the access to and distribution of goods. These goals can also be the avoidance of a particular state such as the minimization of harm to the environment. Sustainability as the ability to satisfy goals can be expressed as thresholds, resilience or adaptive capacity of a system that remains productive despite facing disturbances (Allison and Ellis 2001).

The two perspectives on sustainability are either used strictly in isolation or their use becomes unconsciously mixed. Ideally, an assessment of sustainability that employs both perspectives with a systematic method is preferred because it can remove the arbitrary selection of sustainability indicators, better identify success factors for sustainable fisheries and recommend a greater diversity of management actions.

**The SAV-assessment**

In this study, we adopt a systems approach to fisheries (Charles 2001) and extend the ‘sustainable livelihoods approach’ (Scoones 1998; Allison and Ellis 2001) to include more elements of the fishery system. The approach is tailored towards small-scale fisheries by emphasising the diversity and seasonality of their livelihood strategies (e.g. diversification, intensification, migration). Based on their assets (natural, physical, human, financial and social capital), the individuals within the community use diverse and seasonal income-earning activities (Allison and Ellis 2001). The fishers’ capacity to make a living and to cope with threats depends on the institutional and social context suggesting that the removal of constraints and the support of livelihood strategies will have greater success than technical fixes (Allison and Ellis 2001).
In our conceptual model for the assessment framework, the ecosystem, the fish stocks, the fishery and the wider public have a certain status at the beginning that represents the desired sustainability objectives (Fig 1). Status corresponds to the perspective of sustainability as a set of predefined goals. The criteria that have a value *per se* fall into the status category. These statuses could be the biodiversity of the ecosystem, the biomass of the fish stocks, the income of the fishers or the equity within the community.

The ecosystem, the fish stocks, the fishery and the wider public are exposed to external threats. Threats are those criteria that negatively affect the elements of the fishery system. They are evaluated in accordance with their scale, frequency and intensity. The elements of the fishery system are related to each other through a hierarchy of dependencies in which the fish stocks depend on the ecosystem, the fishery on the fish stocks, and the wider public on the fishery (Fig 1). A change in the respective underlying element is also representing a threat. The exposure to threats and the dependency on the other elements form the vulnerability context in the assessment framework.

Dependency criteria apply only to the fish stocks, fishery and wider public element and they link the elements unidirectional. Impacts of an element higher in the chain on an element lower in the chain are captured by the ‘threat’ criteria. The most important example for this case is fishing pressure. Links that potentially leap other elements in the chain such as the wider public depending directly on ecosystem services are currently not captured but could be included easily if deemed necessary for a particular fishery.

The ecosystem and the other elements react to the threats dependent on their available assets. Assets are criteria that enhance the capability of the elements of the fishery system to deal with threats. In Figure 1, the assets are represented as pentagons congruent to the display of assets in the sustainable livelihoods approach, but fewer assets can be taken into account for each element. The success of the reactions to the threats depends on the context which is composed of the management, values, interests, relationships and information (Deutsch 1979) in the fishery system. The assets and the context determine the adaptability of the ecosystem, the fish stocks, the fishery and the wider public.

Status, adaptability and vulnerability form the three dimension of the SAV-assessment. In accordance with the two perspectives on sustainability mentioned above, ‘status’ reflects the prescriptive goals of the assessment framework and ‘adaptability’ and ‘vulnerability’ the descriptive processes. The goals are achieved dependent on the processes in the fishery system. It typically leads to conflict if the desired outcome could not be achieved and it is often easier to observe the resulting conflict than the underlying system dynamics.
Status, adaptability and vulnerability are assessed for all four elements of the fishery system and contribute in equal parts to the sustainability score of the ecosystem, the fish stocks, the fishery and the wider public (Fig 2). The fishery sustainability is assessed for each element separately but the sustainability scores can be aggregated by discipline so that the scores of the ecosystem and the fish stocks form a combined environmental score and the scores of the fishery and the wider public form a combined socioeconomic sustainability score. Alternatively, the fish stocks and the fishery could contribute to a micro-level sustainability score and the ecosystem and the wider public to a macro-level score. An overall sustainability score can be formed either from the aggregated scores (Fig 2) or directly from the original sustainability scores of the ecosystem, the fish stocks, the fishery and the wider public.

The issue of target conflicts between the different elements of the SAV-assessment has been solved by a combination of thresholds and a weighing mechanism. A minimum threshold is calculated cumulatively for the three categories (status, adaptability and vulnerability; Fig 2) and ensures that a fishery with one element (ecosystem, fish stocks, fishery, or wider public) in a poor state can only be considered to be sustainable if the same element is adaptable and not exposed to serious risks so that recovery of the element seems likely in a timely manner. The importance of the ecosystem, fish stocks, fishery, and the wider public for the overall sustainability of the fishery system is determined.
using Multi-Criteria Decision Analyses (MCDAs) tools. However, the decision on and ranking of sustainability goals is inherently subjective and normative (Hilborn 2007) and the MCDAs can only provide a structured and transparent process of weighing.

The potential for eco-certification
Small scale fisheries the World over are under pressure by competition for large vessels, loss of traditional markets, disruption to social structures, and economic disadvantages due to small size. Eco-certification could provide opportunities to increase markets share and attract investment and so secure social and economic sustainability based on ecological sustainable exploitation of resources. But existing fisheries eco-certification schemes are first and foremost prescriptive and do not consider local sustainability initiatives or socio-economic dynamics. The approach outlined here provides a unique tool that can be applied cost effectively to assess sustainability holistically and hence underpin eco-certification of small-scale inshore fisheries.

References
Fishing in the margin? Small scale fisheries in the Netherlands.

Birgit de Vos (LEI-WUR)
Marloes Kraan (IMARES-WUR)
Floor Quirijns (IMARES-WUR)
Wim Zaalmink (LEI-WUR)

Small scale fisheries in the Netherlands have hardly received any research attention and have been quite invisible in the fisheries policy arena. Lately, attention for the small scale fisheries sector is growing. This growing attention is due to processes like the development of local area economics, sustainable seafood certification, nature protection and the presence of the Knowledge Group Small Scale Fisheries, which forms a part of the Dutch project Fisheries Knowledge Groups. Now that the focus on small scale fisheries has grown, it becomes apparent that a clear definition of what small scale fisheries means in the Dutch context is missing.

In this paper we suggest a definition of the Dutch marine and inland small-scale fishing sector, and describe the process by which we came to it. The role of the Dutch knowledge group for small scale fisheries will be described as this resulted in increased attention for small scale fisheries. We followed a structured approach to come to characteristics of what is ‘the small-scale fishing sector’ in the Netherlands, and the distinction with respect to the more large scale fisheries. In doing so we worked together with the fishing sector, scientists and policy makers. The definition will be useful in discussions on management of the Dutch small scale fisheries.

Is there a crisis in the English small scale fisheries?

Rebecca Korda, School of Geography, Politics and Sociology, Newcastle University, Newcastle-on-Tyne, England, NE1 7RU r.korda@newcastle.ac.uk
Professor Tim Gray, School of Geography, Politics and Sociology, Newcastle University, Newcastle-on-Tyne, England, NE1 7RU
Professor Selina Stead, School of Marine Science and Technology, Newcastle University, Newcastle-on-Tyne, England, NE1 7RU
Abstract
Small scale fisheries (SSF) deliver economic, ecological, and social benefits (Reed et al, 2013), however, globally, they are threatened (Crilly and Esteban, 2013). Over the last 40 years, UK fisher numbers have declined by 58% and vessels by 26% (MMO, 2013). Since 49% of UK vessels are English and 82% are small-scale (MMO, 2013), the English SSF have been disproportionately affected. Explanations for this include the introduction of monthly quota allocation to SSF in 2005; and a systematic representational bias of industrial fisheries interests in policy decisions. This paper investigates how English stakeholders conceptualise challenges facing SSF and assess options to overcome them. In so doing, it contributes to the debate over vulnerability sources to be addressed if SSF are to deliver their full benefits. Convenience sampling enabled the researcher to collect data, which was complemented by a desk-based literature review. The theoretical basis is cast in terms of the contrast between Schumacher’s ‘small is beautiful’ argument and the globalisation argument that big is inevitable. It is concluded that there is nothing inevitable about big.

Introduction
Many fishers operate as SSF, exhibiting similar characteristics (Jentoft and Eide, 2011). Although developed countries fishers may utilise more sophisticated fishing gears, they still qualify if employ relatively limited capital commitment and labour intensive working practices. The EU’s Common Fisheries Policy (CFP), describes SSF as under-12m in length, not using towed gear. However, the English define them as vessels measuring 10m or under. Subsequently, when the English SSF are discussed, it means this ‘under-10m’ fleet.

SSF contributions are increasingly being recognized, going beyond a means of personal income, also contributing to poverty alleviation (FAO, 2005) through employment opportunities and food security, and delivering social and cultural benefits (Urquhart and Acott, 2013). Despite this, SSF appear to remain marginalised, with top-down policies favouring large-scale industrial fisheries interests over SSF’s (Gray et al, 2011).

The English fleet is split into under-10m vessels and over-ten metre vessels, which mainly belong to producer organisations (PO’s act primarily as quota managers). The UK fishing industry has undergone recent changes, with full-time fishers declining by 58% and vessels by 26% (MMO, 2013). Since 49% of these vessels are English, and 82% belonging to English SSF (MMO, 2013), the English SSF has been disproportionately adversely affected. Furthermore, many of their vessels whilst remaining registered are inactive. Numerous drivers have been attributed to this decline, one such being the quota system.

With the formation of the European Union, the CFP was devised to protect common fishing resources and introduced catch quotas. In England, these were initially only attached to over-10m vessels. They were requested to record catches in a logbook, and instructed that a three-year record period would underpin their future track record, and thus future fishing opportunities. This was not offered to SSF, at this time only subject to technical conservation measures, despite repeatedly requesting a similar opportunity.
Instead, their catch was recorded unsystematically by fisheries inspectors, and track record based on ad-hoc catch estimates. This became problematic when they were brought into the quota system in 2005. Allocations were drawn from a shared pool respectfully based on track records. Consequently, quota distribution was skewed in favour of the larger sector, and only (on average) 4% of England’s annual quota assigned to the SSF.

Defra’s preferred solution was decommissioning; reducing fleets to match its quota. The first rounds were for over-10ms only, who initially surrendering their licence, vessel and quota allowance, but sequential rounds removed the vessel and associated licence only for payment. Owners often then used the money to commission 9.99m vessels, altered the English SSF’s previously artisanal structure, leasing out remaining over-10m quota and fishing from SSF quota pool. In 2008, a SSF only scheme requested the surrender of vessels, licences and quota. This was deemed to be underfunded, inefficient and unfair. Owners were also able to use the money to invest in better vessels, contributing to technical creep.

There are, however, signs of resilience as SSF collaborate locally, regionally, nationally and internationally. This is supported by the EU’s recent resolution distinguishing SSF’s, and outlining their benefits. This paper examines how English stakeholders conceptualise challenges facing SSF and assesses how to overcome vulnerability.

**Methodology**

Convenience sampling enabled data to be collected from fourteen main players in England’s South-East during a 2014 conference as a pilot study for a wider PhD study. These included; interviewee 1 and 2 (environmental non-governmental organisations), 3 (non-departmental public body), 4 and 5, (academics), 6 and 7 (national management organisation), 8 and 9, (regional management organisation), 10 (local SSF organisation), 11 (SSF), 12 (national SSF organisation), 13 (local market owner) and 14 (local council officer). Interviews were predominantly face-to-face, though some were interviewed over the phone. Interviews were complemented by a desk-based literature review and data analysed thematically. The theoretical framework is cast in terms of the contrast between Schumacher’s argument that small is beautiful, and the globalisation argument that big is inevitable.

**Discussion**

SSFs are attracting interest globally. In England, many projects seek to study and support SSF. However, are these addressing the central issue, namely ensuring SSF longevity, or are initiatives merely papering over the cracks? With this in mind, two questions are discussed:

- Is the English SSF vulnerable to challenges, or has it sufficient resilience?
- If it is resilient, is support best provided through national broad-brush or customised community focused initiatives?

Vulnerability
English SSF were perceived to be subject to vulnerabilities, rendering them unable to compete with an industrialised fleet, set amongst a globalised market. However, are they characterised more by this vulnerability to globalised economic forces than by its resilience?

Ecological

A limited geographical range and adverse impacts of poor weather, increasingly aggravated by climate change, was noted. They were also deemed to suffer from the consequences of over-10m vessels overfishing, and coastal squeeze; ‘you are looking at rigorous restriction where people can fish’ (8).

Economic

Market access restricted fleet resilience, as SSF are ‘not being able to land sufficient quantities of fish to attract important national and international buyers’, due to ‘globalisation of local markets’ (4). This was linked to issues with ‘the values add that they receive in their position in the supply chain. The majority of that does not go to the fishers.’ The challenge of financial instability and ‘maintaining an economic future’ (4) was discussed, linked to ‘the unpredictability of the industry’ (4). This unpredictability means fishers are unable/unwilling to financially support formal representation. Perceived limited operational opportunities renders SSF are unable to compete with the over-10m fleet. This is compounded since SSF do ‘not have the capital to acquire the technology that the deep sea fleet have’ (4).

Social

SSF are discriminated against by management, ‘they get prosecuted for one box over, and have to pay an exorbitant fine, when there are people smuggling black fish through holes in Scotland worth billions’ (1) and again by the industrial fleet. SSF were also deemed to be experiencing an aging population and human capital challenge with an ‘absence of critical mass in new entrants’ (5).

Governance

Participants perceived both top-down vulnerabilities (lack of recognition by the authorities, a top-down political decision-making structure with little space for SSF involvement) and bottom-up vulnerabilities (weak unity equating weak political capital; ‘Fishermen are like cats, they have all got their own opinion, trying to get one voice out of them is quite difficult’ (10) and a politically apathetic fleet). This leads to a polarised state whereby fishers mistrust the system and management mistrust the fleet.

Resilience

By contrast, participants noted SSF’s ability to overcome vulnerabilities, turning weaknesses into strengths and standing up against a globalised market. They are adaptable and able to punch above their weight, their vulnerability giving them more power against larger industry dominance and an authoritarian government structure. However, managerial groups and politicians must provide support.

Ecological
The SSF was perceived to be generally more environmentally friendly than the larger fleet: ‘we haven’t been responsible for overfishing and... generally operate more sustainably’ (12). Market opportunities are linked to this; ‘their big opportunity is sustainability, sustainable fisheries’ (6), an opportunity they can and are capitalising upon. SSF are also turning their limited fishing range into strength, as it creates an unparalleled knowledge of the area’s ecosystem. This sets them in good stead to ‘work with managers to develop sustainable fisheries, because they have a limited range, and actually they have more of a vested interest in maintaining that... I think that’s quite hard... with larger boats... you lose that idea of ownership or relationship with the stock’ (8).

Economic
SSF sector can be highly operationally competitive as they ‘have very low cost overheads’ (7). They are resourceful, reactive and able to diversify quickly, ‘because the boats are small and generally simple, if a new opportunity arrives, they can react quickly, to take advantage of the opportunity’ (13). Furthermore, their small size and sustainability provides a desirable niche market, which has ‘increasing consumer interest in locally sourced food’ (4), because ‘it sits within the ethos of consumers who want to cut food miles and who are aware of the value of local produce and who want their stuff fresh and want to learn to cook and eat in season. This gives them an excellent marketing story’ (14). These marketing opportunities are supported by recent marketing policies, arising from the 2014 CFP ruling, which allow SSF to ‘directly create links with retail and market themselves as the sustainable fleet’ (1).

Social
Both the public and politicians support SSF; ‘the main parties are developing their manifests... you will see small-scale fishing, tick, tick, tick, because it’s a vote winner, it appeals to the public’ (12). Collaborative working arrangements are also increasing, both with each other but also with other sectors. This creates a stronger community voice, which helps ‘increase their sort of position, in terms of influence both in terms of local and regional and even national planning’ (5). Managerial organisations are becoming less confrontational; ‘what I think is changing a bit were relationships with MMO and other governmental organisations, that were seen as very oppositional and very confrontational’ (5). They are also developing their social networks through Nutfa and LIFE, ‘we weren’t around during the last CFP on an official basis and to be honest, we were a non-entity, and we were nothing... and there was no voice, be that within the UK or Europe... we’ve come on just massively between then and now’ (12). There is also a growing self-confidence and self-awareness amongst the fleet, with an increasing ‘recognition that it can have a political influence, locally’ and an ‘improving political awareness’ (5). Local areas have begun to organise themselves and strengthen their grass root resilience. Hastings SSF is an example, whereby fishers have established a cooperative to maximise on their economic returns, and partnership working at a local, regional, national, and European level. However, SSF’s ability to build resilience against challenges is deeply dependent upon its specific cultural strengths. For example, whilst the quota issue adversely affects the
majority of England’s SSF, only a select few engaged and united communities, created a unique partnership with Greenpeace to participate in the judicial review to secure more quotas. Others are less able or willing to react, requiring a different support method. Finally, social resilience is evident as there is a general belief that SSF fish because of their deep love of the work and that their identity is intertwined with it.

Governmental
A small fleet can be more politically powerful than a globalised industrial one and wield unlikely leverage. Coastal constituencies often support SSF, which makes their survival electorally significant for political parties. NUTFA’s alliance with Greenpeace was also a shrewd political move, raising SSF’s political profile nationally and internationally. Their collaboration with Seafish has illustrated they are capable of undertaking self-management functions, for example, to demonstrate they can fish within MPAs, avoiding sensitive habitats using Vessel Monitoring Systems. English fleets have joined with local stakeholders to establish six EU funded Fishermen’s Local Action Groups. Academic interest is also increasing i.e. the Geography of Inshore Fishing project, examining sustainability issues and methods to add value to the supply chain.

Respondents identified elements of SSF vulnerability and resilience, virtually in equal measure, providing support to each of the opposed notions that big is inevitable and small has longevity. One possible explanation for these apparent self-contradictions is that different respondents interpret differently because their respective backgrounds provide contrasting perspectives. However, not only proponents of vulnerability were pro-industrialist, nor proponents of resilience, pro-SSF. A more convincing explanation is that there is no contradiction and respondents view SSF as simultaneously vulnerable and resilient. They perceived the vulnerabilities, but the SSFs capacity to overcome them to achieve sustained longevity. SSFs appear to be already helping themselves, with collaborations appearing regionally, nationally and internationally.

However, resilience is not guaranteed and requires the correct form of support, so good governance is essential, an appetite for both top-down and bottom-up levels to participate crucial, and financial and political support vital. With that in mind, we examine our second question; to determine how that support can best be provided; is support best provided homogeneously in the form of a common solution? Or heterogeneously by bespoke solutions tailored specifically to the local circumstances of each SSF fleet?

Does commonality exist between the English SSF, or are fleets different

Homogeneity

Many elements of homogeneity exist in the English SSF sector. The quota challenge was collectively perceived to be universally detrimental; ‘if you don’t have access to the resource, then everything else falls by the wayside’ (12). The weather was deemed by some to collectively affect SSFs, as was a lack of political pro-activism and unity; ‘the under-10m fleet is in danger of sleepwalking into oblivion’ (12).

The SSF was perceived to be a largely disenfranchised and marginalised fleet, ‘entirely reliant on a few community stars’ (5), with a general lack of recognition from managerial bodies, ‘I don’t believe that... Defra have any great appetite to help the industry’ (3), resulting in ineffective consultation mechanisms, ‘if they want to attend meetings, they have to take a day away from fishing, which economically quite often doesn’t make sense’
(2). Policies were perceived to be universally driven by large-scale organisations, ‘anything over-10m always had a voice and... every time you have a decision about what should be done with the industry, all PO executives were invited to participate... where they spoke for their own good’ (12). The challenge of political capital appeared to be universally compounded by inadequate consultation mechanisms with SSF to allow them to influence policy. They were collectively felt to be ‘faced with a disproportionate amount of regulation with very little assistance from outside’ (3).

Heterogeneity

Despite the homogeneous nature of the commonalities outlined, challenges have different impacts on different communities, due to differing ecological, economic, and social contexts, ‘one issue could affect one sector and be totally irrelevant to another’ (3). Issues become distinctive the closer one gets to a locality, ‘we have different methods of fishing here, to what the next two or three ports do along the coast and... different needs and aspirations’ (11). Communities have different modes of resilience rooted in their specific contexts, so whilst there may be common problems, appropriate solutions may differ.

Quota is universally imposed on all English SSFs, but its impact is highly area-specific, ‘the specific problems facing the under-10m fleet are mainly concentrated in the south-east’ (FishUpdate, 2013). Weathers impacts are heterogeneous with ‘an uneven impact upon different communities’ (1). Lastly, although lack of political appears universal, it is actually heterogeneous, with different communities reacting differently. Heterogeneity is illustrated in the way that some SSFs are helping themselves, and establishing different collaborations. This shows that fortune favours those who help themselves, and, more importantly, that big is not inevitable and small can indeed succeed.

In my view, the heterogeneities outweigh the homogeneities, and communities need to be treated differently. Therefore, to allow small to really become beautiful, the required governmental response is not to look for common solutions, but recognise that communities, unique circumstances must be understood and tailor community-based solutions to meet specific ecological, economic and social contexts.

Conclusion

The English SSF faces formidable problems. Whilst, a spirit of gloom and recrimination exists, so does many opportunities for self-rescue and widespread confidence in SSF resilience. There is no universal panacea and solutions are likely to be site-specific rather than homogenous. Therefore big is not inevitable, and there is a resurgence of support for SSF with increasing recognition of their unique value. In order for this to be successful, management must engage in a meaningful manner and support the fleet so it can continue to yield its benefits in a sustainable balanced fashion.

References


FishUpdate, 26 March, 2013.


Small scale fisheries and fish marketing: governance challenges and synergies with tourism in Tenerife (Spain)

José J. Pascual-Fernández, Raquel De la Cruz-Modino, Agustín Santana-Talavera, Carmelo Dorta-Morales, Salvador Melgar-Ramírez
Institute of Social and Political Sciences, Universidad de La Laguna (Tenerife, Spain)

The marketing of small-scale fisheries (SSF) is a key factor for securing the long-term viability of these fisheries. Even though SSF catches have a superior quality and freshness, this does not ensure a better price or higher demand. World markets, aquaculture development and new patterns of consumer behavior make traditional selling strategies in many countries non-viable. Frequently, the new value-chain is poorly understood by fishers, who do not have optimal strategies to cope with these new challenges.

In this context, we have recently carried out detailed research into SSF fish labeling in Spain, as this is a strategy that is increasingly being used for the promotion of the sector. What we have discovered is that many of these labeling initiatives are external to the fisheries sector, and only those integrated into well-functioning SSF organizations have
been successful. As a consequence, only a few of these initiatives have had any real impact, making innovation in this area not only a marketing challenge but also a governance one.

Learning from these experiences, we are trying to implement new fish marketing strategies in Tenerife that exploits the strength of Islatuna, a producers’ organization established by local fishermen and local Cofradías (Spanish SSF organizations). These involve a labeling initiative and the development of alliances with other players in the value-chain, specifically luxury hotels, restaurants and supermarkets, with a focus on the consumer. Even though Tenerife has a significant tourism industry, until now this sector has turned its back on SSF. We are trying to overcome these missed connections and create synergies with the tourism sector wherever possible, in order to develop new market niches for SSF catches.

**Approaches and methods to understand the importance of small-scale fisheries (SSF) through the lens of cultural ecosystem services (CES)**

Julie Urquhart & Tim Acott
University of Greenwich

j.urquhart@gre.ac.uk; t.g.acott@gre.ac.uk

For many fisheries-dependent communities, fishing is important not just for economic livelihoods, but plays an important social and cultural role in terms of local identity, heritage, wellbeing and social cohesion. Capturing the multiple ways that SSF are important is a complex task. To date much emphasis has been on biological and economic dimensions while neglecting socio-cultural factors. Drawing on existing work carried out as part of a European Interreg 4a 2 Seas project called GIFS (Geography of Inshore Fishing and Sustainability) this paper reports on approaches that can be used to understand the importance of SSF through the lens of CES. A mixed method approach is advocated that draws on quantitative questionnaires alongside more deliberative techniques like photo-elicitation, interviews and focus groups. In addition to work already completed a research agenda will be discussed that includes the importance of developing new methods that can be applied in diverse geographical settings. An important element of the emerging work is that using multiple methods to identify CES can simultaneously result in the creation of services as people become aware of multiple relational associations connecting nature and society.

**Governability of the small-scale octopus fishery in Portugal**

Cristina Pita, Centre for Environmental and Marine Studies, Universidade de Aveiro, Portugal; c.pita@ua.pt; Institute of Biological and Environmental Sciences, University of Aberdeen, UK; c.pita@abdn.ac.uk

João Pereira, Divisão de Modelação e Gestão de Recursos da Pesca, Instituto Português do Mar e da Atmosfera, Portugal; jpereira@ipma.pt
Abstract
Cephalopod fisheries in Europe, and the fishery for the common octopus (*Octopus vulgaris*) in particular, are of substantial social and economic importance in southern waters. This is the case in Portugal where small-scale fishing is increasingly economically dependent on octopus. Octopus is excluded from quota regulations under the Common Fisheries Policy, and Portugal is responsible for managing its own octopus fishery. Although formal participation of fishers in the decision-making process for octopus management is a recent development, the management measures implemented over the years were the result of pressure from fishers worried about decreasing economic returns. The Portuguese small-scale octopus fishery is faced by many challenges, such as increased conflicts between fishers due to excessive gear use, lack of trust and cooperation between fishers, lack of efficient organization of fishers with consequent little influence in the decision-making process, and lack of understanding about the resource (i.e. octopus) by fishers and of the fishery by managers. This paper describes the natural and socio-economic systems in which the octopus small-scale fishery operates, the governing system for the octopus fishery, governing interactions, key challenges to the system-to-be-governed and discusses the implication for the governability of small-scale octopus fishing in Portugal.

Keywords: Cephalopods; Governability; *Octopus vulgaris*; Portugal.

1. Introduction

The common octopus (*O. vulgaris*) is the most important commercially harvested octopus species worldwide. In Europe, the common octopus is fished in both the northeast Atlantic and the Mediterranean Sea, mainly by the small-scale fishing fleets using hand-jigs, pots, traps, fyke-nets, trammel nets and bottom trawls (Pierce et al. 2010).

In Portugal, the common octopus has long been an important target species for artisanal fishers and, nowadays, it is an increasingly important fishery resource particularly in terms of commercial value. Small-scale fishing fleets targeting octopus in Portugal, as well as in other southern European countries, are of considerable socio-economic importance, with the octopus fishery playing a major role in providing employment in coastal fishing communities and increasingly being one of the main sources of revenue for small-scale fishers.

The present document will briefly describe the natural and socio-economic systems in which the common octopus small-scale fishery operates, the governing system for the fishery, governing interactions and key challenges to the system-to-be-governed.

2. The Portuguese octopus fishery

*The natural system-to-be-governed*
The common octopus is a short-lived (estimated longevity of one to two years in the eastern Atlantic) terminal breeder, with non-overlapping generations, high sensitivity to environmental influence (such as upwelling intensity and the input of fresh water from rivers and rainfall) and a high inter-annual variability of abundance (Otero et al. 2008, Perales-Raya et al. 2014, Pierce et al. 2010).

The decrease in landings of finfish in Portugal, since the 1970s, has directed fisheries towards alternative resources. In the same period landings of the common octopus have increased. Since the 1970s, the octopus fishery has been one of the most important fisheries in the country, and the exploitation of the common octopus more than doubled (Figure 1).

The rise in landings of octopus over time, in response to increasing effort, is possibly a consequence of an increased environmental carrying capacity for this species as it apparently “benefits” from the current high level of fishing pressure and discards of other species. The abundance of the resource is however characterised by large fluctuations (averaging around 40% a year) and it is not clear that landings can keep at current levels in the long-term.

**Figure 1.** Time series of total landings and octopus landings in Portugal, in quantity. Source: INE (Portuguese official statistics bureau) and predecessor official statistics bureaus.

*The socio-economic system-to-be-governed*
Portugal is a traditional fishing nation and fishing has long been an economically important activity for many coastal communities. Portuguese fisheries are characterized by being multi-gear, multi-species small-scale fisheries. The small-scale sector accounts for most vessels registered and fishers employed (Table 1).

Table 1. Socio-economic indicators for the Portuguese fishery (data for 2013).

<table>
<thead>
<tr>
<th>Socio-economic indicators</th>
<th>Total fisheries</th>
<th>Small-scale fisheries (% of total)</th>
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<tbody>
<tr>
<td>Landings, quantity (thousand ton)</td>
<td>144.7</td>
<td>60.5 (42%)</td>
</tr>
<tr>
<td>Landings, value (million €)</td>
<td>253.2</td>
<td>167.1 (66%)</td>
</tr>
<tr>
<td>Fleet, number of boat</td>
<td>8,232</td>
<td>7,409 (90%)</td>
</tr>
<tr>
<td>Fleet, tonnage (GT)</td>
<td>99,917</td>
<td>12,241 (12%)</td>
</tr>
<tr>
<td>Fleet, power (kW)</td>
<td>366,279</td>
<td>147,443 (40%)</td>
</tr>
<tr>
<td>Number fishers</td>
<td>16,797</td>
<td>11,481 (68%)</td>
</tr>
<tr>
<td>National per capita fish consumption (kg/person/year)</td>
<td>61.6</td>
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Notes: a Data for 2007 (Data source: EC 2012); b Refers to small-scale static gear <12m vessels; c Fishers employed in the local and coastal multi-gear (polyvalent) fleet; Source: INE (2014).

The common octopus is one of the most important fishery resources in mainland Portugal in terms of value. In 2013, octopus landings generate 15% (€37.6 million) of the official first sale revenue of all Portuguese fisheries (INE, 2014). The common octopus is captured mainly by the small-scale artisanal fishery, employing pots and traps (around 90%) (Moreno et al. 2014).

The governing system

The common octopus fishery in the European Union (EU), like other EU cephalopod fisheries, is excluded from quota regulations under the Common Fisheries Policy (CFP) and the existing management arrangements have evolved under the tutelage of national and/or local governments.

In Portugal, octopus fishery management derives exclusively from governmental specific and general legislation, under the direct responsibility of the Directorate General for Marine Resources and Maritime Services and Safety (DGRM), which, in turn, belongs to the Ministry of Agriculture and Sea (MAM). Table 2 provides information about the management measures and legislation in place, institutions responsible for monitoring and enforcement, and monitoring systems employed.

Nowadays, the technical measures put in place generally derive from research advice provided by the national fisheries research institute (Portuguese Institute of the Sea and Atmosphere; IPMA), local governmental counterparts, higher education research institutions and through the transposition of European legislation. Since 2010 fishers have
also been called on, by the Secretary of State for Fisheries, to provide advice on octopus management.

Table 2. Summary of governance of octopus fishery in Portugal.

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<tr>
<th>Octopus fishery governance</th>
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<tr>
<td>Management measures in place</td>
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<tr>
<td>Management institutions</td>
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<tr>
<td>Fishery monitoring</td>
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<td>Control and law enforcement institutions</td>
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Compliance with rules and regulations is very limited, especially at times of economic difficulties. The effectiveness of the monitoring and control system at sea is very limited due mostly to lack of human resources to patrol large areas. This means that the number of traps deployed is in practice not under control. There is also very little control on land, reducing the efficacy of the minimum landing weight legislation.

Recently, several developments have been put in place aimed at the long-term sustainability and profitability of the octopus fishery. One of such measures is a campaign by DOCAPEsca S.A. (the state-owned company responsible for organising the first sale of fish and support fishing and fish ports) to promote the consumption of Portuguese octopus, develop new recipes and uses for octopus (e.g. ready to eat meals). Further measures are also being explored, such as an initiative to implement an adaptive management system for the octopus fishery in the Algarve. This initiative consists of a bottom-up co-management system based on the optimization of results. DGRM is also exploring the possibility of establishing exclusive area-based concessions for the exploitation of octopus, a form of Territorial Use Rights in Fisheries (TURF), a system already successfully implemented to achieve sustainable benthic resources management, including for octopus (see Gelcich et al. 2012). Although these initiatives are still at early stages of development and it is not yet possible to evaluate their performance, these types
of measures tend to be seen by fishers as a step in the right direction and have the potential to increase the profitability and economic viability of small-scale fisheries.

**Governing interactions**

In Portugal, small-scale fishers participate in management initiatives through a large number of small fishery associations. Management is carried out through a top-down system and formal participation by small-scale fishers in the decision-making process is scarce and quite recent. Nevertheless, measures put in place for the octopus fishery so far resulted from fishers’ demands.

The high dependence on octopus by the Portuguese artisanal fleet and the resulting socio-economic impact in years with low catches has been the main driver to increase the pressure on governmental bodies from fishers, leading to changes in legislation, and to the increased interest by the industry to participate in the decision-making process. This was the case in 1996, when representatives of artisanal fishers approached fishery management bodies with concerns about increasing effort, overexploitation and a potential future decrease in catches and requested protective measures for octopus (Pereira 1999), which resulted in the implementation of legislation setting a minimum landing weight. Fishers’ worries were taken into consideration but fishers were not formally involved in the decision-making process. A “bad” fishing year was again the driver for pressure from fishers for change in legislation in 2010. In this instance fisher associations were involved, in an *ad-hoc* expert-group convened by the Secretary of State for Fisheries, and provided advice which was added to the scientific advice that resulted in new legislation.

Recently, governmental fisheries bodies, research institutions and fisher associations are attempting greater and more effective involvement and participation of the industry in the management of the octopus fishery. However, a general lack of internal consensus amongst fisher associations means that they lack a single voice and still have little influence.

### 3. Key challenges for the governability of the octopus fishery

The Portuguese small-scale octopus fishery is faced by many challenges which need to be taken into account for successful management. These include inappropriate management of the resource, a lack of understanding about the resource (i.e. common octopus) by fishers and about the fishery by managers, landings of undersized octopus, illegal effort deployment, potential problems of economic viability of the fishery, lack of empowerment of small-scale fishers, increased conflicts between fishers due to excessive gear use, lack of trust and little cooperation between fishers and their associations and representatives, lack of efficient organization of fishers with consequent little influence in the decision-making process.
The biological features of the species (i.e., short lifespan, non-overlapping generations) and its sensitivity to environmental influences present particular problems, most obvious the inter-annual variability of abundance of octopus. Even if abundance variation is to some extent predictable, it requires fishers to be adaptable, for example to switch to other target species in years of low abundance. However, the dominating rhetoric demonstrates that the expectations of the fishing sector are that octopus will continue to provide increasing volumes of landings at a high price, and it appears that most coastal communities are content to specialize in octopus fisheries.

4. Concluding remarks

Significant challenges remain for octopus fishery management and there are many opportunities for improvement. There is an absence of management measures for most European cephalopod fisheries and the International Council for the Exploration of the Sea (ICES) recently held a workshop (in October 2013) on the need for cephalopod management (ICES 2013).

The octopus fishery was systematically ignored by management bodies in Portugal for a long time. However, this trend seems to be changing and there seems to be openness from management bodies for new management initiatives for small-scale fishing, with a strong focus on the octopus fishery, which proves an excellent opportunity for developing new management frameworks.

The future of the octopus fishery in Portugal depends on the successful implementation of management measures in cooperation with the fishing industry, to fight illegal fishing, instigating monitoring and assessment, improving control and enforcement of rules and regulations, as well as increasing the added-value of the catch.

Acknowledgements

CP wishes to thank “To Big To Ignore: Global Partnership for the Future of Small-Scale Fisheries” and the Social Sciences and Humanities Research Council of Canada for the financial support to attend the 2WSFC. CP also wishes to acknowledge the “Cátedra do Mar” UA-CGD grant “Sustainability of small-scale fisheries: Alternative approaches to fisheries management and governance”. GJP thanks Caixa Geral de Depósitos (Portugal) for financial support. Part of the information used in this document resulted from interviews carried out as part of the “Cátedra do Mar” project and the authors wish to thank the representatives from fishers associations who took part in the survey.

5. References


**Special session 4.5: Empowering small-scale fisheries to better contribute to food security and poverty eradication**

Organized by Food and Agriculture Organization of the United Nations

**Synopsis:**

During the last ten years, the contributions of small-scale fisheries to poverty alleviation and food security have been receiving increased attention at the international level.

These advances come as a result of the leadership and efforts shown by fishers, fish workers, their communities and their organizations as well as by the intense support provided by a diverse communities of civil society organizations, non-governmental organizations and dedicated professionals (both in the academia and the public sector), who recognize the undeniable positive impact of small-scale fisheries on the local and national food security and poverty eradication, as well as its strategic role in the sustainable management of aquatic resources. With some exceptions, these advances have yet to trickle down to the local level and the challenges faced by small-scale fishers continue to be numerous. Strong political commitment and increased awareness to improve governance of the sector and to foster development of fishers, fishworkers and
their communities, are still required – especially at national and regional levels. This can be reversed, however, by applying the principles and guidance developed and included in international instruments, fora and dialogues and, in particular by enhancing empowerment.

The concept of empowerment is not new. However it has only recently been mainstreamed into global dialogues on small-scale fisheries. As a concept, empowerment is a process through which people become strong enough to participate within, share in the control of and influence, events and institutions affecting their lives or a process, a mechanism by which people, organizations, and communities gain mastery over their affairs.

Fishers, researchers and other professionals in the sector have understood for some time that empowerment is a key aspect of fisheries governance. Until recently, this concept has been ignored in the international fisheries development agenda. The empowerment of fishers and their communities is a critical objective of the recently approved Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forestry in the Context of National Food Security as well as other processes both inside and outside the UN system. In short, the empowerment of fishers, fish workers and their communities is critical for the sustained development of small-scale fisheries and therefore, a crucial component of their ability to enhance food security and nutrition.

Additionally, there is a strong understanding that the strengthening of community-based and professional organizations in the small-scale fishers sector, both formal and informal, enhances the opportunities for small-scale fisheries stakeholders to exercise their right to organize, participate in the development and decision-making processes and influence the fisheries management outcomes. Strong organizations could also improve the participation of fishers and fishworkers in policy dialogues, as well as their access to markets, financial services and infrastructure.

With these advances, the question becomes more practical: what support may the international community provide to empower fishers, fish workers and their communities to become active and effective stewards of their fishery? Whether it’s empowerment through knowledge creation and dissemination, through strengthened organization and association, through effective participation or through improved opportunity, join us to

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learn what actions FAO and its partners are taking and discuss what we can do as a community of small-scale fisheries partners.

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<td>Susana Siar</td>
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<td>Empowerment through opportunity</td>
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<td>Audun Lem</td>
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THURSDAY SEPTEMBER 25th, 2014

Special session 5.1: Living with environmental change: An analysis of social-ecological adaptations in lagoon-based small-scale fishery systems across the world
Organized by Prateep Kumar Nayak and Sarah Coulthard

Session Synopsis

Prateep Kumar Nayak, School for Environment, Enterprise and Development, University of Waterloo, Canada
Email: pnayak@uwaterloo.ca

Sarah Coulthard, Department of Social Sciences, Northumbria University, UK.
Coastal lagoons play a critical role in providing fishery-based livelihood opportunities for a vast majority of people, and offer essential habitat for a range of coastal, marine and lagoon species. They are also host to a good part of our planet’s biodiversity. Consequently, lagoon social-ecological systems continue to be major attractions from the point of both conservation and human wellbeing. Many lagoon systems of the world are undergoing a peculiar ‘identity’ crisis, partly because of an ongoing process of change coupled with inadequate policy frameworks and weak governance structures. Lagoons provide extremely dynamic and changeable environmental arenas in which people and ecosystems are continually adapting in a highly inter-dependent system. It is the transitional nature of lagoons, and their growing fragility, which stimulate urgency for a coordinated response to their management and governance. Lagoon ecosystems, and the stresses they face, have a degree of commonality, and comparability, across different regional contexts. However, the fragmented nature of lagoon research is reflective of a much wider neglect in lagoon science and policy.

We propose here a panel on coastal lagoons that takes a broader social-ecological-institutional-economic analysis of lagoon functioning, using case studies from across the globe. Our motivation lies in better comparative learning about change and adaptation in lagoon-based small-scale fishery systems, and the implications for their governance. The panel results from an ongoing book project that aims to bring together research on the ways in which people live with and respond to the dynamic and often unpredictable environments of lagoon social-ecological systems. We aim to contribute to the understanding of how lagoon-based small-scale fishery societies respond to, and deal with, environmental change and its implications for the theory and practice of governance and sustainability.

**Keywords:** Coastal lagoons, environmental change, small-scale fishery, adaptation, governance, livelihoods, wellbeing, sustainability.

**Session Plan:**

The session will comprise of five oral presentations, two panelists and facilitated discussion involving the audience. Each presenter will speak for 10 minutes followed by 2 minutes of clarification questions from audience (12 x 5 = 60 minutes). Two panelists will comment for 5 minutes on at least two key issues / learnings / recommendations emerging from the presentations (5 x 2 = 10 minutes). Time will be dedicated to a moderated discussion between the audience, presenters and panelists (20 minutes).

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Lagoon systems as learning platforms for living with dynamic social and environmental change

Prateep Kumar Nayak, University of Waterloo, Canada
Sarah Coulthard, Northumbria University, UK

**Abstract:** This presentation will focus on a collection of research from lagoons around the world, which relates to ways in which people live with dynamic and often unpredictable environments of lagoon systems. By focusing on lagoons as an integrated social-ecological system it aims to contribute to the understanding of how societies respond to, and deal with, environmental change and its implications for sustainability. Using various chapters from an ongoing book project the presentation analyses some of the striking similarities that can be found across different lagoon systems, highlights potential themes for comparative learning, and advocates for a more coordinated international approach to lagoon governance and research.

An approach for understanding social-ecological change and transformation through community perceptions of system identity in the Cau Hai lagoon, Vietnam

Mark Andrachuk and Derek Armitage, Environmental Change and Governance Group, University of Waterloo, Canada

**Abstract:** In this paper we develop an empirical approach to diagnose long-term social-ecological system (SES) change that draws on resource users’ perceptions of system identity and thresholds (Cumming et al. 2005, Robinson and Berkes 2010). We apply this approach in the Cau Hai lagoon, a coastal area dominated by small-scale fisheries in central Vietnam. Nine focus groups with more than 70 fishers were used to gather information about key SES elements (e.g., water salinity, specific species, gear types), interactions between elements, drivers of change, and sources of continuity in order to gain insights into changes and possible thresholds between distinct SES identities. Our
findings suggest that a social-ecological transformation is underway but that perceptions of the characteristics and drivers of SES change vary widely within and between groups of fishers. This period of upheaval and transformation in the Cau Hai lagoon has already presented the impetus for establishing co-management arrangements (structured around territory-based fishers’ associations). However, there are indications that policies and programs aimed at alleviating persistent problems in the lagoon (e.g., overfishing, aquaculture disease) disregard the ways that fishers perceive and experience social-ecological change. We argue that positive outcomes of co-management efforts in the lagoon will require greater attention to the normative and contested understandings of the ongoing social-ecological transformation. Outcomes of this research also reaffirm that scholars needs to be careful about the labels that we place on types of changes taking place in SES.

**Role of local knowledge in adaptation to environmental change: A case of Chilika Lagoon small-scale fishery, India**

Ashok Selvaraj, School of Environment, Enterprise and Development, University of Waterloo, Canada

**Abstract:** Coastal lagoons and their associated ecosystems are highly productive areas that offer a range of ecosystem services for communities dependent on it. Historically, these lagoons have been managed locally by controlling its water exchange with the sea, depth and topography to produce salinity that favours particular habitats and species, and allows for food production contributing to human wellbeing. In the recent decades, however, many coastal lagoon ecosystems around the world have suffered serious decline due to anthropogenic stressors and processes of environmental change with adverse effect such as habitat and species loss along with large-scale occupational displacement and livelihood crisis in the fisher communities. Using Chilika lagoon on the east coast of India near the Bay of Bengal as a case, I discuss a range of drivers that have caused changes in the social-ecological system of the lagoon and the various adaptation options fishers considered when faced with such extreme environmental and social change, and examine what worked and what did not. Data comes from a three month-long qualitative and participatory research in Chilika. I focus particularly on the role of local fishers’ knowledge in crafting various adaptation strategies and consider a number of policy implications resulting from this analysis. The outcomes of the research will help in better adaptation strategies by the fisher communities in Chilika and offer lessons for lagoon policy.

4. **Environmental change and property rights: The case of Nurri and Jubhoo lagoons in the Indus delta, Pakistan**
Sajida Awan, School of Environment, Enterprise and Development, University of Waterloo, Canada

Abstract: Coastal ecosystems play a vital role in supporting human well-being and conservation of unique biological resources. They are crucial for the protection of the coastline from extreme events like floods and providing diverse livelihood opportunities to people. Lagoons are an important part of the coastal ecosystem. However, coastal lagoons face a range of threats from multiple drivers at local, regional and global scales, and they are both anthropogenic and climatic in nature. A variety of concepts and methods have been used to analyse change in coastal lagoon social-ecological systems. Analysis of property rights to examine change in the social-ecological aspects of small-scale fisheries has been a prominent approach used in various parts of the world involving diverse ecosystems. However, the use of this approach has been somewhat limited in the case of coastal lagoons. In this paper, I examine changes in the property rights regime of the small-scale fishery systems in Nurr and Jubbho lagoons, Pakistan to better understand its two-way linkages with processes of environmental change. Both these lagoons are Ramsar sites, located in the Indus delta of Pakistan, which is the world’s fifth largest delta system. The entire region, which includes a number of important wetlands, has undergone serious degradation over the past at least three decades. This paper aims to examine the history of changes in property rights regime in the two lagoons, the management of which has changed from being a commons to a privately owned property and its impact on the adaptation process within the socio-ecological system of coastal lagoons.

Building Adaptive Capacity to Weather Variability: The Case of small-Scale Fisheries in Two Southern Brazilian Lagoons

Daniela C. Kalikoski, Universidade Federal de Rio Grande, Brazil
Tiago Almudi, Instituto de Pesquisa Ambiental da Amazônia, Brazil

Abstract: Fishing community’s vulnerabilities to weather variability is a major issue to the governance of fisheries resources, having direct effects on human security and livelihoods. In this paper we explore the dynamics of social-ecological systems in two coastal lagoons in southern Brazil: Patos and Peixe Lagoon. This paper aims at (1) identifying the key factors that increase and/or minimize the vulnerabilities of the fishing systems in these lagoons; (2) identifying which are the most vulnerable fishing systems and analysing why they are so; and (3) investigating the mechanisms developed by fishing communities to cope with their vulnerabilities. Results show that fishing communities with a higher degree of self-organization were able to create ways to minimize their vulnerabilities in adverse climatic conditions. Only a few communities have developed adaptive mechanisms to cope with the influence of climate over resources abundance and availability. Little external institutional support for small-scale fishing communities, erosion of their traditional resource use systems (e.g. informal rules and
agreements among fishers), and decrease in fishing stocks in the recent decades are factors leading to a gradual increase in the vulnerability of fishing livelihoods in these lagoons. The uncertainties associated to the weather have shown to be quite relevant to increasing vulnerability and influencing directly the degree of resources conservation and exploitation. The lack of public policies to deal with the impact of weather variability and climate changes on the livelihoods of fishing communities and the presence of still weak institutions that include fishers in resource governance represents major threats to fisher social security.

**Regular Session 5.2: Rights and access**

**Updated status of “turn rights” traditional fishing systems in Arraial do Dabo and Itaipu (RJ Brazil).**

Loto L., Universidade Federal Fluminense, Niterói, Rio de Janeiro, Brasil. lotoluciana@yahoo.com.ar

Lobão R. J., Universidade Federal Fluminense, Niterói, Rio de Janeiro, Brasil. ronaldolobao@yahoo.com.br

Cinti A. Centro Nacional Patagónico (CENPAT-CONICET), Puerto Madryn, Chubut, Argentina. acinti@email.arizona.edu

Monteiro Neto C. Universidade Federal Fluminense, Niterói, Rio de Janeiro, Brasil. cmneto@id.uff.br

**Abstract:**

In two beaches on the coast of Rio de Janeiro State (Brazil): Itaipu, in Niterói, and Praia Grande, in Arraial do Cabo, the traditional rule systems called “Corrida de Canoa” or “Direito à Vez” ("turn rights systems") exists since the 1950s to regulate access and use in beach seining artisanal fisheries. These traditional systems regulated competition among different fishing teams or “companhas” for catching fish schools approaching the beach in these locations. In Itaipu and Arraial do Cabo, the existence of these systems set the basis for the recent creation of marine protected areas (MPAs) in the form of “Reservas Extrativistas Marinhas”, a type of MPA that grants exclusive access to marine resources inside the reserve to traditional populations inhabiting these areas. In this communication we describe these traditional systems, their justifications, and local representations. We also describe their trajectory as a function of observed changes in the way that fish schools approach these coasts, which, to some extent, are representative of the construction of local fishermen identity. Additionally, we present some indicators and evidences suggesting that the substitution of local rules by official management documents, such as management plans or “Planos de Manejo”, affects not only the forms of local organization, but also the ways in which these groups interact with the market, with politics, with the institutions regulating fishing and environmental activities, and especially with the social systems in which they are embedded.
Key words: Small-scale or artisanal fisheries, traditional rule systems, Reservas Extrativistas Marinhas, Brazil.

Introduction:
The beaches of Itaipu (Niterói) and Praia Grande (Arraial do Cabo) present similar characteristics, both showing a semicircular coastline in E-W direction and under the influence of the seasonal upwelling of the South Atlantic Central Water (SACW) occurring with greater intensity in the Cabo Frio region (Monteiro Neto et al. 2008). This upwelling system is modulated by the high frequency and amplitude of NE winds, the presence of meanders and vortices of the Brasil current, and local topography. Upwelling events are common during spring and summer. Water circulation enhances primary production which is controlled by rapid predation by zooplankton. Small pelagic fishes regulate plankton growth and are consumed by larger piscivores, resulting in large fishing stocks at a regional scale (Coelho-Souza et al. 2012).

These features favored the emergence in both localities during the XIX century of artisanal fisheries characterized by fishermen that wait for the fish to arrive (“esperam o peixe chegar”): these are fisheries of pelagic migrant fish approaching the coastline in schools.
Since long ago, these fisheries were organized in large wooden dugout canoes, made out of one piece tree trunk, using beach seine nets (called “de cerco”), and a team of 6-7 fishers that encircle the schools at sea, whereas other fishermen and members of the communities stay at the beach helping to haul the net to the shore.

Another common characteristic of the two localities is the implementation of Reservas Extrativistas Marinhas (Resex-Mar), a type of MPA that grants exclusive access to use the marine resources inside the reserve to traditional populations inhabiting these areas. The creation of both reserves responded to the existing traditional use of resources through beach seining fisheries, which defined the identity of local artisanal fishermen.

Methods:
We carried out a literature review of artisanal fisheries in both regions, including studies from diverse disciplines like biology and anthropology. Most of the studies in the literature search corresponded to investigations led by members of the research team at Universidade Federal Fluminense, Niterói, RJ, coauthoring this publication. Between 2011 and 2013, we followed the fishing and social activities in both communities through participant observation and semi-structured interviews, to document changes in traditional rules and fishing practices.

Results:
1) Description of the beach seine fishery: the unit of production is called “companha” (fishing team) (Fig 1) and its components are as follows (see also Loto 2012):

The “Vigia” (watchman): his role is to wait on top of the cliffs (beach rocky points), observing the appearance of schools close to shore and recognize their dimensions. The
vigia is the person that guides how the net should be used, considering several variables like prevailing currents and wind, the schools’ swimming direction and knowledge of each species behavior. He tells the companha how the net should be closed and hauled at the beach, but is not obliged to pull the net. Nowadays, most vigias use a radio to tell the companha that fish schools are approaching, but regardless of technology, vigias still use specific signs transmitted with a white rag, sending directions from the top of the cliff (Fig 1). The vigia appraises the dimension of the schools through customary categories, referring to a “magote” (less than 100 fishes), a “cardume” or school (between 100 and 500 fishes) or a “manta” (more than 500 fishes). In Itaipu, vigias do not observe on top of the cliff waiting for the fish to arrive from the east as in Praia Grande. Instead, they locate themselves at the beach level (oriented to the west) and send indications to the companha, located at the opposite side of the beach.

The “Mestre”: interprets the signs of vigias and tells the rowers how fast they should navigate. He also communicates the team when it is the right moment to throw the net. The mestre directs the canoe with the stern row, observing the currents and winds, and throws to the water the extreme of the net to the “cabeiro”, who grabs the net at the beach. Mestres also guide the rowers during landing and launching operations, and are responsible for the safety of the companha when surpassing the surf zone.

“Remeiros”: they are four, attentive to the signs and orders from the mestre. Maintain the desired direction of the canoe, rowing with different intensities and direction.

“Chumbereiro” and “Corticeiro”: they guide how to throw the net into the water, maintaining its position and tension depending on the canoe speed. They also interpret the signs of vigias but follow the orders of mestres.

“Cabeiro”: stays at the beach waiting for the rope (extreme of the net) to be thrown at him by the mestre. When about to receive the rope, he is positioned between the beach and the canoe. Once he grabs the net, he swims towards the beach and starts the process of pulling the net together with other people, always following mestre’s directions.

Figure 1:

By Luciana Loto 2012
The success of these fisheries still depends on fishers’ traditional knowledge to allow the elaboration of predictions regarding the appearance of large fish schools, which importance generally depends on their market value. Anthropological studies have documented and systematized this knowledge in diagrams called “rodas” (see Britto 1999; Kant de Lima and Pereira, 1997). Rodas represent a combination of biological and environmental factors upon which the social production of fishing is organized.

These traditional fisheries are based on a hierarchical structure, the one of the companha, having technical knowledge as its hierarchical principle (Dumont 1997) and a unique communicational language among its members, having also naturalistic knowledge to allow predictions on the arrival of fish to the shore.

ii) Description of the “turn rights” system (“Corrida de Canoa” and “Direito à Vez”):
The beach seining artisanal fishery of both localities is the one that reflects the most fishers’ naturalistic knowledge and prediction systems. It is the most emblematic fishery due to the complex knowledge implied in its practice and its relevance for the social organization of local fishermen. Fishermen give meaning to the spaces where they dwell and work through customary norms and practices for using the beach and common fishing areas, reinforcing the organization of its labor system. Such rules reflect internal relationships of their social organization, particularly regarding the distribution of access opportunities to the fishing areas. These rules are condensed in a system called “Corrida de Canoa” in Praia Grande, Arraial do Cabo, and “Direito à Vez”, in Itaipu.

Both rule systems express a set of procedures of successive and sequential appropriation of the beach space –sand and sea- by the companhas. They consist of rotational systems where access opportunities to strategic fishing areas are allocated in turns among participating members, establishing equal opportunities for resource appropriation for participating fishermen. Also, these traditional rule systems seek to avoid or resolve conflicts between beach seining fishers and other fishing groups (local or external to these communities), as well as internal conflicts between companhas using or attempting to use a common space and resources (Kant de Lima and Pereira 1997, Britto, 1999).

A fishery should operate in accordance with certain rules, created upon and considering local rights to control contradictions generated by an individualized exploitation of common pool and limited resources (Ostrom 1990). The sea is limited in that the target resource, that is, fish schools or those species predicted as most likely to occur at a certain moment, are seen as limited common property resources, to be appropriated by few fishermen at a given day, from a whole set of potential appropriators. According to Brazilian law, the fish is res nullius –property of no one while it swims at sea, only considered as one’s property when captured. In this sense, the Direito à Vez or Corrida de Canoa systems do not interfere directly on the juridical status of the fish but do affect the procedures to allow its transformation to private property of the fishermen.

iii) Recent transformations:
Recent studies detected a decrease in catches in the beach seine artisanal fisheries in both locations, as well as a decrease in the number of beach seining companhas and the frequency of fishing trips associated to these fisheries (Mibielli 2004, 2014; Tubino et al. 2007, Monteiro Neto et al. 2008, Loto 2012, Calandrino 2012, Carvalhido 2012). Consequently, significant transformations in the traditional rule systems for appropriating fishery resources can be observed.

Field work conducted in both communities, suggests diverse potential explanations for the observed reduction in fishery production and also in the form that fishermen resignify their production spaces and fishing practices. At a first glance, observations too restricted to the beach space do not allow identifying direct influences. In Arraial do Cabo and Itaipu, there were no significant changes in the condition of the sea, considering biotic and abiotic factors. It is common to both locations the fact that well formed fish schools are no longer observed in coastal areas as to justify the presence of the vigia guiding the fishing team. In Praia Grande (Arraial do Cabo), traditional wooden canoes are still used but in most cases through a different modality than before. The new technique, called “gancho” fishery, is derived from a fixed net fishery, supported by canoes. In Itaipu, canoes are still used for recovering the catch of fixed gill nets left in the water for long periods of time, capturing fish that swims in low numbers.

Apparently and somewhat paradoxically, the presence of schools (of “tainha” Mugil spp., for example) has been detected in unusual but close to shore locations, which suggests not its disappearance but modifications in the factors that attract or expel fish schools in or off shore. For Itaipu bay, three hypotheses were formulated to attempt explain the observed changes:

“Hypothesis 1: an increase in production of tainha by the fleets of States of south and southeast regions generated a decrease in local captures. [...]”

“Hypothesis 2: an increase in the amount of gill nets used did not allow the approximation of fish schools to the area of operation of the beach seine artisanal fishery. [...]”

“Hypothesis 3: the increase of organic discharge coming from the metropolitan region promoted the movement of schools off shore.” (Tubino et al. 2014).

None of these hypotheses has been corroborated through available statistical data or direct measurements. However, a loss of cognitive references by local fishermen to make possible the elaboration of detailed predictions has been observed, due to a higher dispersion of target resources and a change in the form of resource appropriation to a more individualistic form, evidenced in the quasi disappearance of the companhas.

In Praia Grande (Arraial do Cabo), in spite of the lack of statistical data to facilitate the elaboration of hypotheses as in the case of Itaipu, a reduction in the number of companhas and the almost disappearance of vigias in the seining artisanal fishery, suggests a similar interpretation, with emphasis on the second hypothesis (increase in the amount of gill nets).
This may be a consequence of the opening of road connections along the Restinga da Massambaba (a large beach) and environmental problems at the Araruama lagoon (the restinga separates the lagoon from the ocean) that generated high population densities at the southern end of Praia Grande and a significant increase in the use of gill nets along the shore. Although hypothesis two has not been directly verified in the portion of Praia Grande where the seining fishery operates, hypotheses two and three appear articulated at the southern end of Praia Grande, 5 kilometers apart.

Another distinction between the two localities has to do with the existing management regime applied for marine resources in the area, corresponding to the creation of Resex-MAR in the two beaches, in 1997 in Arpoador do Cabo and in 2013 in Itaipu. In spite of the differences in dates of creation of both Resex-MAR, both groups of fishers were subjected to the same homogenizing discourses. On the one hand, these new regimes superimposed a different identity to the usual local identity. In Arpoador do Cabo, the “cabista” - from the “Cabo”- fishermen gained the label of “traditional people or population”, and in Niterói, the Itaipu fishermen revalued their identity as “professional and traditional small-scale fishermen”.

On the other hand, the result of collectively constituting themselves as candidates to become effective recipients as grantees of exclusive access to renewable resources inside the reserve, has forced them to gradually substitute their naturalistic knowledge, a sophisticated and adaptive predictive system developed through generations, by a model of resource management founded on marine biology, oceanography and fishery statistics, as to get the “sustainable” label (Lobão 2010, Loto et al. 2014).

That change has depended necessarily on a shift in orientation in the way of living the space and the fishing practices of these traditional fishermen. The conception of local agreements involved in the “corrida de canoa” and “direito à vez” traditional systems, deeply rooted in past experiences, lived locally and adaptively interpreted (non linear), had the past and local spatial arrangements as its guiding temporal dimension. The new conception based on sustainable development and fishery statistics, has a future orientation, with foundations on linearity and detached from locality (Lobão 2010).

References:


"Forced eviction of artisanal fishermen in the South Coast of Jalisco: violation of collective rights and damages to the biocultural diversity"

Paulina Martínez González (Universidad de Guadalajara)
Antonio Corgos López-Prado (Universidad de Guadalajara)
Diverse studies distinguished the importance of artisanal fishing as an activity that generates jobs, strengthens the local markets, and represents a source of highly nutritional food for the local communities. Unfortunately, in the coast of Jalisco, Mexico, there are problems that affect this practice. For example, the lack of infrastructure and the absence of economic and social rights for the fishermen. In the last decades the tendency of using the neighboring land with the federal maritime zone to build tourist resorts has increased dramatically (33 of the 36 beaches in the state have been concessioned to private individuals). These concessioners (mainly real estate companies) forced the eviction of the fishermen from their traditional landing and catch handling sites and the impoverishment of the communities. Moreover, the preservation of the bio-cultural diversity is now threatened. In this investigation we analyzed the eviction processes in five cases and its consequences for the coastal communities: the number of fishermen involved and their relatives, strategies against eviction, life quality changes. Lastly, we discuss the damages to the bio-cultural diversity that were caused by the appropriation of land by real estate companies.

The role of policy change processes in the development of successful rights-based management: a comparative analysis of sea urchin fisheries in Mexico, the U.S., and Canada

Elizabeth Clark (Duke University)
Xavier Basurto (Duke University)

Rights-based management is increasingly promoted as an essential tool of fisheries reform, one that includes a range of potential rights of access, harvest, and participation in governance. The diversity and complexity of the world’s small-scale fisheries require a nuanced approach to policy-making, and while there is increasing focus on understanding which configurations of rights may be suited to particular biophysical and social contexts, less analytical attention has been given to the dynamic and political processes through which new rights regimes are selected and implemented. The variable social and ecological outcomes of recent rights-based management measures suggest that we need a better understanding of how the policy change process itself can influence the development of fishing rights that match local contexts and support sustainable small-scale fisheries.

The goal of this study is to explore the relationship between policy change processes and the development and outcomes of new rights of access, ownership, and co-management, through a comparative analysis of three sea urchin fisheries in Mexico, the U.S., and Canada. Focusing on the involvement of fishing communities, governments, and other stakeholders in policy change, we analyze the institutions through which these actors diagnose problems and identify potential solutions, develop aims and objectives for resource management, and determine new coastal rights regimes. By comparing three cases with contextual similarities and key differences in policy change processes, this
analysis reveals how such processes for changing fisheries policy can support or hinder the emergence of successful rights-based management approaches.

Navigating transformations in marine stewardship of small-scale fisheries in Latin America and the Caribbean

Sebastian Villasante, Elizabeth Selig, Kristin Kleisner, Freddy Arocha, Gonzalo Macho, Stefan Gelcich

Latin American and Caribbean (LAC) countries provide fish stocks of critical importance for millions of individuals and thousands of fishing communities. These fish stocks harvested by small-scale fisheries (SSF) come from some of the richest and most diverse ecosystems of the world. This emphasizes the need for ecosystem stewardship that can contribute to securing functioning and resilient marine social ecological systems. Ecosystem stewardship that enables a capacity to respond to rapid and unexpected dynamics is critical for sustainable improvements in human well-being in the region. In order to address this challenge, this chapter presents an innovative analysis, which investigates the governance transformation of these SSF by creating a typology of the key fisheries characteristics (e.g., single or multi species fisheries, stock and habitat degradation, densities of species), enabling conditions (e.g., strong leadership, fishers cooperation, community involvement), and design considerations that result in the success or failure of various management tools and practices. The management tools include input controls (e.g., limited entry programs, gear restrictions), output controls (e.g., TACs, quotas), and technical measures (e.g., marine protected areas, time-area closures, size limits). This analysis considers case studies from real fisheries derived from a literature review in combination with questionnaires and interviews on the effect of institutional failures in fisheries management directed towards a group of experts from different countries. The aim in using these approaches is to be able to identify and evaluate the role of institutional changes that have been noted as critical for the success or failure of SSF in LAC countries. The results presented in this chapter will provide a relevant illustration of the ways in which adaptation of the social processes of coastal communities as well as institutional and organizational changes resulting from adaptive fisheries governance can help to improve the ecosystem stewardship of SSF in Latin America. This contribution will also provide scientific support for fishers, policy makers and national governments in the region. The goal is to demonstrate how a more sustainable and resilient management strategy can be achieved for SSF, which should yield important benefits for present and future generations.

Assessing multiple outcomes and critical assumptions underpinning rights-based fisheries management in practice
Elodie Le Cornu (Center for Ocean Solutions, Stanford University, Stanford Woods Institute for the Environment)
Elena M. Finkbeiner (Hopkins Marine Station, Stanford)
Adam L. Ayers (Department of Urban and Regional Planning, University of Hawai‘i at Mānoa, Honolulu)
John N. Kittinger (Conservation International, Hawai‘i Fish Trust, Betty and Gordon Moore Center for Science and Oceans)

Here we assess what are the key attributes of property rights and the critical assumptions underlying rights-based management approaches to small-scale fisheries, and how – by making these attributes and assumptions in the theories of change more visible – we can guide implementation of rights-based management approaches to be more successful.

There is substantial interest in implementing rights-based management approaches in small-scale fisheries globally, driven in part by funders as well as researchers and NGOs. Rights-based management approaches to small-scale fisheries have been widely researched and there is a growing body of literature on applied case studies. However, the assumptions that underpin the theories of change for these management approaches have not been critically evaluated. This knowledge gap precludes understanding what drives the relative success or failure of these initiatives. By making the critical assumptions that underpin rights-based management more visible, we will illuminate the critical enabling conditions for these management approaches to be successful.

We developed a generalizable theory of change for applying rights-based management approaches to small-scale fisheries that helped structure a review of case studies. For each case study, we assessed whether the assumptions were met, the specific outcomes of the initiative, and the alternative outcomes (unintended outcomes) associated with specific strategies. Based on the results, we will develop recommendations as ways forward to guide direct investments in rights-based approaches to small-scale fisheries.

¿Del mar quién es dueño? Small-scale Fisheries, Tourism Development and the Struggles Over Access To Marine Resources in Gigante, Nicaragua

Nikolai Alexander Alvarado (University of Denver)

In post-revolutionary Nicaragua tourism development has been embraced as a way to inject foreign exchange into the ailing economy. The rapid growth of the tourism sector, however, particularly along Nicaragua’s southwestern Pacific coast, threatens the livelihoods of local small-scale producers. This research focuses on the impacts of tourism development to the fishing community of Gigante. I center on the struggles over access to marine resources that results from this interaction, and particularly, from the creation of La Anciana Marine Protected Area (MPA), a marine conservation corridor being pushed forth by the largest resort development in the area. In my findings I show how tourism is beginning to shape Gigante’s landscape by competing for space and labor with the community’s traditional fishing economy. I reveal how the proposed MPA
overlaps with some of the most important fishing grounds that support local subsistence and small-scale commercial fisheries. The implementation of the MPA, without adequate ecological, economic, and social studies and without the effort to include local producers during the planning stages, could result in the failure of the MPA, the marginalization of the local fishing-dependent population and the eradication of Gigante’s fishing tradition. I suggest that the Nicaraguan Sandinista government provide protection to local producers and tangible avenues for them to be able to participate in the tourism industry. In addition, I suggest that the tourism industry looks beyond economic benefits and integrate social and cultural dimensions to ensure a sustainable development that prioritizes community well-being.

Special session 5.3: Governing the governance (Part 1)
Organized and chaired by: Svein Jentoft Norweigian College of fishery science, University of Tromso, Norway) and Ratana Chuenpagdee (Memorial University, Canada)

Synopsis:
Fisheries governance experience is generally one of failure and disappointment. Despite decades of efforts, we are not doing a good job in achievable sustainable fisheries goals. Fisheries resources are in peril, large segments of the industry are in crisis, and people whose livelihoods depend on them are negatively affected. How can this be? Why do these problems persist? Does the effort lack the needed resolve, or could it be that fisheries systems are inherently complex and difficult to govern? Or is it because the governing institutions are simply not up to the task? Drawing examples and experiences from small-scale fisheries governance around the world, papers in this session aim to address these questions through interactive governance and governability lens, as they apply to the challenges facing this sector. The session is organized as part of Too Big To Ignore, Working Group 6.

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Two rules for the same fish: marine small-scale fisheries management in Ecuador mainland and Galapagos Islands.

Maria-Jose Barragan Paladines (Memorial University of Newfoundland)

The marine small-scale fisheries sector in Ecuador mainland and Galapagos Islands face large-scale challenges. Diverse threats compromise them, weakening their viability in the long term. Lack of trust, leadership, and cohesion among small-scale fisheries entities; lack of willingness to observe rules; and social changes in fishing communities; limited agency of the official entities; lack of politic intention, and deficient operational mechanisms, are among others, features that compromise this sector. Despite their relevance, these aspects have been inadequately addressed and the information regarding them is deficient. This investigation is set in Ecuador and Galapagos Islands. The Interactive Governance Approach –IGA, and the Governability Assessment Framework –GAF inspire this study which explores two management modes of governance applied to fishing resources of the same country, under two different legal frameworks. Using different sources of evidence, a systematic description of the Governing System (GS), the System to be Governed (SG) and their corresponding interactions (GI) is presented by answering: How is the actual and formal role of the GS in small-scale fisheries governance? How is the governability of SG achieved? Which are their mechanisms for GI to take place? Some alternatives are discussed as potential strategies to promote a shift from the current management approaches toward a more horizontal mode for small-scale fisheries governance. Conclusions highlight the role that the politic, social, environmental and legal dimensions play in achieving sustainability in small-scale fisheries as a way to modify their negative trend in the last decades.

From institutional dysfunction to institutional stability: Explaining governance success in the Lake Winnipeg fishery since the late 1960s.

Sölmundur Karl Pálsson (University of Manitoba)

In the history of the fisheries of Lake Winnipeg, a critical moment of transition occurred in the late 1960s as a result of the recognition that the lake’s fisheries were becoming increasingly ungovernable. From the 1940s to 1960s, the organization of the lake’s fish marketing combined with inadequate management controls created a highly unjust distribution of returns from the fishery and drove an increasingly desperate and destructive race for the fish. During the period 1968 to 1972, the Manitoba provincial government and the Federal Government implemented two new governance innovations: an individual quota system, that was made transferable in 1985, and the Freshwater Fish Marketing Corporation. From the perspective of the present, this appears as an unorthodox combination of management institutions yet the interventions together
addressed the serious governability problem faced by the fishery and ushered in 40 years of stability. This paper examines the reasons for the success of the two institutions in the fishery and suggests broader lessons for fisheries governance from the case.

The governability of mangrove ecosystems: Self-governance in an ever changing world

Estelle Jones, Newcastle University, Newcastle upon Tyne, UK
Heidi Schuttenberg, University of Aberdeen, Aberdeen, Scotland, UK
Ratana Chuenpagdee, Memorial University, Newfoundland and Labrador, Canada (tentative)
Tim Gray, Newcastle University, Newcastle upon Tyne, UK
Selina Stead, Newcastle University, Newcastle upon Tyne, UK

"Global decline in small scale fisheries (SSF) have led to broad-scale recognition of a need to improve governance arrangements, with devolution to local communities often championed as a way to achieve sustainability in fishing practices. In five of villages from the provinces of Ranong and Phang-nga along Thailand’s west coast, a range of efforts have been underway to establish self-governance by small-scale fishers through the creation of different types of marine protected areas. In this case study we will apply the Governability Assessment Framework to examine the ways in which the system to be governed (SG), the existing governing system (GS), and the governing interactions (GI) have responded to efforts to foster self-governance in these communities; in doing so we will identify the key supports and barriers to self-governance that have arisen in these areas, and suggest possible strategies for achieving a hybrid governance system that is better able to achieve sustainability within this context. In the matrix proposed by Jentoft and Chuenpagdee we view our case study as exploring the self-governance row, with a particular concentration on the self-governance-GS cell. Specifically, we will investigate the nature of these self-governing arrangements; how they have evolved in the region; what degree of acceptance they can claim; and the limitations of their effectiveness by drawing on our data about community action, compliance, and attitudes to self-governance. In particular, this work will highlight how broader scale attributes of the SG have challenged the ability to realize self-governance, such as the influx of post-tsunami aid and interventions by external parties that undermined the traditional governance system.

Lessons from existing modes of governance in Malawi’s artisanal fisheries

Mafaniso Hara, Institute for Poverty, Land and Agrarian Studies (PLAAS), University of the Western Cape, P/Bag X17, Bellville, 7535.
Over 95% of Malawi’s annual fish catch is landed by small-scale fishers. Fish is the cheapest source of animal protein in the country. The fishing sector provides income and employment to about 65,000 fishers and over 500,000 people engaged in post-harvest activities such as processing, trading and boat building. Annual fish production for the commercially important Chambo (Oreochromis species) has plummeted from 8,000 to less than 1,000 tonnes annually since the 1980s (recent years though have experienced 60-70% increase in catch mainly of low value usipa (Engraulicypris sardella)). Continued decline in production has great negative implications for protein supply, income and livelihoods for all those in the entire fish value chain.

Most of the management problems can be traced to problems of governance. Fisheries management still remains largely centralised under the Department of Fisheries. A number of co-management arrangements had been introduced in the 1990s such as in Lakes Malombe, Chilwa and parts of Lake Malawi, with mixed results. Examples of organic community based management also exist such as on Lake Chiuta and Mbenji Island, which appear to be yielding very positive results from fishers’ perspective. Administrative decentralisation, whereby power and authority including that for fisheries management will be delegated to District Assemblies, is strongly on the cards after the 2014 general elections. This chapter will analyse the varying performances of management under the three existing modes of governance and the influence of the Governing Interactions between the Fisheries System (SG) and Governing System within the existing modes in Malawi. Such a critical analysis will contribute towards finding possible solutions to current management failures in Malawi fisheries and other small-scale fisheries with similar characteristics.

**Governability along the value chains of lobster fisheries in the Wider Caribbean**

Iris Monnereau (CERMES, University of the West Indies)
Robin Mahon (CERMES, University of the West Indies)
Patrick McConney (CERMES, University of the West Indies)
Leonard Nurse (CERMES, University of the West Indies)

Climate change vulnerability assessments in fisheries have been gaining increased prominence in both policy as well as the academic literature over the past decade. The impacts of climate change are believed to be highest in Least Developed Countries (LDCs) and Small Island Developing States (SIDS). SIDS are often, however, considered to be ‘data-deficient’ and thus seldom included in global vulnerability analyses of fisheries, even though highly dependent on the fisheries sector. This underrepresentation masks the vulnerability of the small scale fisheries sector in SIDS. To address this we have developed a national-level fisheries sector vulnerability framework incorporating
over 100 indicators across the components of exposure, sensitivity, adaptive capacity that includes data on the majority of SIDS. We have used principal component analysis to assess the value and strength of these different components and the different vulnerability characteristics of the fisheries sectors of Caribbean, Pacific and other SIDS, and LDCs. This assessment may help to inform policy for small-scale fisheries in the face of climate change. Coherent and equitable global policy requires us to assess and evaluate the vulnerability of the fisheries sectors of all nations regardless of size and development status.

Special session 5.4: Quantitative assessment methods adapted to data-limited, small-scale fisheries
Organized and chaired by: David Kaplan (Virginia Institute of Marine Sciences (VIMS), USA)

Synopsis:
Small-scale fisheries are often data limited, meaning that insufficient information is available for performing a full classical stock assessment. Instead, quantitative and qualitative assessment methods must combine available data sources, taking maximum advantage of the limited data that is available. Robust uncertainty and sensitivity analyses to understand the accuracy of predictions and the value of collecting additional data are also of critical importance. The objective of this session will be to present a variety of different assessment approaches that have been adapted to small-scale fisheries, focusing on how each approach addressed the difficulties of limited data. Approaches addressed will span a wide variety of different levels of complexity and detail, including single-species stock assessment, metapopulation dynamics, ecosystem approaches and MPA assessments. Time permitting, there will be a short discussion at the end of the session around the theme of identifying best practices for assessment in data limited situations and developing a set of tools or recommendations for assessment at different levels of complexity.

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<thead>
<tr>
<th>Presenter</th>
<th>Title</th>
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**Data-limited population-status evaluation of two coastal fishes in southern Angola using recreational catch length-frequency data**

Jennifer Beckensteiner (VIMS, USA) (may present if funding can be found)  
David M. Kaplan (Virginia Institute of Marine Sciences (VIMS), USA)  
Warren M. Potts (Rhodes University, South Africa)  
Carmen Santos (Faculdade Ciências da Universidade Agostinho Neto (FCUAN), Angola)  
Michael R. O’FARRELL (NMFS-SWFC, NOAA, USA), Email: dmk@vims.edu

Excessive truncation of a population’s size structure is often identified as an important deleterious effect of exploitation, yet the effect of this truncation on population persistence is seldom quantified. In this study, we estimate changes in eggs per recruit (EPR) using annual length-frequency samples over a 9 year period to assess persistence of the two most important recreational fishes in southern Angola: west coast dusky kob (Argyrosomus coronus) and leerfish (Lichia amia). Using a length- and age-structured model, we improve on an existing method to fit this type of model to length-frequency data and estimate EPR. The objectives of the methodological changes are to add considerable flexibility and robustness to the approach for assessing population status in data-limited situations. Results indicate that dusky kob presents very low levels of EPR (5%-10% of virgin reproductive output) in 2013, whereas large inter-annual variability in leerfish estimates suggest caution must be applied when drawing conclusions about its exploitation status. Using simulated length frequency data with known parameter values, we demonstrate that recruitment decline due to overexploitation leads to overestimation of EPR values. Considering the low levels of EPR estimated for the study species, recruitment limitation is not impossible and true EPR values may be even lower than our estimates. It is, therefore, likely that management action, such as the creation of Marine Protected Areas, is needed to reconstitute the west coast dusky kob population.

**Evaluation of the effectiveness of marine reserves for transient spawning aggregations in data-limited situations**

Arnaud Gruss (RSMAS, University of Miami, USA)  
David M. Kaplan (Virginia Institute of Marine Sciences (VIMS), USA)  
Jan Robinson (James Cook University, Australia)
Numerous coral reef fish species form predictable, transient spawning aggregations. Many aggregations are overfished, making them a target for spatial management. Here we develop a per-recruit model to evaluate the performance of no-take marine reserves protecting transient spawning aggregations. The model consists of only 14 demographic and exploitation-related parameters. We applied the model to a protogynous grouper and a gonochoristic rabbitfish from Seychelles, and tested 6 scenarios regarding the extent of protected areas, the level of fish spawning-site fidelity, and fishing effort redistribution post reserve implementation. Spawning aggregation reserves improve spawning-stock biomass-per-recruit, and reduce sex ratio bias in protogynous populations for all scenarios examined. However, these benefits are often small and vary among the different scenarios and as a function of sexual ontogeny. In all scenarios, increases in yield-per-recruit do not occur or are negligible. Long-term yield increases due to spawning aggregation reserves may still occur, but only if spawning-stock biomass recovery results in a recruitment subsidy. Given these limited benefits, the value of no-take reserves must be weighed against those of other management options, such as fishing effort reduction and seasonal fishery closures. The latter is particularly appropriate when spawning and non-spawning areas overlap in space.

Facing data-poor, multi species fisheries head on: Community fisheries monitoring techniques in Baja California Sur, Mexico

Constanza Santa Ana (Sociedad de Historia Natural Niparaja, A.C.)
Amy Hudson Weaver (Sociedad de Historia Natural Niparaja, A.C.)
Tomás Plomozo Lugo (Sociedad de Historia Natural Niparaja, A.C.)

"Small-scale fisheries around the world suffer from the lack of information that can be used for management. Many of these fisheries are in distant locations, tend to be under-reported, and are generally not top priority for researchers due to their low economic value. In examples when scientific studies do exist, they often perceived as a threat to fishers, since fishers do not understand the information and do not agree with the methods used to generate it. In the Gulf of California, Mexico organizations are working with fishermen and the government to generate the necessary information to evaluate small-scale fisheries resources, while at the same time involving local communities in the information collection. The case study we present is an example of how we have begun to solve the problems of the lack of information and participation. In this study we present the work of three years that includes: training fishers to participate in fisheries monitoring, initial results, and potential application of this information to fisheries management tools."

The barefoot ecologists: “social catalysts” and local providers of scientific/technical support for allowing informed community-based management
There is consensus about two requirements for successful SSFs management; participation of the local community in the decision-making process and availability of trusted information to assess the fishery, conceived as a social-ecological system. Approaches from industrial fisheries management are not suitable, but bridging the gap between fishing communities and the fisheries administration is still a challenge across all kinds of SSFs, everywhere. Convergent solutions have evolved independently worldwide, with several elements in common. They all involve local agents that act as “social catalysts” to assist the fishing communities in the development of biological and socioeconomic monitoring programs and informed management plans as they enter co-management arrangements. These so-called “barefoot ecologists” (BE) 1) have an active role at the scale of local fishing communities & SSFs, 2) facilitate fishers’ participation in the management process, 3) undertake a wide scope of activities using skills from social and natural sciences, and 4) act as knowledge collectors/translators among stakeholders and managers. Comparing BE programs worldwide we have found several differences in relation to the institutional arrangements (government programs, NGOs, academia, etc), the operational mode (BE inserted or not in the fishers’ community, duration of involvement, etc), and the roles/responsibilities (social support, fishery monitoring, assistance in co-management, etc.). To be most effective, BEs need to be inserted within the fishing communities, skilled in the social/natural sciences, equipped with appropriate toolboxes, and networked with the scientific/management community. They should not be simply external catalysts, but rather active partners in their condition of support providers.

Establishment of a fishery management plan for the gastropod Concholepas concholepas (loco) in chile by assessing larval connectivity

Garavelli Lysel 1, Kaplan David 2, Colas Francois 3, Verley Philippe 4, Yannicelli Beatriz 5, Lett Christophe 5
1 Harbor Branch Oceanographic Institute, Florida Atlantic University. Fort Pierce. FL. United States, lgaravelli@fau.edu
2 Virginia Institute of Marine Science. Gloucester Point. VA. United States dmk@vims.edu
3 Institut de Recherche pour le Développement (IRD), LOCEAN-IPSL UPMC, Paris France, francois.colas@locean-ipsl.upmc.fr
4 Institut de Recherche pour le Développement (IRD), UMR EME 212, Centre de Recherche Halieutique Méditerranéenne et Tropicale, Sète, France philippe.verley@ird.fr
5 Centro de Estudios Avanzados en Zonas Aridas (CEAZA) Facultad de Ciencias del Mar Universidad Catolica del Norte, Coquimbo Chile, Centro Universitario Región Este. Universidad de la República, Montevideo, Uruguay beatriz.yannicelli@ceaza.cl
Along the Chilean coast, one of the commercial species targeted by benthic fisheries is *Concholepas concholepas*, commonly named “loco”. It was a highly valuable benthic fishery until the end of the 80’s. Then the resource became over-exploited and different management plans were applied to ensure the sustainability of the fishery. The current management plan (territorial users’ rights in distinct areas) does not lead to the expected stock recovery. One of the main challenges is therefore to evaluate the spatial scale of management the most appropriate to loco biology and ecology. We chose to use a modeling approach to assess the scale at which the current management areas are connected by larval dispersal. To investigate connectivity of loco along the Chilean coast at regional scale, i.e., connectivity between distant biogeographic regions, we have developed a spatially-explicit model of larval dispersal, coupling a regional model of oceanic circulation (ROMS) to an individual-based model of ichthyoplankton dynamics (Ichthyop). This approach allows including several biological factors in the model in order to investigate their influence on connectivity patterns and scale. We found that biological factors imply significant change in the connectivity patterns for loco along the Chilean coast. From our results, we identified largely independent subpopulations for loco and proposed a new regional management plan.

### Patterns of abundance and mortality rate of benthic resources: the trade-off between sustainability in TURFs and adjacent exploited areas

Miriam Fernández, Miguel Andreu Cazenave, Stefan Gelcich, Juan Carlos Castilla and Anna Steel

Recent reports on the status of the global fisheries show that only 20% of the exploited stocks are assessed. Smaller stocks tend to be in much worse conditions becoming urgent to quantify the impact of fisheries and different management instruments. Territorial user right fisheries have been suggested to promote sustainability of artisanal fisheries. However, the effectiveness of this instrument in determining fishing mortality, abundance of exploited species, and ecosystem health at large scale has not yet been evaluated, mostly due to data limitation. Here we evaluate (a) the effectiveness of TURFs in diminishing fishing mortality, (b) the influence of TURFs on resource abundance and biodiversity, and (c) the trade-off between the benefits of protection in dedicated areas (TURFs), against the cost paid for open access areas (OAA) due to effort displacement. We focused our study in central Chile combining fisheries data (CPUE) and direct assessments of density and mortality. We found that density of the most important benthic invertebrates and fishes was significantly higher in TURFs than in OAAs. Consistent with this pattern, we found that mortality rate was significantly higher in OAAs than in TURFs, which in turn showed a higher mortality rate than no-take areas evidencing the impact of fishing. It is interesting that mortality rate of the most valuable resource (the
loco *Concholepas concholepas*) is higher in open access areas where fishing of locos is prohibited than in TURFs, suggesting the effectiveness of co-management in TURFs to enforce quotas and regulations. However, this spatial arrangement displaces effort to the open access areas with consequences that could counteract the potential benefits of TURFs. We analyzed patterns of abundance of limpets (density) along the coast of central Chile in regions exhibiting different fractions of the coast dedicated to TURFs. We found a decrease CPUE in OAA over time, after TURFs were established, particularly in areas where a larger fraction of the ocean is assigned to exclusive use rights, suggesting a compromise between enhancing resource abundance inside TURFs and the consequent cost on OAA.

**Speed Session 5.5**

**Metapopulation analysis as a tool for a marine extractive reserve management in Southern Brazil: The clam *Anomalocardia brasiliana* (Gmelin, 1791) as a case study**

Ana Paula Rosso, University of Vale do Itajaí, Brazil, anaprosso@hotmail.com
Paulo Ricardo Pezzuto, University of Vale do Itajaí, Brazil, pezzuto@univali.br

**Abstract**

The clam *Anomalocardia brasiliana* is exploited by artisanal fishers in two adjacent tidal flats located in the Pirajubaé Marine Extractive Reserve (RESEX) (Southern Brazil). Besides inhabiting RESEX and been one of the most important reasons for the reserve creation, this clam is found also in other eight similar areas in both bays. This spatial structure (*i.e.* several beds bordering two semi-enclosed and interconnected bays) allied to the planktonic larval dispersal of the species suggest that the stock may constitute a metapopulation. This study aimed to investigate the potential of larval connectivity among them in order to assess the relative role that the subpopulations inside and outside the reserve could play in sustaining the metapopulation. To this end, systematic biological sampling was carried out in all areas (485.92 ha) during the fall of 2008, summing up 464 samples. Biomass was estimated and population structure was examined in all sites. The RESEX beds accounted for nearly half of the stock biomass (1,583.66 t) in spite of corresponding to only 36% of the total area. Local surface current patterns as available from the literature supported the metapopulation hypothesis and suggested that RESEX might receive significant larval contributions especially from the nearest four beds in South Bay. Three of them showed not only high biomasses as a population structure very similar to the observed in the reserve. If the hypothesis of larval connectivity is true, then a precautionary approach should be enforced for all banks as a whole.

**Introduction**

The clam *Anomalocardia brasiliana* is exploited by artisanal fishers in two adjacent tidal flats (Baixio Principal and Praia da Base) located at the Pirajubaé Marine Extractive Reserve (RESEX), Southern Brazil. The reserve is situated in the oriental margin of a
A semi-enclosed bay (Florianopolis Bay - the water body between Santa Catarina Island and the mainland in southern Brazil) (Figure 1). Besides inhabiting RESEX and been one of the most important reasons for the reserve creation, this clam is found also in other eight similar areas around the bay. This spatial structure (i.e. several beds bordering two semi-enclosed and interconnected bays) allied to the planktonic larval dispersal of the species suggest that the stock may constitute a metapopulation.

Fishing management rules are available only for RESEX, while open access unregulated catches prevails in the other sites. Therefore, in case of RESEX and the other eight beds are connected by larval drift, management measures established within the protected area may not be sufficient to ensure the sustainable use of its fishing resources as replenishment of RESEX beds may depend, at least in part, of the other sub-populations. The spatial extent of the metapopulation and the role played by each sub-population in the maintenance of the species are dependent processes associated with larval dynamics and patterns of coastal circulation, which are rarely known (WING et al. 1998).

This study aimed to investigate the potential of larval connectivity among ten areas in order to assess the relative role that the subpopulations inside and outside the reserve could play in sustaining the metapopulation.

**Methods**
The work was conducted in ten intertidal flats located along the Florianopolis Bay, Santa Catarina State, Southern Brazil. Florianopolis Bay is a coastal system formed by two semi-enclosed bays (North Bay and South Bay), connected by a ~400m wide constriction (Bonetti-Filho et al, 1998). Two out of the ten intertidal flats are inside the Pirajubaé Marine Extractive Reserve (RESEX), situated in the oriental margin of the South Bay.

Systematic biological sampling with corer was carried out in all areas (total 485.92 ha) during the fall of 2008, summing up 464 samples.

Total biomass of *Anomalocardia brasiliana* per bed was estimated through a posteriori stratification of the sample design, based on the finding of a strong inverse relationship between the species occurrence/abundance and the percentage of fine sediments (clay and silt) in the samples (ROSSO, 2012). Population structure was examined by size (shell length) frequency distributions.

Studies of Melo et al (1997) and Prudêncio (2003) were used in order to investigate the potential for larval interconnection among the beds, as these authors have studied tidal currents patterns both in the North and South Bays of Florianópolis.
Results
Population structure of *A. brasiliana* was similar and unimodal in Baixio Principal, Tapera da Base, Tapera do Sul, Cubatão, Maciambú and Aririú beds. Praia da Base showed a bimodal distribution with peaks at 10mm and 24mm shell length (Figure 2). On the other hand, Pontal da Palhoça, Maruim and Praia da Daniela showed irregular distributions with small (6 to 10mm) and large (22 to 40mm) individuals, and few or any clams of intermediate sizes (Figure 2).
Figure 2: Size-frequency distributions (Shell length, in mm) of *Anomalocardia brasiliana* in the sampled intertidal flats.

Total biomass of *A. brasiliana* was estimated in 3,134.66 t, considering all beds. Corresponding only to 36% of the surveyed area, RESEX beds (Praia da Base and Baixio Principal) accounted for nearly half of the stock biomass (1,583.66 t) the last area summing up 973 t (or 30% of the total). Pontal da Palhoça exhibited the lowest biomass (29.07 t or 0.93% of the total) (Table 1).

In general, beds were dominated by areas covered with sediments with low mud (silt and clay) contents (0.1 to 10%). These areas exhibited also the highest biomasses. Maruim bed was an exception, where mud contents between 10.1 and 20% prevailed, and also where the highest biomasses occurred (Table 1).

**Table 1**: Values of areas (ha) and average biomass (tonnes) for each mud content class analyzed. As well, the values of total biomass (tonnes) for each bed and their respective contributions (in percentage) in relation to the sum of the total biomass.

<table>
<thead>
<tr>
<th>Bed</th>
<th>Mud content (%)</th>
<th>Surface (ha)</th>
<th>Mean biomass (t)</th>
<th>Total biomass (t)</th>
<th>Total biomass (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baixio Principal</td>
<td>0.1-10</td>
<td>71.43</td>
<td>746.74</td>
<td>972.97</td>
<td>31.04</td>
</tr>
<tr>
<td></td>
<td>10.1-20</td>
<td>13.39</td>
<td>226.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.1-100</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Praia Base</td>
<td>0.1-10</td>
<td>81.01</td>
<td>532.12</td>
<td>610.17</td>
<td>19.47</td>
</tr>
<tr>
<td></td>
<td>10.1-20</td>
<td>8.61</td>
<td>78.05</td>
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<tr>
<td></td>
<td>20.1-100</td>
<td>0.07</td>
<td>0.00</td>
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<tr>
<td>Tapera da Base</td>
<td>0.1-10</td>
<td>24.47</td>
<td>366.70</td>
<td>366.70</td>
<td>11.70</td>
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<tr>
<td></td>
<td>20.1-100</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
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<tr>
<td>Tapera do Sul</td>
<td>0.1-10</td>
<td>12.81</td>
<td>122.88</td>
<td>130.57</td>
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<td>6.09</td>
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<td>0.1-10</td>
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<td>20.1-100</td>
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<td>---------</td>
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<tr>
<td>Maciambú</td>
<td>105.82</td>
<td>339.85</td>
<td>339.85</td>
<td>10.84</td>
<td></td>
</tr>
<tr>
<td>Pontal</td>
<td>2.84</td>
<td>17.96</td>
<td>29.07</td>
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<tr>
<td>Cubatão</td>
<td>38.83</td>
<td>276.11</td>
<td>295.19</td>
<td>9.42</td>
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<tr>
<td>Aririu</td>
<td>16.32</td>
<td>106.47</td>
<td>171.26</td>
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<td>Maruim</td>
<td>5.20</td>
<td>21.70</td>
<td>168.70</td>
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<tr>
<td>Daniela</td>
<td>7.86</td>
<td>6.68</td>
<td>50.19</td>
<td>1.60</td>
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<tr>
<td>Total</td>
<td>485.92</td>
<td>3,134.66</td>
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<td>RESEX</td>
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<td>Other Beds</td>
<td>311.40</td>
<td>1,551.51</td>
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</table>
Discussion
From the ten areas investigated, the RESEX beds revealed to be the most important in term of total biomass in the system (Table 1). Coincidentally, they are the only for which legal measures are established for manage the exploitation of \textit{A. brasiliana}. All other areas are submitted to free-access fishing.

Studies on local surface current patterns demonstrated that tidal waves penetrate in the system from both extremities of Florianopolis Bay (entrances of the North and South Bay) with a relatively small phase difference (MELO et al, 2007). The result of the superposition of two progressive waves traveling in opposite directions is a standing wave (antinode) in the middle of the South Bay (MELO et al, 1997; MARTINS, 1997; PRUDÊNCIO, 2003), slightly to the south of the RESEX beds (Figure 3). Thus, they could be influenced by the flood-tide currents coming both from the south as from the north areas.

If larval transport and retention is dependent from recurrent oceanographic patterns as argued by ORENSANZ and JAMIESON (1998), it is likely that Baixio Principal and Praia da Base could figure out as major larval sinks in the system, especially during flood-tide periods, as their sheltered condition and their position in relation to the antinode could contribute, respectively, to larval retention and receiving of propagules from both South and North Bays (ROSSO, 2012).

On the other hand, during the ebb-tide periods (Figure 3), beds situated in the northern portion of the South Bay, as Maruim, Baixio Principal and possibly Praia da Base could export larvae to the North Bay, potentially reaching Praia da Daniela, while larvae from the other beds could be easily exported to the sea through the South Channel (Figure 3). Local surface current patterns, as known from the literature, seem to support the metapopulation hypothesis and suggest that RESEX might receive significant larval contributions especially from the nearest four beds in South Bay: Tapera da Base, Cubatão, Aririú and Maruim. In fact, the former three beds were characterized also by showing not only high biomasses, but population structure very similar to the RESEX.

If the hypothesis of larval connectivity is true, then the sustainability of the \textit{A. brasiliana} exploitation might depend, in a large extent, not only from the rules which apply to the RESEX fishery, but also of expanding the management and habitat protection measures to the neighbor areas too, especially to the other four nearest beds. Thus, a precautionary approach should be enforced in order: a) to prevent overfishing of the unprotected subpopulations and b) to ensure the long-term sustainability of the RESEX beds, which, in spite of exhibiting the highest abundance in the system, seem to maintain important interdependence with other metapopulation units.
Figure 3: Instantaneous tidal current fields at spring (flood – left; ebb – right) tide in the South and Noth Bays, Florianópolis, SC. Adapted from PRUDÊNCIO (2003).

Acknowledgement
A.P.R. and P.R.P. were supported, respectively, by a FUMDES / 171 (State of Santa Catarina) scholarship and a research grant from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq - Process 308658/2009-4). Thanks to all who contributed to the extensive collection of biological and sedimentological samples.

References
Deciphering contextual influences on local leadership in community-based fisheries management

Abigail Sutton (York University, UK)

Community-based fisheries management (CBFM) strategies have been adopted in a variety of small-scale fisheries around the world. Within these management structures, leaders are increasingly regarded as essential for viable CBFM. By strategically reviewing published research from fisheries, natural research management, and other sectors, it became apparent that previous work on leadership has focused on relatively coarse-scale characteristics of leadership, and the functions that leaders perform. The
presence of a leader is beneficial to CBFM, however it does not appear to be a necessary condition, but part of a broader set of complex, compound sufficient conditions. Systematic analysis into the intricate mechanisms of leadership is essential to progress leader research. As with any social phenomena, causal complexity (i.e. the possibility that multiple combinations of factors may lead to successful outcomes) necessitates context-dependent analyses and attention to how different pathways might lead to success in some situations but not in others. Assessment of CBFM leadership should strive to identify conditions that are necessary and/or sufficient to facilitate effective collective action. I will present a new methodology in fisheries management, to assess necessary and/or sufficient conditions for effective leadership in CBFM. Qualitative Comparative Analysis (QCA) in an increasingly popular method to measure necessity and sufficiency, having only been used a few times in fisheries management, multiple times in terrestrial resource management, and frequently in other fields. Case studies of fisheries leadership will be taken from South East Asia, to demonstrate the methodology, and to determine contextual influences on successful leadership.

Economic and social strengthening of fishermen and fishing organizations

Mario Rojo - Egle Flores - Amanda Lejobwics - Alejandra Meza (Comunidad y Biodiversidad, AC)

To achieve conservation of marine biodiversity and sustainable fisheries management is necessary for users (fishermen and fishing organizations) to possess common goals, clear rules and obtain a social and economic benefit for taking this primary activity: fishing. During the past 10 years Comunidad y Biodiversidad A.C has detected that, 1) the organizational and functional structures of some fisheries cooperatives are inefficient, and 2) there exists an interest of fishermen to improve the quality of life in their communities. Thus, it has been classified and worked in a model of three stages in the operation of cooperatives to ensure that fishing becomes profitable businesses, with capacity to invest in the proper use and conservation of fishery resources. These stages are: a) Establishment and/or strengthening, b) Transparency in administrative and accounting processes and c) access to different markets. Which have been implemented in Sonora, Quintana Roo and Baja California Sur, respectively.

To strengthen the fishermen skills, a community leaders program was designed with the aim of turning them into shift agents in their communities through productive, conservation and education projects, taking into account some human dimensions (ethics, spiritual, cognitive, emotional, communication, ecological, economic and cultural) in three communities of the Gulf of California.

Community based tourism and other complementary income in coastal and river/lake communities
Abstract

Artisanal fishing practiced in a responsible way, can be considered socially and environmentally sustainable, but in view of overfishing and reduced catches, income from fishing may not be sufficient to make it economically sustainable. Fortunately communities which depend on fish for income, food sovereignty and well being are located in naturally attractive ecosystems, which provide excellent potential to develop community based tourism called CBT.

We define CBT as follows: "Tourism business in the community is planned, developed and managed by the native residents providing accommodations, meals, eco trails, excursions and other services for tourists, generating income and small business development. Thus income from tourism remains in the community, contributes to the local economy, while minimizing the negative impacts of tourism at the same time." To develop TBC communities need to have territorial rights, established community organization and experience with projects for local economic development. Other complementary livelihoods such as agro-ecology, family aquaculture, handicrafts and arts, information and communication technology and small scale manufacturing also contribute to economic sustainability. CBT is not limited to coastal communities alone, but can be developed along rivers and lakes and is especially suitable for areas reserves for sustainable use (Resex/RDS). We will show the case of coastal communities in the state of Ceará which started with the first CBT experience in Prainha do Canto Verde in 1998 and has grown to a 15 community destination network last year. From 8 CBT destinations in 2003, Brazil has grown to over 250 community destinations in 2013.

Community based tourism and other complementary income in coastal and river/lake communities

TBTI - Too Big To Ignore is an event many of us who are working towards sustainable small scale fisheries development haven been wishing for a long time and our first objective is to join efforts to bring about big changes for small scale, also called artisanal, fishers both in marine fisheries and continental water bodies. Many of the communities we are working with already have the territory reserved for rights based use, in a variety of marine protected areas for sustainable use with the objective to tie the wellbeing of our communities to the conservation of aquatic biodiversity. This is what separates industrial from artisanal fishing. Industrial fishing in most cases aims for large catches with maximum profit for shareholders or private owners of the companies. Artisanal fishers look for the wellbeing of their families and community members and the need to care for the protection of the resource and the environment. Artisanal fishing practiced in a responsible way, can be considered socially and environmentally sustainable, but in view of overfishing and reduced catches often caused
by illegal fishing, income from fishing may not be sufficient to make it economically sustainable.

Communities which depend on fish for income, food sovereignty and well being generally are located in naturally attractive ecosystems and protected areas, which provide a perfect environment to develop community based tourism (CBT).

In Brazil we define CBT as follows:
"Tourist services in the community are planned, developed and managed by the native residents providing accommodations, meals, eco trails, excursions and other services for tourists, generating income and small business development. Thus income from tourism remains in the community, contributes to the local economy and minimizes the negative impacts of tourism (drugs, prostitution and wealth concentration)."

To develop TBC, communities need to have territorial rights, established community organization and experience with projects for local economic development. Other complementary livelihoods such as agro-ecology, family aquaculture, handicrafts and arts, information and communication technology and small scale manufacturing also contribute to economic sustainability. CBT is not limited to coastal villages alone, but can be developed along rivers and lakes and is especially suitable in reserves for sustainable use (Extractive Reserves/Resex Reserves for Sustainable Development/RDS in Brazil).

The first community tourism destination in Brazil started to develop in Prainha do Canto Verde, in the northeastern state of Ceará in 1998. The community is well know for its strong organization, the struggle against real estate speculation and the leadership among coastal communities against illegal lobster fishing and the articulation for participation in fisheries management. More about this price-winning project: http://www.todo-contest.org/preistraeger-en/prainha01.html

Other communities along the coast of Ceará with 576 kilometers of beaches which were receiving technical assistance for local economic development from the NGO Instituto Terramar, followed in the steps of Prainha do Canto Verde and in 2008 the first regional network for community tourism was born, called Rede TUCUM – www.tucum.org. Tucum is a fiber from native palmtrees and in this context is used as a symbol for resistance and network, since all the communities have a history of resistance and working together against land grabbing. The main activities for most of the 15 communities are ocean fishing in sail boats, extracting shrimp and crabs in mangroves and seaweed farming with other auxiliary activities typical for fisher communities, like boat construction and fabrication of fishing gear. More about the network: http://www.todo-contest.org/preistraeger-en/rede_tucum01.html

Numbers of tourists vary widely from one community to another depending on the distance from large cities where the main tourist market is located which provides 75% of tourists, while 25% of the guests originate from other states in Brazil and foreign countries. Tourism flow goes from 100 to 1,500 visitors with 300 to 4,500 overnights a
year and guests spend between US$ 10,000 to US$ 150,000 a year per community for a variety of services (guest houses, restaurants, transfers, excursions and local activities). The share of income from tourism in the local economy is still relatively low, but the growth potential of CBT is enormous.

Complementary economic and environmental activities

Three Tucum communities have taken to seaweed farming. The pilot project installed by Terramar’s molecular biologist Dárlio Teixeira using *gracilaria birdiae* has been tested over the last 8 years using long line structures in close shore region protecting natural seaweed banks from overexploitation. This project helps to protect juvenile lobsters in nursery areas and has a good potential for poverty reduction and food security. Seaweed is being dried into powder for sale for cosmetic and medicinal products. Dried seaweed is sold to restaurants and complements family diets.

Crustacean and mollusks extraction and farming: Industrial shrimp farming along the northeastern coast of Brazil is a monoculture using *Litopenaeus vannamei* introduced from Asia. Shrimp farming has been responsible for mangrove destruction and pollution in estuaries and has led to the expulsion of extractive fishermen and women from their traditional activity of gathering seafood in the mangroves. Low density shrimp farming by two community groups has shown that this activity can be economically feasible and ecologically safe. Another community only 20 km from Prainha do Canto Verde has shown that oyster farming alongside the collection of shrimp and crabs is possible in a sustainable way.

Artisanal boat builders are still very common in the northeast of the country and most sail boats (jangadas, canoas and others) create job opportunities for construction and also for maintenance. The modernization of fisheries generally leads to migration to motor vessels with the known consequences with rising fuel costs which are compensated with fuel subsidies. An experience in Prainha do Canto Verde has shown that there are alternatives. Catamarans are generally used for leisure and sports, not in Prainha. Here catamarans could just become the fishing fleet of the future. The catamaran (8 meters) cost less to build, because it doesn’t need an engine and is economical in fishing operations. It has a similar fishing capacity for lobsters and fish and operates with the help of the wind at 10% of operating cost. Equipped with solar panels that power GPS, fishfinder, radio and light on board the boat is well equipped for diversified use like commercial fishing, sport fishing and tourism; motorized lobster boats to the contrary are limited to the lobster fishery only and are no longer economically feasible.

Agro-ecology for sustainable production and consumption. The semi arid region of the northeast of Brasil gave origin to history’s greatest migration of poor people from the savannas of Ceará, Pernambuco, Piauí, Rio Grande do Norte, Paraíba, Bahia, Sergipe and Alagoas to the capitals of the south like São Paulo, Rio de Janeiro and Brasília. People fleeing from the drought that punishes humans and animals and turns ever more soil to desert, rivers suffer from erosion on the riverbanks and ever less nutrients are carried
downstream to the sea. Climate change will contribute with reduced rainfalls to erosion of rivers and will affect coastal resources negatively. Thus coastal populations have to adapt and develop other sources of nutrition and income. Most Tucum destinations are located in hospitable coastal areas with great reserves of water in protected aquifers. Using permaculture- and agroecological practices, sandy areas can become productive for fruit and vegetable using modern irrigation technology and energy from small wind generators. These products will improve food security and contribute to a balanced and healthy nutrition for the families. These products join fresh fish and lobsters caught by local fishers, complemented by shrimp, and crabs extracted from the mangroves. Villages from coastal regions, river basins and lakes can promote their community tourism product with food fresh from nature and become associated to the growing global Slow Food http://www.slowfood.com/ and Slow Fish http://www.slowfood.com/slowfish/ movement

- **Wind and solar energy generation in coastal communities:** Wind energy generators are a common picture along beaches and increasingly in the ocean. Steady and strong winds and long hours of sunshine in coastal communities along the seashore, make this the ideal place to invest in energy generation. In most regions of the world this is happening with a negative impact for communities and fishers and with little or no economical benefit. With rights based conditions of land and coastal waters in marine protected areas energy generation can become an income opportunity for the population, either as investors in joint ventures with energy companies or by receiving compensation for the environmental impact in the fishing area, where this is unavoidable. Wind generation is a profitable business and companies are willing to pay royalties to the owners of the land where wind farms will be located. Public policy to guarantee land tenure to traditional populations will make it possible for their community organizations to sign contracts for power generation on community lands thus providing income forever.

- **Alternative sanitation systems and water disinfection.** The economic advisor of presidential candidate Marina Silva, Dr. Joê Eli de Veiga, defines poverty not as absence of money but lack of sanitation and drinking water. Billions of people in developing and emerging countries, where the great majority of small scale fishers live, have one big problem in common. The lack of sanitary installations and safe drinking water is a major factor contributing to poverty and poor health. In Brazil for example 62% of the population is without treatment of waste water. Over 50% of the population in the northeast have no access to clean drinking water. This is the main cause for diarrhea and child mortality and costs us money everyday. The good news is that there are alternatives available for most people who live in the sunny south.

a) Artisanal waterwells, aquifers, rivers and lakes of which most of us depend for drinking water, can easily be disinfected with a new method of water treatment approved by the World Health Organisation in addition to clorine and boiling water. It is called SODIS and works wherever you have a minimum of 6 hours of sunshine a day. The advantage of Sodis is that it is extremely low cost and can be easily replicated all over the world.

http://www.sodis.ch/index_EN
b) Environment friendly toilets adopting the principles of permaculture - evapotranspiration tanks* - can be easily built for less of the cost of septic tanks which pollute our aquifers. Building constructions and video in portuguese http://www.deolhonagua.org.br/site/livro_e_cartilha/de_olho_na_agua_guia_de_referencia.pdf

* Evapotranspiration tank is a closed system of septic water treatment that is non-pollutant and follows the principles of permaculture. Effluents are collected in a sealed chamber where solids are decomposed anaerobically by fermentation. Excess fluids are filtered out of this chamber as they rise through the layers of gravel, sand and topsoil where root systems absorb nutrients and water. Nutrients are recycled into the plants without pathogens and water evaporates to the environment by transpiration of plants, mainly banana and papaya trees.

- **Compensation for environmental services – Bolsa Verde.** Thanks to recently approved legislation for environmental compensation, low income families in sustainable use reserves already have access to monthly payments in the amount of US$ 40.00 a month. Hopefully the legislation will be regulated so that there is an obligation of these families to effectively contribute to conservation. Fishers who participate in co-management and enforcement of the fishery, effectively contribute to the conservation of bio-diversity and so do families which participate in selective collection of trash.

- **Mangrove re-forestation.** One of the tours which is offered by the TUCUM community network provides environmental education for tourists. Staying in CBT destinations of Ponta Grossa and Tremembé tourist will visit the Mangrove Ecological Station MES, were they are introduced to permaculture, evapotranspiration toilet, visit the mangroves and participate in replanting mangroves. Citizens condemned for environmental crimes will learn about the importance of mangroves and participate in the re-forestation program at the MES.

In 2003 the first international workshop which joined 8 community based tourism destinations in Brazil took place in Prainha do Canto Verde. With very little government support and public policy to help promote CBT a study to be published this year by the University of Rio de Janeiro will document more than 250 communities tourism destinations in our country. Many countries in Latin America have public policies and community tourism destinations are organized in National Federations which count on national government und United Nations support.

Besides the examples shown in this short presentation there are many more simple ways to make or save money which can complement income from fisheries. Low cost technology and sustainable community practices can be exchanged through the many networks which are participating in this event – TBTI is not only about fishing, but about the wellbeing of billions of people in rural and coastal communities around the world.

Websites: www.prainhadocantoverde.org português; www.tucum.org português, español, english
Toward gender equality in small-scale fisheries: constraints and opportunities

Sarah Harper, Fisheries Economics Research Unit, University of British Columbia, Canada, s.harper@fisheries.ubc.ca; U. Rashid Sumaila, Fisheries Economics Research Unit, University of British Columbia, Canada, r.sumaila@fisheries.ubc.ca

Abstract

The contribution by women to fisheries economies globally continues to be overlooked, in part, because ‘fishing’ is often very narrowly defined. Both men AND women are involved in fisheries but often in different roles and activities. Fisheries research, management and policy have traditionally focused only on direct, formal and paid fishing activities—which are often dominated by men, ignoring those that are indirect, informal and/or unpaid—where women are most often engaged. This has led to a situation where men and women’s contributions to fisheries are not equally valued or even recognized and has resulted in women being largely excluded from fisheries decision-making processes. Examples herein from Mexico and South Africa highlight some of these gender inequalities and identify constraints and opportunities for gender balancing and mainstreaming in small-scale fisheries.

Introduction

Women are thought to represent 47% of the global fisheries workforce (World Bank 2012) and, in some regions, contribute 25-50% of the small-scale fisheries catch (Harper, Zeller, Hauzer, Pauly, & Sumaila 2013; Kleiber, Harris, & Vincent 2014a), yet these contributions are often completely overlooked, under-estimated and/or under-valued. One reason for this oversight is in how fishing is defined, i.e., who is counted as a ‘fisher’ and what counts as ‘fishing’ (Kleiber, Harris, & Vincent 2014b). Traditionally, it has been those who go out to sea to catch fish, from a vessel, using specialized gears that are seen and counted (mostly men), while those who collect invertebrates and small fish from shore are not (women, men and children). Another reason that women’s work in fisheries is overlooked is that it is often unpaid, informal, part-time or simply considered an extension of women’s domestic/household responsibilities. As we expand the scope of our definition to be more inclusive, we can see that women do fish and that they are involved in many other fishing related activities along the fish value chain.

Recognition of the role of women in fisheries is not new. Several decades ago key publications brought to light, through rich descriptions, the important contributions women make to fisheries economies around the world (Chapman 1987; Nadel-Klein & Davis 1988). Since then, there has been a growing body of literature on gender and fisheries with some recent studies going beyond anecdotal evidence to quantify these contributions (Fröcklin et al. 2014; Harper et al. 2013; Kleiber et al. 2014a; Thorpe et al. 2014). While these case studies are invaluable, they cover only a small portion of the
world’s fisheries and only a few fishing communities within any given country. And although there is increasing attention being given to the gender dimension of fisheries at the international level, women continue to be marginalized in access to and control over fisheries resources (Matthews, Bechtel, Britton, Morrison, & McClennen 2012). The many accounts of women in fishing communities around the world suggest that gender inequalities in the fisheries sector are substantial and that such inequalities may be compromising the outcomes of valuable efforts to rebuild fisheries and to improve the livelihoods and wellbeing of all those in fishing communities—including men, women and children. Gender inequality in fisheries is embedded within a broader context of marginality, whereby small-scale fishers are often excluded from policy and decision-making processes. Developing more inclusive and representative management processes in small-scale fisheries first requires identifying all those involved.

This study takes a more in-depth look at the gender dimension of fisheries in two major fishing countries from different regions of the world, Mexico and South Africa. Both countries have extensive coastlines and substantial small-scale fisheries sectors, which provide food, income and jobs to thousands, if not millions. Although the social and economic benefits of fisheries have been recognized and quantified in these countries, how these benefits are distributed has not been adequately addressed and rarely from a gender perspective.

Approach and limitations

To better understand the gender dimension of fisheries in Mexico and South Africa, information was gathered systematically through online searches in directories and databases related to gender and fisheries, from peer-reviewed literature to government white reports and other sources. All sources were reviewed for both quantitative and qualitative information on gender roles and participation, management and decision-making, and policy. Triangulation of data and consultation with local experts were the primary methods used to identify common themes and issues. Given the limited quantitative data on women in fisheries, this work relies heavily on qualitative descriptions, much of which comes from case studies on specific communities. The examples and themes highlighted are, therefore, not necessarily applicable to all women in all fishing communities within these two countries. While it is recognized that women are not a homogenous group and that issues affecting women are also influenced by race, class, ethnicity and religion (Vazquez-Garcia & Montes-Estrada 2006), here we focus only on gender.

Gender roles and participation

While fishing in Mexico and in South Africa is culturally constructed as masculine work, women in both countries are involved in all aspects of the fisheries value chain. Their participation is dominated by post-capture activities (e.g., large- and small-scale processing and marketing) and to a lesser extent direct capture (mainly the collection of
invertebrates from shore). Although neither country had comprehensive sex-disaggregated data on participation in fisheries, a rough estimate of the number of women involved in the sector was derived by combining estimates from several studies. In Mexico, an estimated 50,000 women participate in fisheries, mainly in processing and trade. This figure was calculated by combining an estimated fisheries workforce participation by women of 7% (INEGI 2011) with a total fisheries workforce of 750,000 (Teh & Sumaila 2013). In South Africa, participation by women was estimated at 25,000 (23% of the total fisheries workforce) based on estimates of female processing factory workers (Jeebhay et al. 2008) and subsistence fishers (Branch, May, Roberts, Russell & Clark, 2002). Looking specifically at processing, women make up a much larger percentage of the workforce, with women representing 63% of fish processing plant workers in South Africa (Jeebhay et al. 2008) and 50% of seafood processors in Mexico’s Yucatán Peninsula (Salazar & Castañeda 2002). What these participation numbers do not capture are the many additional activities that women undertake to support fishing families and operations; therefore, these numbers reflect a minimum estimate.

**Management and decision-making**

Based on the above quantitative accounts and the many qualitative descriptions of gender roles and participation, women are clearly important stakeholders in the fisheries sector of these two countries, yet are often under-represented in management and decision-making. For example, in Tabasco, Mexico, women represent less than 3% of partners in the El Botadero Oyster Cooperative, despite their prominent role as processors (Pérez-Brito, Galmiche-Tejeda, Zapata-martelo, Martínez-Becerra, & Meseguer-elizondo 2012). In many cooperatives women may become cooperative members only if they are widowed and without a son over the age of 18 but are not guaranteed entry and rarely hold leadership positions (Pérez-Brito et al. 2012; Salazar & Castañeda 2002).

There is some evidence from both Mexico and South Africa suggesting that women are becoming more involved in fisheries committees and/or forming their own cooperatives and unions but progress has been slow (J. Sunde, pers. comm., University of Cape Town; Maria L Cruz-Torres, 2004; Salazar & Castañeda, 2002). For example, for women shrimp traders of Sinaloa, Mexico, their role as marketers was only formally recognized after a long struggle to gain legal rights to sell their shrimp and to form a union (Maria L Cruz-Torres 2004). When women first started selling shrimp in this region, their activities were discouraged and considered illegal. Through their collective action, persistence and resistance, these women were able to establish their own space within a strongly male-dominated industry (María Luz Cruz-Torres 2012).

**Policy reform**

In South Africa, changes to fisheries management and policy over the past decade have resulted in a struggle by all fishers and their families for access to marine resources. This has created new tensions between men and women as they negotiate these changes in the face of poverty, drug abuse, violence and food and livelihood insecurity (Isaacs 2013).
However, through this struggle, some notable progress has been made in bringing a gender lens to fisheries. The newly adopted small-scale fisheries policy marks an important step forward in terms of gender mainstreaming in the fisheries sector, as it recognizes the important role of women in fisheries and outlines gender-specific measures such as promoting the economic empowerment of women and reducing inequalities in access to and benefits from marine resources (Department of Agriculture Forestry and Fisheries 2012). While small-scale fisheries policy reform in South Africa created an opportunity for bringing gender considerations into focus, it may be some time before these measures are implemented and any real progress is made.

In Mexico there is growing recognition of the need for fisheries reform (Cisneros-Montemayor, Cisneros-Mata, Harper, & Pauly 2013) and, if acted upon, this may create an opportunity for bringing in gender measures. However, policy reform alone will not necessarily guarantee a more equitable environment. As the women shrimp traders of Sinaloa highlight, it is also through women’s collective action and agency that cultural and institutional change occurs. Therefore, efforts to promote gender equality should focus on reforming discriminatory laws and gender-blind policies, while simultaneously encouraging women to develop their own voice and leadership skills.

Conclusion

The global community is beginning to acknowledge the importance of gender equality in fisheries (FAO 2013; World Bank 2012). Countries recently endorsed a set of international guidelines for securing sustainable small-scale fisheries developed by the Food and Agriculture Organization’s Committee on Fisheries (COFI), which includes gender equality as one of its key guiding principles (FAO 2014). While these are voluntary guidelines and not all fishing countries are in support, it does provide further impetus for looking at fisheries through a gender lens and incorporating gender sensitive policies into the fisheries sector. In South Africa, small-scale fisheries policy has already taken steps in this direction and hopefully other countries such as Mexico will follow suit.

Although some important progress has been made, much still needs to be done to address gender inequalities in the fisheries sector and level the playing field so that men and women can benefit equally from this resource. With increasing evidence of the vital but often overlooked role of women in fisheries economies, and as fisheries management adopts a more holistic approach with greater emphasis on equality, gender considerations may finally gain the momentum they require to bring them into the mainstream. However, a major impediment to developing gender sensitive policies and programs continues to be the lack of quantitative baseline data needed to determine existing inequalities and to measure progress in closing gender gaps.

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References


Incorporating GIS into Socio-economic monitoring for coastal managers (SocMon)

Jehroum Wood, Kimberly Baldwin, Maria Pena and Patrick Mcconney
Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies, Cavehill Campus, Barbados

Abstract

Understanding the biological and physical parameters of coastal ecosystems and resources is vital for prudent and adaptive management. But the socio-economic context within which any coastal management initiative is undertaken also impacts its success or failure. Monitoring the nature, status and trends of socio-economic characteristics is necessary to determine the most appropriate approaches for successfully managing both the resources and the human interactions at and around the site. Socio-economic Monitoring for Coastal Managers (SocMon) is a global program which provides a practical, yet flexible, standardised methodology for collecting social and economic monitoring data for coastal management. The socio-economic information from SocMon can help managers achieve sustainable resource use by balancing protection and conservation with community needs for livelihoods, food security and equitable use of resources. Although SocMon was not designed explicitly for use with Geographic Information Systems (GIS), many of the monitoring variables are spatially based. SocMon can be enhanced through spatial representation of information by incorporating GIS, including stakeholder participation where possible. The mapping of information and
incorporation into a GIS presents an additional method of storing, analysing and representing some socio-economic variables by providing spatial references locations, boundaries, trends and changes, regarding resources, people and their interrelationships. This paper sets out research undertaken in the Caribbean on methods for efficiently and effectively assimilating GIS into the SocMon methodology to develop ‘SocMon Spatial’ as an enhanced application for coastal, marine and fisheries management.

Keywords: Caribbean, SocMon, Socio-economic Monitoring, GIS, PGIS

1 Introduction
Coastal and marine habitats are complex and very vulnerable (Rodríguez et al. 2009) and in the Caribbean, they have declined in health over the past few decades (Fanning et al. 2011). Historically, coastal regions have been heavily developed, populated and associated with a variety of uses that result in socio-economic and environmental conflicts and threats (Szlafsztein and Sterr 2007). These problems are a result of interacting anthropogenic and natural pressures that present challenges requiring prudent and adaptive management interventions. These strategies necessitate a comprehensive understanding of the socio-economic parameters that interact with the natural environment components. Socio-economic assessments provide an understanding of the social, cultural, economic and political conditions of individuals, communities and organisations (Gill et al. 2007).

1.1 SocMon
The Global Socio-economic Monitoring Initiative for Coastal Management (SocMon) provides a methodology for the collection, analysis and presentation of socio-economic information for coastal and marine management (Bunce et al. 2000). A global network of six regional coordinators supports SocMon by conducting or assisting socio-economic monitoring mainly for coastal and fisheries management and marine protected areas (MPAs) (visit www.socmon.org). Each region has its own guidelines (e.g. SocMon Caribbean) but all utilise essentially the same set of variables for measuring socio-economic features at site level. Data collected via SocMon can be applied in a variety of ways to enhance management. SocMon has the potential to benefit management by providing relevant information for enhancing our understanding of the socio-economic context within which management strategies are being undertaken (Loper et al. 2008). It can help in the assessment of present conditions and the prediction of future circumstances. These benefits highlight the importance of SocMon as a tool for improving coastal, marine and fisheries management.

1.2 Spatial representation
Geographic Information Systems (GIS) is an effective tool for environmental management due to its capacity for storing, visualising and analysing large quantities of data from multiple sources (Meaden and Aguilar-Manjarrez 2013). In fisheries, many management strategies are spatially based; for example, area closures or quota allocations for specific regions (Riolo 2006). GIS is also used as a tool to map the location and status of resources, key habitats and features of the built environment (Riolo 2006). Furthermore, GIS is widely utilised to assist regulatory zoning and marine spatial planning (Agardy 2010).
Conventional GIS applications, are criticised for their focus on biophysical considerations; downplaying the importance of the social components of management. However, Participatory Geographic Information Systems (PGIS) allow for the spatial representation of local and scientific knowledge by stakeholders using GIS (Mercer et al. 2012). PGIS can support community participation to produce socio-economic information, thereby indirectly aiding sustainable resource use and marine governance (Baldwin 2012). Yet, methods of spatial representation using PGIS have not been widely applied to enhance the global SocMon initiative.

2 Research Aim and objectives
This research explored and developed an adaptive methodology to assimilate PGIS into SocMon to create SocMon Spatial. The study contributed to Working Group 4 on ‘enhancing the stewardship’ in the Too Big to Ignore (TBTI) research partnership on small-scale fisheries (SSF). TBTI is a project concerned with improving understanding of SSF’s value and the development of research and governance capacity for addressing SSF issues. Working Group 4 is primarily concerned with social-ecological interactions, monitoring systems and stewardship in SSF. As an activity of WG4, this research explored aspects of socio-economic monitoring by providing a methodology for enhancing SocMon using a PGIS approach.

The aim of this study was to identify and test certain commonly used SocMon variables for representation in a GIS platform and develop a methodology for synthesising SocMon data into the PGIS approach.

The research had four main objectives:
- Selection of eight SocMon Caribbean variables most suitable for spatial representation allowing for incorporation into a GIS.
- Determination of suitable methods for collecting, analysing and representing SocMon data.
- Development of practical methods for integrating SocMon and PGIS to enhance coastal, marine and fisheries management initiatives.
- Creation of a demonstration module for the application of this methodology which can be employed to provide recommendations for further development and training in SocMon Spatial.

3 Study Area
There were two separate study sites: The Pile Bay study area on the west coast of Barbados; and the South Coast marine Conservation Area (SCMCA) in St. Vincent.

Different methodologies were applied at these sites to compare techniques and determine those best suited for the development of SocMon Spatial.

3.1 Pile Bay
Pile Bay is located on the west coast of Barbados and was selected as a study site due to the diverse array of activities that occur in the coastal zone. The study site contains a variety of marine resources including coral reef habitat and turtle nesting beaches. Two popular beaches there are heavily utilised by locals and visitors. As a result, recreational and tourism activities (i.e. jet ski operation, tourist accommodation, snorkelling, diving)
are prominent within the study site. Pile Bay is also characterised by fisheries activity as it contains a fishing village, landing site and fish market. The diversity of resource uses and users in this area, and their possible conflicts and threats, present many opportunities for spatial representation and analysis.

3.2 The South Coast Marine Conservation Area (SCMCA)
The South Coast Marine Conservation Area (SCMCA) is located on the south-west coast of the mainland of St. Vincent. The study site includes a wide array of resources, including: various reef fish, nearshore pelagic fish, sea turtles, sea eggs, coral reef and sea grass. The Blue Lagoon area provides nursery habitat for fish and other marine organism, adding to the diversity of ecosystems in the area. The area is of particular management importance due to the dense human population and high levels of activity present within the area. It is the main tourism hub on the mainland and contains a highly productive fish landing site. Furthermore, plans to upgrade the area to MPA status will require increased space use planning and regulation. As such, this research can explore the applicability of SocMon Spatial to MPA management.

4 Methodology
This research comprised several components in which tools and techniques applied to integrate PGIS with the SocMon methodology were assessed. The study adapted the methodologies of both SocMon Caribbean (Bunce and Pomeroy 2003 and the Grenadines Marine Resource and Space-use Information System (MarSIS) (Baldwin 2012). The Grenadines MarSIS is a PGIS that integrates marine-based knowledge to provide a database that informs coastal marine planning and management. Error! Reference source not found. outlines the main components of this study in a flow chart.
Figure 5 Components and process of the study

Eight of the 60 SocMon variables were selected for use with SocMon Spatial, based on their frequency of use in previous Caribbean SocMon studies and their inherent spatial characteristics for incorporation into PGIS. Data were collected in order to gather spatially referenced information for each selected variable. The criteria and processes for selecting SocMon variables for spatial representation were set out to guide future development.

Mapping exercises were then conducted with a variety of stakeholders using different mapping tools (i.e. 18’x 24’ poster map, 11’x 14 topographic map, 8.5’x 11’ paper maps and a laptop computer) to evaluate them for use with SocMon Spatial. The data collected were digitised and stored in their respective study area geodatabases. The data collected were later analysed using a variety of geoprocessing tools in ArcGIS before formatting and finalising the geodatabases. Attribute data fields were filled using information provided by respondents. Different geodatabase structures were used for each study area to assess the effects of structure on functionality and ease of use. Although ArcGIS is the preferred software package of many researchers and government authorities, various less costly or complicated open source alternatives were tested to determine their suitability for SocMon Spatial.

Once the geodatabase were finalised, they were converted into Google Earth (.kml file) format to allow use as a public display tool. Attribute data from the SocMon Spatial geodatabase were added directly into Google Earth map windows. Additionally, images taken during field visits were attached to map features using the Google Maps web
application and then made available on the SocMon Spatial demonstration website (https://sites.google.com/site/socmonspatialdemo) using an Application Programme Interface (API). Feedback on the product and process was later recorded during validation exercises. Additionally, respondents were provided with a link to the SocMon Spatial website and instructed on how to view the associated dataset and provide feedback on the website’s message board.

5 Findings
Following are major findings and recommendations for the use and further development of SocMon Spatial. Also listed are benefits for management that can be gained from SocMon Spatial.

5.1 Variable selection
SocMon Spatial studies conducted subsequent to the completion of a full SocMon study will have pre-selected variables. In this case the spatial relationships between these variables must be analysed in order to decide on the best geodatabase structure and if any variables necessary for spatial representation are missing. The variable selection process should follow the guidelines of the SocMon methodology (Bunce et al. 2000). However, spatial characteristics and relationships should also be considered during initial variable selection. This will guide researchers to select variables which are spatially related and allow them to develop a preliminary geodatabase structure during the initial stages of the project rather than have an inefficient add-on.

5.2 Data collection and Mapping tools
Researchers must focus on the spatial relationships between features. This spatial awareness helps to facilitate data collection and geodatabase development. Furthermore, respondents with an intimate knowledge of the area and its spatial characteristics are required (i.e. living or regularly working in the area). The efficiency of tools was tested for both the researcher and respondents. Tools were ranked based on: cost; manoeuvrability in the field; ease of collection; and data integration into ArcGIS. The primary difference recognised between the mapping tools, is ease of use. Respondents generally preferred the 8.5’x 11’ paper maps in the field. However, for indoor exercises a combination of paper maps and a laptop computer were the most effective. Mapping tools should be chosen based on the characteristics of the study. If financial resources are scarce, then the 8.5’ x 11’ paper maps provide a cheap, yet effective option. If funds are not a limiting factor then direct digital input using a tablet computer may be the best option. Exercises should be kept short (less than 15 minutes) to limit disruption of the daily routine of the respondents and allow the collection of data from more persons.

5.3 Data analysis
GIS software provides many geospatial analysis tools that can be used to interpret and manipulate spatial data. The analysis choices are left up to the discretion of the researcher and should be based on the characteristics and objectives of the study. For example, depending on the number of respondents, we used different geospatial analysis tools (Merge/Intersect) to either exclude outliers or include minority perception (Figure 2).
Figure 6 Results of different geospatial analyses ‘(Merge’ and ‘Intersect’)) on the spearfishing shapefile

For example, where only 3 spear fishermen could provide precise spatial extents of fishing areas, all 3 of their responses were included using the merge tool as intersection would only reveal two small areas that would not adequately represent the reported extent of spearfishing.

5.4 Geodatabase development

The geodatabase structure is essentially the organisation of spatial data within the database. For this study, the geodatabase design was guided by the selected SocMon variables and their inherent properties and relationships. Variable type (feature or attribute) should be determined during the variable selection process. Furthermore, the
structure of the geodatabases should be left up to the researchers, this process should be flexible and customised to suit the goals of the project.

5.5 Presentation of results
This is an integral stage of the process; the spatial data should be made freely accessible and easy to understand/use. Web-based GIS is a powerful tool that allows data to be shared with a wide range of stakeholders.

More than double the number of persons were reached through the SocMon Spatial web-map than were contacted for the entire project, in just two weeks. Visitors viewed the database page (Figure 3) for an average of six minutes and forty-eight seconds. This shows that more individuals were exposed to and engaged by the online product than were involved in the other phases of the study.

Figure 7 SocMon Spatial web map user interface (https://sites.google.com/site/socmonspatialdemo)

5.6 Benefits for management
SocMon Spatial provides the same benefits as any other SocMon study by:

- Providing socio-economic data for MPA, fisheries and coastal area management.
- Improving understanding of the socio-economic characteristics of coastal and marine resource use.
- Assisting education and decision-making efforts.
- Improving communication and information exchange between stakeholder groups.

However, the spatial nature of the data collected, using PGIS approaches can have various other benefits. Spatially referenced categorical data enhances stakeholder understanding. For example, natural ecosystem conditions and the intensity of impact from stressors both vary spatially.

In Figure 4 categorical data are used to show the relationship between variations in perceived reef conditions and pollution impacts. The visualisation of this variation can help managers to target areas and demarcate boundaries for different management strategies. This is valuable for monitoring because it allows researchers to see changes in specific areas over time and the effects of management strategies on these areas.
Figure 4 Map of spearfishing, reef condition and pollution datasets showing how categorical data can be represented
SocMon Spatial also has other benefits, for example:

- Providing information which is specifically suited to addressing spatial issues.
- Supplying a database for the storage and analysis of socio-economic data.
- Legitimising and promoting local knowledge to be used for informing decision-making.
- Establishing engaging and accessible means of representing and sharing SocMon data.

6 Conclusion
The SocMon Spatial methodology that was developed is intended to conform to the principles of the global SocMon initiative and PGIS. It closely follows general SocMon methods to assist integration into existing monitoring projects. Although this was an exploratory study, the benefits of SocMon Spatial can be easily identified. Various types of information, from a variety of sources can be incorporated into a single database and analysed to meet multiple goals. This presents a powerful tool for ecosystem based management. Also, the visual representation of socio-economic considerations can be of value for generating interest and be beneficial for engaging stakeholders. This research shows that SocMon and PGIS can be effectively integrated and that it has great potential for enhancing the SocMon initiative. As a result, further exploration and development of SocMon Spatial should be considered.

7 References
Characterization of the reef fish fishery in the National Park “Cayos de San Felipe”, Cuba

Leonardo Espinosa - Pantoja (National Park Cayos de San Felipe, Pinar del Rio, Cuba)  
Elena of Guardia (CINVESTAV- Mérida)  
Zaimuiri Hernández- González (National Park Cayos de San Felipe, Pinar del Rio, Cuba)  
Lázaro García- López (Centro for Marine Research, University of Havana, Cuba)  
Jesús Ernesto Arias – González (CINVESTAV- Mérida)  
Jorge Angulo - Valdez (Centro for Marine Research , University of Havana, Cuba)

The Marine National Park “Cayos de San Felipe” is traditionally used for reef-fish fishing by villagers from the fishing community “La Coloma”, located south of Pinar del Rio, Cuba. Recent studies suggest a scarcity big size reef-fish species of commercial value within the National Park. Scientists and fishermen opinion is that overfishing is main factor for the absence of these species. In town, there are 577 sport fishermen and 60 boats with easy access to the National Park. Although there are no catch statistics for their activities, the practice is thought to be intense and effective; as it includes spearfishing and the use of gill nets (which uses is prohibited by law). This paper presents data obtained from interviews with sport boat crew members and fishermen and form sampling of fishermen catch at landing in the fishing port “La Coloma”, or during the fishing. We analyzed the catch composition, fishing effort, and fishing gear in different areas of the park and their variations over time. To determine whether the fishing practices are sustainable, we used indicator based on fish maximum length, weight and sexual maturation in catches. This baseline information will be used to promote the conservation of biodiversity through proposing a set of modifications to the current fishing regulations and trough the implementation of adaptive management strategies for the fisheries within the National Park.
Integrated Local Environmental Knowledge (ILEK) supporting voluntary actions of fishermen toward sustainable resource and community managements

Tetsu Sato (Research Institute for Humanity and Nature)

Bottom-up actions by small scale fishermen groups are important for sustainable management of fisheries resources and improvement of livelihood and well-being of fishing communities. Many case examples of fishermen-driven management actions revealed importance of effective use of integrated knowledge base (Integrated Local Environmental Knowledge: ILEK) to visualize values and options for fishermen to promote voluntary actions toward sustainable resource management. ILEK is a transdisciplinary blend of scientific knowledge and local knowledge produced in daily livelihood of fishermen and other stakeholders. ILEK project is a 5 years research project aiming to clarify production mechanisms of ILEK and characteristics of knowledge circulation processes to support ILEK-based voluntary management of ecosystems by massive case studies and meta-analysis from over the world. ILEK project has identified important actors to promote these processes including residential researchers and bilateral translators of knowledge. Residential researchers live in local communities, and as a community member and stakeholder, conduct transdisciplinary research driven by issues local communities are facing. Residential researchers often play a role of bilateral knowledge translator in the communities by translating and bringing scientific knowledge and values into local community members and, at the same time, translate local knowledge among stakeholders to scientific languages, actively mixing different knowledge systems to form ILEK. In this talk, I introduce the conceptual framework of ILEK-based voluntary actions for sustainability and the roles and functions of these actors in the real world examples where fishermen and members of fisheries association play the role of residential researchers and translators.

Governance of “Satoumi” in coral reefs - To harmonize conservation and sustainable fisheries

Shinichiro Kakuma, Okinawa Deep Seawater Research Center, Japan
kakumsh@pref.okinawa.lg.jp

Abstract
Coral reefs and fisheries resources have been devastated in Okinawa similar to many tropical and sub-tropical countries. Major threats to the coral reefs in Okinawa include bleaching, crown-of-thorns starfish, and anthropogenic influences such as soil runoff and excessive nutrients. Catches and stocks of coral reef fish have decreased greatly in the last 30 years mainly because of over-fishing. To conserve the coral reefs, one option is to
protect pristine wilderness from all human impacts including fisheries. However in many cases, this would deprive local communities of essential ecosystem services and often of their livelihood, and would not be a realistic option. It is thus essential to harmonize the coral reef conservation and the sustainable use of the resources, especially in Asia-Pacific. Satoumi concepts are useful to realize this. The Satoumi experiences in Okinawa illustrate a number of good practices for managing biodiversity and fisheries resources in reef ecosystems under significant anthropogenic influence. Besides technical, cultural or ethical aspects, governance aspects of Satoumi are important. Village residents in Okinawa rely on the fishery resources inside the reefs as commons. However, as many sedentary resources are subject to common fishery rights, professional fishers in the fisheries cooperative associations have the right to harvest them. This complicated resource use system should be rearranged to create Satoumi. Marine Protected Areas (MPAs) could be good tools to create Satoumi, and Okinawa has many MPAs which have been governed by local fishing communities.

1. Introduction
“Sato” means village and “umi” means the sea in Japanese. So Satoumi means “village seas” literally. However the most widely used definition of Satoumi is “High productivity and biodiversity in the coastal sea with human interaction” by Professor Tetsuo Yanagi in Kyusyu University (Yanagi 2007). Indifferent to the definition, there are so many Satoumi in Japan. For example, in a Fisheries Agency project, there are 700 groups who worked on Satoumi activities all over Japan in 2013. The Secretariat of the Convention on Biological Diversity published Technical Series No. 61 which features 10 Satoumi case studies in Japan including Okinawa (Kakuma and Kamimura 2011). The ecosystem targeted in the Okinawa case study was coral reef ecosystem.

2. Anthropogenic threats to the ecosystem and the resources
Some of the anthropogenic influences of greatest impact include increase in soil runoff, excessive input of nutrients and chemical substances, land reclamation, dredging, illegal harvesting of coral, fisheries, aquaculture, and excessive tourism. Powerful natural influences include typhoons, massive coral bleaching, predation damage by crown-of-thorns starfish and shellfish, and diseases. Coral bleaching and the increasing magnitude of typhoons are associated with climate change, and it is possible as well that crown-of-thorns starfish outbreaks and the spread of diseases are the indirect impact of human activities. These phenomena might be viewed as anthropogenic influences as well.

1) Redo-soil runoff
So-called red soil pollution is a grave environmental problem in Okinawa. Massive runoff of the red-coloured soil found on Okinawa, Ishigaki and Iriomote Islands has increased, one of the reasons being coastal development. The red soil does not contain toxic components but massive quantities of red soil flow into coastal waters, silting over the reefs. Even small quantities are sufficient to stress the coral which secretes mucus in response. Clouding of seawater by red soil, moreover, adversely affects the photosynthesis of zooxanthella, microorganisms that have a symbiotic relationship with
the coral. Furthermore, coral larvae cannot settle to the ocean floor if it is covered in red soil sediment.

The guiding principle of red soil pollution countermeasures is preventative measures at the pollution source. In 1995, Okinawa Prefecture instituted the Okinawa Prefecture Red Soil Runoff Prevention Ordinance. Red soil pollution associated with development has apparently decreased due to this ordinance, but runoff from farmland and other areas continues. For this reason, agricultural management-related measures must be strengthened (Nakasone and Kimura 2011).

2) Excessive nutrient
Growth of *Acropora* corals was found to be poor in marine areas where there were high concentrations of nutrients. Coral reefs ecosystems have adapted to nutrient-poor environments, so the influx of excessive land-based nutrients is a serious problem. Although the direct effects of the nutrient influx on coral are not fully understood, it is known to favour phytoplankton development, which clouds the water, and the excessive nutrients results in increased algae growth as well. As algae and coral compete with one another, the algae propagate, and the coral reefs go into decline.

3) Overfishing
Catches of coral reef fish species such as *Lethrinidae, Serranidae, Scaridae, Caesionidae, Siganidae* have decreased by half in the last 15 years in Yaeyama district of Okinawa. Not only have catches declined, CPUE (catch per unit effort) has fallen and resources have diminished. Although over-fishing is probably main cause, coral reef degradation is also thought to be responsible. For this reason, there is a pressing need for fishery resource management, including in the form of Marine Protected Areas (MPAs).

Thus, the conservation of coral reefs and the management of fishery resources are central issues in Okinawa’s Satoumi. While “passive” measures such as curtailing red soil and excessive nutrient input from terrestrial areas and imposing catch limits are strategic pillars of conservation efforts, “active” measures involving direct human intervention are needed as Satoumi activities.

3. Harmonize conservation and sustainable use
There is wide consensus that coral reef ecosystem conservation is essential and even vital for many coastal communities around the world, and is a critical aspect of global marine biodiversity preservation as well. There is, however, considerable debate on the best way to achieve this, with at one end the view that natural wilderness environments, protected from all human impacts should be sought for the protection of biodiversity. For this purpose, “fisheries” should be strictly restricted (Pandolfi et al. 2003). In many cases, this would deprive local communities of essential ecosystem services and often of their very livelihood, and would therefore not be a realistic policy option. It is thus essential to harmonize the coral reef conservation and the sustainable use of the resources, especially in Asia-Pacific. Satoumi concepts are useful to realize this. The Satoumi experiences in Okinawa, although still work in progress, illustrate a number of good practices for
managing biodiversity in reef ecosystems under significant anthropogenic influence. It is hoped that they may be of use for the management of similar ecosystems around the world.

4. Activities and their outcomes

1) Seaweed culture in Onna Village

In Onna Village on the main island of Okinawa, fishers are engaged in aquaculture of seaweed, especially Mozuku (\textit{Cladosiphon okamuranus} & \textit{Nemacystus decipiens}) for much of their livelihood. Mozuku aquaculture, where nets are stretched over sandy bottom areas of moat, enhances the biodiversity of those areas not only by providing habitats for small organisms such as shrimp that live among the seaweed, but also by providing food for fish such as rabbit fish (\textit{Siganidae}), which feed on Mozuku. The fishers also propagate Mozuku seedlings, maintaining the water level by enclosing some areas of the tidal flats with sandbags, rocks or other material. This forms seagrass beds, and the biodiversity of the area is clearly greater than in the tidal flats surrounding them. A further initiative is coral aquaculture, planting corals on the top of iron bars in sandy areas. If coral grows, small fish congregate and the biodiversity of the areas is enhanced. Although some of the new growth are cut off and used for restoration of coral reefs, it is anticipated that this initiative will also function to supply larvae to the surrounding areas, as the cultured coral spawns.

2) Stone weir in Shiraho village

The use of \textit{ishihimi} (stone weir) in Shiraho village on Ishigaki Island is another example of “enhancing productivity and biodiversity through human interaction”. \textit{Ishihimi} are the infrastructure of an ancient fishing method where rocks are piled up in walls on the tidal flat or in shallow areas of the coral reef in order to use the tides to catch fish. Replaced by more efficient net fishing techniques, this method had almost sunk into obscurity. Recently, however, the technique has been reconsidered for its value for environmental education and interest to tourists, and thus a movement has emerged to revive this fishing method. \textit{Ishihimi} do not merely function as fishing infrastructure, they also enhance biodiversity as the crevices of the piled up rocks create habitats for a variety of organisms. The algae that grow densely on the rocks attract sea life that feeds on it, which in turn causes fish species to increase in the area. A study conducted by WWF Japan confirmed that in the \textit{ishihimi} areas, shellfish and fish species have increased.

The International Stone Tidal Weir Summit in Shiraho - Creating Satoumi - was held in Shiraho in 2010. Stone tidal weirs are found outside Japan, including in Taiwan, South Korea, the Philippines, France, Spain and Micronesia. Therefore, this summit was intended to be a conference where people from all over the world who are associated with this fishing gear can share their experience and discuss the relationship of such approaches to the Satoumi and ecosystem.

3) Eradication of Crown-of-Thorns Starfish (COTS)

Starting in the 1970s and continuing through the 1980s, COTS outbreaks occurred throughout Okinawa, severely damaging the corals. Eradication projects failed to protect
the corals, and the objective of the projects now is not to kill masses of this starfish, but
rather to protect the precious corals. Conservation areas of greatest importance have been
designated for each marine area; and in these locations, the efforts for thorough
eradication are concentrated there. These eradication activities could be called Satoumi
activities because productivity and biodiversity in the coral reef areas would be enhanced
by human interventions.

In the 1980s, the coral of Yaeyama marine areas was also devastated by predations of
COTS. The coral recovered afterwards, but another outbreak occurred around 2008.
Eradication efforts (mainly by fishers and diving associations) had taken, with 65,000
starfish killed in 2008 (20 times the number killed in 2007), and 96,000 killed in 2009.
The basic eradication policy in Yaeyama is to focus extermination efforts on priority
marine areas. Nevertheless, the marine areas of Yaeyama are vast, so focusing on areas of
high priority is no easy task, and this is complicated by the different preferences of fishers
and divers. For example, while fishers may be inclined to eradicate starfish in fish
spawning grounds set in MPAs, divers would prefer to protect diving spots dotted
throughout the vast Yaeyama marine area that they use frequently. The Yaeyama COTS
Eradication Committee was established to link many eradication projects together and to
select high priority marine areas. Then fishers and divers joined forces to intensively and
continuously eradicate the starfish.

4) Commons and fishing right systems
Essential aspects of Okinawa Satoumi include commons and local rules. “Commons” are
resources that are shared and used by local people; “local rules” refers herein to resource-
use regulations that are autonomously determined by local communities. Okinawa’s
Satoumi feature ino, or moat, shallow, calm waters located between the offshore coral
reefs, where the waves break, and the shore. Since old times, professional fishers have
harvested their catch in the outer seas, while village residents relied on the fishery
resources of the ino inside the reefs as commons, and have led a semi-agrarian-, semi-
- fishing-reliant lifestyle. This commons-type usage is practiced even today, particularly in
the remote islands. On the other hand, as many sedentary resources are subject to
common fishery rights, members of fishing cooperative associations (FCAs) have the
right, in principle, to harvest or capture them. This has greatly complicated the
relationship between traditional customs regarding the ino and the fishery right systems.
Legal and governance aspects must hence be considered, in addition to technical issues,
for the enhancement of productivity and biodiversity in the ino. For this reason, the local
people, who are the most closely involved with the ino, must create local rules and
observe them.

5) Managing fishery resources by way of MPAs
From 1998-2002, in order to allow fishery resources that had declined to recover, the
fishers of Yaeyama managed resources through the establishment of Marine Protected
Areas (no-take zones), targeting Pacific yellowtail emperor (Lethrinus atkinsoni), one of
their most important resources. Furthermore, in 2008, as catches not only of Pacific
yellowtail emperor, but of all coral reef fish species fell dramatically after this
management was discontinued, a new fishery management programme was launched. The cornerstones of this programme are MPAs and fish size limitations.

The number of the target fish species increased significantly, not only the Pacific yellowtail emperor, but also the most important species such as grouper (*Serranidae*). Fishing was prohibited during the main spawning season, from April to June. The number of MPAs increased, from the previous four main spawning grounds to five, expanding the total marine area to five times its previous size. Past resource management of the emperor fish had not resulted in a full recovery of the resource. One possible reason for this is that the total MPA area was too small. Increasing the size of the area was significant in achieving restoration.

A feature of this type of resource management is that not only professional fishers, but also recreational fishers and divers work together to manage the resources. In addition to familiarizing people with resource management through posters and mass media, the fishers hold discussions with diving associations and request divers to cooperate by not entering MPAs.

The management of boundary buoys and surveillance are important in terms of giving teeth to the rules against entry to MPAs. Surveillance has conducted by the FCA youth group. FCA regulations have provided that “violators must pay fines equivalent to five times the value of takings for that day.”

Thus in Okinawa, MPAs function to protect fishery resources through self-imposed rules set by FCAs. A feature of the MPAs that should be noted is that they do not offer protection throughout the whole year, but only temporarily, such as during spawning seasons or periods when juvenile fish aggregate.

**References**


Depletion of sea cucumbers in Isla Arena may have enhanced local governance to promote resilience in the Social-Ecological System

Pável Galeana Guarneros (Ecosur-Campeche)
Francisco Gurri (Ecosur-Campeche)

This document describes the self-organizational process that took place in Isla Arena, located in the Campeche Bank, after the depletion of sea cucumbers (Holothuria floridana). This fishery had only been opened two years between 2011 and 2012. Isla Arena is a small coastal community located between two Biosphere Reserves in the north of the Yucatan Peninsula where people depend exclusively on fishing. We document how the perception that the depletion of H. floridana generated negative ecological and social impacts affecting other fisheries, promoted local collective action to extend a ban on cucumber fishing indefinitely. Ecological impacts were expressed in terms of a reduction in the local catches, and the intrusion of fishermen from outside the community, and pollution were listed as negative social outcomes. Because of the profitability of this fishery, not everyone in the community is happy with the current situation. The motivations behind each of the disputing groups will be discussed during the presentation.

Challenges in applying the ecosystem approach under data scarcity: the case of the grouper (Serranidae) fishery in northern Quintana Roo, Mexico

Felipe E. Sosa-Cordero (El Colegio de la Frontera Sur);
Angélica Ramírez-González (El Colegio de la Frontera Sur);
Bertha Aguirre-García (El Colegio de la Frontera Sur);
Giezi M. Yam-Poot (El Colegio de la Frontera Sur)

The grouper fishery in Quintana Roo, also known as the Mexican Caribbean, exhibits strong geographical differences in target species, fishing pressure (fleet size, number of fishers) and development. In northern Quintana Roo the continental shelf is greater and coral reefs are reduced, compared to south and central Quintana Roo. In this work we address the problems arising when we attempt to apply the ecosystem approach to fisheries –after FAO, in northern Quintana Roo. To deal with data scarcity, we rely on the local knowledge of the fishers, and also we conducted a short-term data collection, during July-September 2013. Both sources of information yielded an unexpected amount of knowledge at local level. According to the fishers, there are 21 sites where the groupers form spawning aggregations. The grouper catch was composed by 15 species, with four species amounting 86.3% in number of the sample (n= 2088) of fish: red grouper Epinephelus morio (55.5%) gag Mycteroperca microlepis (12.4%), black grouper M. bonaci (10.7%), and warsaw grouper E. nigritus (7.7%). We identify three types of fleet:
artisanal-coastal, artisanal-open water, and semi-industrial. Based on our results, we obtain some advances in our primary purpose: the application of the ecosystem approach in this local fishery. We discuss some salient features of this fishery, based on our findings, and delineate the following steps, which includes to devise actions in fishery monitoring and resource appraisals, as well as to promote the involvement of fishers, fish distributors, and management authorities of the federal and state government.

Regular Session 6.1: Multiple-use/multi-stakeholders governance

Fisheries, tourism and marine protected areas: conflicting or synergistic ecosystem services?

Priscila F. M. Lopes (Federal University of Rio Grande do Norte)
Shirley P. de Souza (Federal Institute of Sao Paulo)
Mariana Clauzet (University Santa Cecilia)
Renato A. M. Silvano (Federal University of Rio Grande do Sul)
Alpina Begossi (University of Campinas)

Most of the coastal degradation has been caused by anthropogenic actions, threatening the ecosystem services (ES) humans depend upon. A solution could be the protection of specific ES, such as biodiversity, through Marine Protected Areas (MPAs), although that could potentially lead to conflicts with fishers and tourists. We analyzed the possibility of building on the use of the three main ES (fisheries, coastal tourism and biodiversity provisioning) provided by the Paraty bay (SE Brazil), to increase synergy among them and to decrease their negative interactions. We sampled fish landings (n=823) in three villages and performed multiple rounds of interviews with fishers and middlemen regarding fisheries, tourism and conflicts with the MPA. Fishing production was high (average of 9.25 ton/fish/day) and could be more profitable, if not for a faulty market chain. Tourism was a non-conflicting activity, and if done by fishers in permitted areas outside the MPA, could benefit both fisheries and biodiversity conservation, by reducing the time fishers allocate to fishing and by attracting visitors for wildlife viewing. Also, fishers involved with coastal tourism showed a higher average income than the ones who practiced only fisheries. Hence, in order to assure that ES services are not conflicting it is recommend that users benefit from more than one service and that management considers the efficacy of the market chain. Building on a service that is likely to benefit others, such as inclusive tourism, could be a key to profitable and sustainable use of coastal ecosystem services.

Marine Protected Areas and Maritime Heritage in the context of tourism: the new frontiers for Fishers and fishing villages in the Yucatan Peninsula
Tourism is not new in the Yucatan Peninsula. During the last fifteen years, all fishing villages have experienced changes within their economic dimension by increasing the third sector (services, leisure travel and nautical tourism). This is an analysis of what happened in six communities, within the three states of the Yucatan Peninsula, and the local perception of fishers enhancing their transition from artisanal fishing towards tourism services. This work provides a better understanding about the changing role of local communities in different temporal scales in the context of fast coastal urbanization growth. From a perspective of maritime anthropology to understand how the new generation of fishers takes advantage of tourism services in the frontiers of mass tourism and alternative tourism. While federal programmes push the ideas and financial support in several communities to change these areas to get the infrastructure, not for fishing capture, but for services in natural protected areas. Specifically a long term vision from Isla Arena in Campeche, Tulum and Xcalak in Quintana Roo, and Celestun, San Felipe and Rio Lagartos in Yucatan, all of these communities need to reevaluate the maritime heritage like other communities in the world. This communication with a geographical scale and from a social anthropological analysis will take the debate of "community", fishers specialization and rapid urban coastal areas growth that need to be reconceptualised from our methodological and theoretical views.

Conflict between small-scale and industrial fisheries: When does national policy help or hurt?

Margot L. Stiles (Oceana)
Michael F. Hirshfield (Oceana)
Amélie Malafosse (Oceana)
Javier Lopez (Oceana)
Jon Warrenchuk (Oceana)
Ben Enticknap (Oceana)
María José Cornax (Oceana)
Jamie Cotta (Oceana)
Stacy Beharry-Baez (Oceana)
Jenna Henderson (Oceana)
Charlotte Grubb (Oceana)

400 million people suffering from hunger live in major fishing countries. In many of these places, ensuring the productivity of small-scale fisheries is the key to providing livelihoods to address this global challenge. We draw on case studies from México, Perú, Senegal, South Africa and Vietnam to compare governance solutions to conflict between small-scale and industrial fisheries and assess their effectiveness. Though many countries
reserve a nearshore boundary for exclusive use by small-scale fishers, that boundary is widely ignored. Government solutions to this problem range from improved enforcement to additional limitations on gear, improved management of industrial fleets, reduction in industrial fishing effort, with varying levels of results. Oceana conducted interviews with stakeholders and government representatives in each of these countries during 2014 to evaluate the current state of small-scale and industrial fisheries management and compare policy solutions which ensure access for small-scale fishing communities. These interviews were undertaken by Oceana in partnership with many organizations and support from the Rockefeller Foundation.

Mediations across co-management interfaces: revealing interests and accountabilities through conflicts over small scale fisheries in the Kei Islands, eastern Indonesia

Dr. Dirk J. Steenbergen (Research Institute for the Environment and Livelihoods, Charles Darwin University, Australia)
Prof. Leontine E. Visser (Sociology of Development and Change Group, Wageningen University, The Netherlands)

Contemporary co-management initiatives directed towards small scale fisheries (SSF) widely seek participation of resource-dependent actors to develop and implement frameworks which enhance resource governance, livelihoods and local empowerment. These frameworks often spring from collaborations between technical agencies and local communities, and typically set out how rules are made, sanctions are passed and conflicts are resolved. The success or failure of SSF governance is thus often considered a reflection of a particular framework design, where the role of technical organizations is assumed as ‘limited to facilitation’. In this paper however we argue that technical agencies are equally interested stakeholders. Assessments therefore need to acknowledge more the pivotal relationships that form to link technical agencies with communities and that translate frameworks into on-the-ground management.

The functioning and strategic manoeuvring of actors involved in a participatory SSF management program in eastern Indonesia is examined in the context of three conflict case studies. The case studies provide opportunity to examine actor behaviour and decision-making in polarised settings, whereby otherwise unnoticed interests and accountabilities surface.

The cases illustrate (i) how an NGO’s local presence is defined largely by its investments in particular links to people and/or local institutions that enable targets to be achieved, and (ii) how local actors on their part prioritise specific (horizontal) relationships over other (vertical) relationships according to their aspirations, cultural norms and institutional accountabilities. Drawing from these cases we identify how local resource-users and technical agencies utilise particular relationships and how this in turn gives resource governance its local form.
Tangled in their own safety nets: Fijian small scale fisher’s responses to fisheries resource scarcity

Patrick Sakiusa Fong (The University of the South Pacific)

Surrounded by vast fishing grounds coupled, with the availability of limited resources and opportunities in small island developing states, small scale fisheries play an important role on the livelihood and economy of the local people. However, for SIDS such as Fiji, this overdependence on the sector and poor management over the years have resulted in the decline in fisheries resources. One of the major concerns arising from this crisis is its negative impacts on the people that depend on small scale fisheries. In this context, the goal of this research is to address the current fisheries crisis by providing a more policy-relevant analysis of fisheries resource scarcity and its social impacts on the local people, and simultaneously help the sector continue contributing to its pro-poor functions in SIDS. The study use a combined resilience-wellbeing framework to capture the human dimensions of the fisheries crisis and better understand the consequences that this crisis and the policy responses it has triggered, have on the lives of the people who depend on fish-related activities in SIDS. Recommendations based on the research findings can provide a way forward on addressing the fisheries crisis.

Moving beyond employment figures: The livelihoods of small-scale fishers in Mexico, Peru, Senegal, South Africa and Vietnam

Charlotte Grubb, Marine Economist, Oceana egrubb@oceana.org
Margot Stiles, Director of Science and Strategy, Oceana mstiles@oceana.org

Abstract
955 million people do not have enough food to eat and 400 million hungry people live in major fishing countries (FAO, 2009). On a global basis, a fully productive ocean could provide one meal/day for 700 million people, or 13-15% of the animal protein produced on the entire planet (FAO, 2010). Here we discuss the relationship between livelihoods and small-scale fisheries as well as the implications for equity in the distribution of benefits. With the central concept of resilience as a proxy for sustainability, we assess how identified vulnerable populations are affected by changes in the fishing landscape. We use Oceana’s research in the five countries of Mexico, Peru, Senegal, South Africa and Vietnam to highlight key trends and insights useful for other small-scale fisheries around the globe.

The total value of global fisheries is between $225 and 240 billion per year, with a larger estimated multiplier effect for secondary economic activities in developing countries (Dyck, 2010). There are a total of roughly 260 million (+/- 6 million) people involved in
global marine fisheries, of which about 22 million (+/- 0.45 million) are small-scale fishers (Teh & Sumaila, 2011). As small-scale fisheries comprise a large source of food and income globally, it is important to understand the dynamics of livelihoods and fisheries. Here we describe the vulnerability profile of small-scale fishers in Mexico, Peru, Senegal, South Africa and Vietnam through a cross-comparison of key characteristics.

**Introduction**
Rising standards of living and increasing urbanization are also increasing demand for food, especially demand for animal protein, at about twice the rate of population growth. The demand for food is projected to increase 70 percent by 2050 (FAO, 2009). An often overlooked solution to this problem is our oceans. A fully productive ocean could provide a nutritious meal daily for up to 15% of the planet (FAO, 2010). Moreover, wild-caught ocean fish has several advantages compared to other sources of animal protein: it uses no land; needs negligible amounts of water (for processing only); is the lowest cost per pound to obtain; and provides human health benefits.

Critical to gaining a more comprehensive understanding of how to address this issue of food security is to understand the relationship between livelihoods and small-scale fisheries. In order to do this, we explore the concept of vulnerability across the countries of Mexico, Peru, Senegal, South Africa and Vietnam to try and highlight key trends insights useful for other small-scale fisheries around the globe.

In our comparison, we look at highlights in the following topics: relevant economic history, key demographic trends, poverty indicators, value of fisheries, trade patterns, domestic fish consumption levels, employment figures, food security and livelihoods. Employment figures are often used to explain the link between fisheries and livelihoods. This presentation tries to move beyond employment figures to capture a more comprehensive portrayal of the role that fisheries play in livelihoods around the globe.

**References**


Special Session 6.2: Innovative approaches to improve management of small-scale fisheries: Challenges and opportunities
Organized and chaired by: Silvia Salas, Cinvestav, Mexico and Charles Steinback, Point 97 –ECOTRUST, USA

Synopsis:
Effective management of small-scale fisheries requires a variety of information types. For these types of fisheries, it has been questioned the benefits that technology can generate. In this session, we want to show how technologies are advancing opportunities for assessment, management and operation of small-scale fisheries and shrinking the risk for small-scale fishers typically shoulder –from fishery related data collection to vessel monitoring systems to improved hookah systems- fishers can optimize systems to better support fisheries resource management efforts. In this context, efficient technologies that accelerate data collection, monitoring, and analysis can make a difference. Trends incorporating traditional or local knowledge in addition to scientific knowledge also come into play, creating a rich data management environment that ensures a holistic assessment and encourages management of the fishery as a whole. We make emphasis of fisher’s participation in the development and implementation of different tools that can generate benefit of accessing historical trip data for fishers and managers, which can help them for adaptations in their fishing practices, development of strategies for fishing, and implementation of viable management strategies. The session includes seven talks presenting cases studies from 20 fishing communities from Mexico and USA where development and application of technology showed to have a positive impact on small-scale fishers and in the assessment and management of the fisheries they depend on. Talks will be followed by a general discussion where challenges, opportunities and ways forward will be debated.

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Duration of the session: 2 hours
Digital Deck: An Impact Technology Solution for Mobile Fisheries Catch Reporting for United States Virgin Islands and Puerto Rico

Charles Steinback, Point 97- ECOTRUST, USA

For Caribbean fishermen and fisheries managers, striking a balance between economic opportunity and resource management, boils down to the timely access and use of data, a key factor missing with the collection and processing of paper catch reports. To fill this gap, Point 97 worked closely with local fishermen and resource managers to develop Digital Deck: an electronic catch report platform designed to transition legacy, manual, and error prone data collection practices into reliable fishery harvest data. With an easy-to-use interface via cell phone, tablet, or computer, Digital Deck enables fishermen to digitally collect harvest data and transmit the data to fisheries managers. Tracking fish harvest in near-to-real time ensures that fisheries managers can assess current season harvest activity in relation to established Annual Catch Limits. Fishermen have the added benefit of accessing their historical trip data to track and inform business planning. Over time, Digital Deck can promote collaborative fishing efforts among fishermen, better tracking and management of fisheries data, and increased market value to seafood, while empowering fishermen to make better harvest decisions. In collaboration with the Caribbean Fisheries Management Council, NOAA, USVI DFW, and PR DNER, the platform produced over 500 catch reports from over 20 St. Croix, St. Thomas, and Puerto Rico fishermen between November 2013 and May 2014. As plans for program expansion and technology enhancements take shape, Point 97 shares in-field insights to support ocean and marine resource management in operationalizing a data-driven environment to build deeper, sustained impact.

Interdisciplinary approach for the development and implementation of a vessel monitoring system for small-scale fisheries

Silvia Salas, Euan- Cinvestav- Recursos Merida, Mexico; J., R. Atoche Tecnolóógico de Mérida, Mexico; V. Mendoza Plenumsoft, Mexico, A. Muñoz, Universidad Riviera, Mexico

Information on spatial and temporal distribution of fishing effort is required to improve assessment and management of small-scale fisheries (SSF), especially given the wide spread areas were they operate and land catches along the coast. Vessel monitoring systems (VMS) have been set up at industrial fleets in many countries for this purpose and in order to reduce illegal unreported catch (IUC); application on SSF is however still questioned. In addition to the cost, acceptance of fishers and characteristics that can fit requirements for small boats have been seen as limitations. The implementation process of these systems demands collaborative actions among fishers, scientists and industry
working in innovative developments. This interaction is usually difficult, as interests, technical language and aims hardly council. Efforts in this direction were taken from a local initiative in the southeast of Mexico for the development and implementation of a pilot assessment of VMS for small-scale fisheries. Technical capacities of software and hardware of people from industry combined with fisheries science from academia and practice involving fishers and managers enabled a three years project. The devices developed were tested in 21 fishing communities of four states involving 40 fishing organizations. The effect of a triple helix concept usually is used when it comes to innovation developments, here we emphasizes that participation of fishers from the design to the implementation, which was one additional and important component on the innovative process and the success of the pilot test. The use of VMS in SSF can help not only for assessment and management of SSF but also can help to promoting safety at sea, sensitizing fishers on security, and providing information on fishing effort distribution for coastal planning (implementation of protected areas, allocation rights, etc.). The process, challenges and required adaptations during the development and implementation are presented and discussed; ways forward are also exposed.

**Evaluating risk on human health and resources sustainability in a lobster fishery of Yucatan, Mexico: combining local knowledge and technology**

Oswaldo Huchim-Lara; Salas Silvia Cinvestav- Merida, Mexico; Chin Walter- UCLA Gonda Center for Wound Healing and Hyperbaric Medicine, USA; Fraga Julia- Cinvestav Merida, Mexico

Worldwide, millions of people find in fisheries a source of income and food; however, workers of this industry have higher mortality and morbidity rates than those of any other occupation. Diving with *hookah* system (HS) as fishing method represents an important health risks for fishermen worldwide, this risk could increase when target specie availability decreases. A study was undertaken in a lobster fishing community of the eastern Yucatan coast to identify health problems due to fishing method. A combination of tools was used in the field so that traditional knowledge and fisher’s perception were captured through focus groups and data from fisher’s dives during their fishing journeys was recorded using a Sensus Ultra (Reefnet Inc.) dive computers. Fishermen testimonies were recorded, coded and analyzed with the constant comparative method drawn from grounded theory. Fishermen described decompression sickness as the main health issue they face. This problem has been associated to dive in deep waters and long time spent underwater, both actions implemented by fishermen in order to make trips profitable, especially when facing resources scarcity or when changes in market demand. Results from data collected with computers on the other side, showed that fishermen exceeded recommended diving norms. It was found a positive correlation between catches to maximum depth and total bottom time. From 120 dives, 24% of dives exceeded the no-decompression limit. Average speed for 319 ascents was 20.28 FSW/min, 5% exceeded the recommended speed. Hence, fisher’s perception was confirmed with field work using
the computers; results from the computers were shown to the fishermen. From the focus groups results it was observed that fishers could not be clear how changing their dive patterns and the conditions of their HS could be associated to health problems, they believe improvements on the fishing method were unviable. Socio-economic factors such as market demands, scarcity of catch, and financial stress seem to contribute to high-risk diving behavior and decompression stress. In this context, the use of technology to create awareness can be a way to move in cases of high risk, like diving. Working close to fishermen and bringing back results of research could contribute to change mind setting regarding risk in fisheries.

**User-friendly hookah system adaptations to improve fishermen health. What can we learn?**

Walter Chin - UCLA Gonda Center for Wound Healing and Hyperbaric Medicine, USA, Huchim-Lara Oswaldo, Silvia Salas, Julia Fraga- CinvestavMerida, Mexico

The hookah system (HS) is worldwide used as fishing method for harvesting marine resources. An advantage for fishermen while using this system in contrast to other diving systems is the unlimited time they could have to spend underwater for caught fish, described as a risk factor to develop decompression sickness. Another health problem linked to the HS underlies onboard is the presence of carbon monoxide (CO). Recognizing that health is an important door to have access to fishermen and their cooperation a process of intervention to measured and adapt the effect of HS on fishers health in Yucatan Mexico is presented here. The process took place by: collecting information in the field, session with fishermen in focus groups, and finally intervention with the participation of the same fishers. Information collected during the 2013-2014 lobster fishing season at the Yucatan coast, showed that 90% of volume tanks of HS tested had CO levels over the limit allowed. Authors conclude that possibly many cases of CO poisoning were underdiagnosed because the similitude of symptoms with decompression sickness. A prototype of the HS was developed in lab and adapted in the field using simple and low cost materials to reduce CO levels. The levels of CO were measured before and after intervention. During fieldwork fishermen was involved to get the parts and handwork and watch measurements. The tests showed that close of 80% of CO were reduced in the HS that were adapted in the field. Fishermen were present during the process and could confirm the changes obtained in CO levels. It is stressed here that a simple intervention can improve health of users and involvement to improve their health and wellbeing could increase their participation in studies of this and other kinds.

**Using technology for community building: smartphones and Facebook**

María José Espinosa-Romero and Jorge Torre. Comunidad y Biodiversidad, A.C. Guaymas, Sonora, Mexico.
The use of technology in small-scale fisheries (SSF) has contributed to make fishing operations more effective, less costly and safer. Technology is also being used in SSF to accelerate the process of generating and sharing information that supports fisheries management. This work focuses on the use and perceived impact of smartphones, particularly the use of Facebook in SSF. In Mexico, as in all countries, the use of smartphones is spreading: 34% of the population has reported to use smartphones and 70% are using it to have access to social networks. Small-scale fishers are acquiring and getting more familiar with the use of this technology. Fishers are particularly using smartphones and social networks (mainly Facebook) to share experiences with other fishers on responsible fishing and marine conservation practices, as well as to share information on species, catch, new events, and new projects. This has resulted in a well-communicated community of stewards of the sea, which was challenging before giving the isolation of most coastal communities.

A new tool to enhance the stewardship of the Mexican small-scale fisheries in the Gulf of Mexico

Jiménez-Badillo Lourdes1, Galindo, C.G.1, Quiroga B.C.2, Gómez, O. G.3, Mendoza, C.M.6, Acosta J.J.1, Pérez, S.E.4, Pérez, C.R.7, Perera, G.M.51 Instituto de Ciencias Marinas y Pesquerías, Universidad Veracruzana, 2 Centro Regional de Investigación Pesquera en Veracruz, Instituto Nacional de Pesca, 3 Centro Regional de Investigación Pesquera en Tampico, Instituto Nacional de Pesca, 4 División de Ciencias Biológicas y Agropecuarias, Universidad Juárez Autónoma de Tabasco 5 Unidad Los Ríos, Universidad Juárez Autónoma de Tabasco, 6 Colegio de la Frontera Sur, 7 Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma de Tamaulipas.

Most of the fisheries in México are of small-scale nature, which use multiple fishing gears and catch multiple species, condition that makes difficult their assessment and management. People in the coastal area whose livelihoods depend on this activity face every day the decline of the fisheries resources and their earnings. Fishing regulating tools and management strategies are limited and insufficient. The minimum necessary information to support the stock assessment and fisheries is punctual, dispersed, scarce, concentrate in a few species or locations, and in some cases, even not available to decision-makers. A Geographic Information System for small-scale fisheries was designed with the aim to facilitate access to wide and compiled information over coastal fisheries. This information can facilitate manager’s decisions, the tasks for scientists and student research and in any other use that stakeholders could demand for resource management actions. This tool, could contribute to concentrate different kind of information (environmental, biological, ecological, economic, social, cultural and geopolitical) in one place, with friendly access to query and get response in form of maps, tables, graphs, photos, etc. that can easily be interpreted visually. The system can help for
a better understanding of the small-scale fisheries complexity, to identify information gaps, to evaluate the effect of the decision-making actions and more. The system can be maintained and improved according to the needs of users, who also can contribute with more information to update the system permanently. The process to achieve the goal and the options it offers are presented and discussed.

Special session 6.3: Governing the governance (Part 2)
Organized and chaired by: Svein Jentoft Norweigian College of fishery science, University of Tromso, Norway) and Ratana Chuenpagdee (Memorial University, Canada)

Fisheries governance experience is generally one of failure and disappointment. Despite decades of efforts, we are not doing a good job in achievable sustainable fisheries goals. Fisheries resources are in peril, large segments of the industry are in crisis, and people whose livelihoods depend on them are negatively affected. How can this be? Why do these problems persist? Does the effort lack the needed resolve, or could it be that fisheries systems are inherently complex and difficult to govern? Or is it because the governing institutions are simply not up to the task? Drawing examples and experiences from small-scale fisheries governance around the world, papers in this session aim to address these questions through interactive governance and governability lens, as they apply to the challenges facing this sector. The session is organized as part of Too Big To Ignore, Working Group 6.

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Now, where do all the fish go?" The impacts and implications of the Deep Fisheries Reforms on the governability of aquatic resources in the Great Lake Tonle Sap, Cambodia

Ronald Jones, Learning Institute, and Say Sok, Cambodia

For over 100 years, auctioned “Fishing Lots” dominated the commercial scale fisheries in Cambodia’s Great Lake, Tonle Sap (TSL). As part of the world’s largest freshwater fishery, these pre-colonial aquatic resource concessions allowed elite stakeholders to strictly control access to lake resources and to extract large aquatic resource rents, paying little in tax, or being subjected to any truly effective upward accountability to the Fisheries Administration (FiA). In March 2012, in conjunction with past reforms, the Prime Minister of Cambodia finally removed all the remaining fishing lots via a unilateral sub-decree known locally as the “Deep fisheries Reform”. Using the Interactive Governance Framework and Assessment Methodology the chapter first outlines the historical context of the TSL Fishing Lot system and small scale fishing; the causes for their often tumultuous and violent relationship and begins to unpack the underlying raison d’être for this profound top-down decree. We explore potential impacts and outcomes of what their rapid removal means for any real system reform and increase in aquatic system governability. We ask what are the important cross scale and organizational level challenges now facing this very diverse actor set as they now try to coordinate and implement these “Deep Reforms”? Building upon Resilience Theory the chapter concludes with possible impacts on the resilience of TSL fishing communities as Cambodian fisheries now tries to come to terms with its changing and perhaps diminished role in a rapidly changing and modernizing Khmer socio-economic reality.

Fisheries governance and coordination problems- A case study of coordination and community co-management in Senegal

Camille Manel, Director of DPM, (Direction des Pêche Maritimes), Dakar, Senegal

We discuss the problem of coordination, which is common in development but not well known for small scale fisheries, and we show examples from Senegal community co-management programs, and how this problem is slowly being addressed. The Paris Declaration and Accra agreement were established to address coordination problems by having all actors focus programs through the states, but this is not always implemented. Coordination problems arise here when multiple international actors implement independent programs with communities, but there is limited incentive for interaction, coordination and sharing of information. This results in multiple compounded problems for governance. Diverse projects operate with different authority, at different scales with different objectives and approaches, limiting compatibility. Individual organizations enter with preconceived ideas and solutions for problems, thus there is rarely any knowledge of or deep assessment and adaptation of programs to local contextual conditions. Another
problem is when information is considered proprietary, with a focus solely on an individual program for assessments and reports, emphasizing success. Critical information is not shared or is lost and information from failed projects is unknown, thus there is no collective learning and synergy for effective fisheries governance. These multiple programs also put strains on small scale fisheries with limited time and resources, requiring much time coordinating at regional and national levels. Another coordination problem occurs when there is policy incoherence at national and local levels, such as when local communities set up spatial management and MPA's, but contrary national regulations such as open access (state owns fish) can exasperate conflict.

Limits to governability of transboundary fisheries: an inquiry from desperate small-scale fishers in the Palk Bay, South Asia

Joeri Scholtens, University of Amsterdam, j.scholtens@uva.nl

Transboundary fisheries are an increasing worldwide phenomenon that has a notable impact on small-scale fisheries. This chapter explores governability problems of transboundary fisheries in connection to small-scale fishers’ marginality. We derive our clues by studying the practice of transboundary fishing in the Palk Bay, South Asia, where a sizable Indian trawler fleet impedes Sri Lankan small-scale fishermen to carry out their occupation. By analyzing the features of the fisheries systems and the fragmented practices of governance, we derive six governability challenges: 1) the mismatch between scale of governance practice and the scale of the issue; 2) the high level of institutional fragmentation with limited cross-linkages; 3) the entrenchment of the trawl sector; 4) the power imbalances between Sri Lankan and Indian fishers; 5) the deep politicization linking fisheries to the dominant ethnic conflict; 6) actors¹ strategic framing of the nature, causes and solution of the problem. We conclude that given the involvement of state boundaries, transboundary fisheries provide limited opportunities for self-governance, even though governments also proved not to be able to provide solutions. While co-governance is in theory crucial for transboundary governance to be more responsive to the situation at hand, this chapter explains why such collaboration is difficult, if not impossible, to create in practice.

Instituting “Sectors” in New England Fisheries: Producing Governable Fishermen or a New Foundation for Economic Difference?

Kevin St. Martin (Rutgers University, USA)

The advent of fishing “sectors” within the groundfish fishery of New England, USA has restructured the industry in profound ways. While the formal rules governing fishermen
are linked to vessels, gear type, and species sought, they are now also linked to voluntary collectives of fishermen called “sectors.” Sectors receive a quota of the annual catch which is then distributed amongst sector members according to rules of their own making. While there has historically been considerable resistance to quota-based management in New England, particularly amongst the small-scale fleets, sectors have been successfully institutionalized and have been operational for several years. As a result, there has been an increase in interactive governance; Interactions amongst and between fishermen, sector organizations, managers, and scientists engaged with sector-base assessments have multiplied along with the institutionalization of sectors. Yet, while sectors have clearly lead to an increase in interaction, their performance in terms of both environmental and community wellbeing is, at best, mixed. Fishing communities continue to suffer from attrition and abandonment throughout the region as fishing effort is reduced and consolidated through sectors themselves, and fish stocks continue to recover only slowly and unevenly from pre-sector overfishing. In this case, an increase in governability has certainly been achieved but other goals (i.e. ecological sustainability and livelihood maintenance) remain elusive. To better explore this outcome, we add the concept of governmentality to the framework of governance and governability used here. In particular, fishermen’s propensity to cooperate in and through sectors may be understood as a new form of governmentality that aligns with neoliberal agendas of privatization and individualization that undermine environmental and community wellbeing. Such alignments are, however, never complete and, despite being marginal, other possibilities are emerging. For example, some sectors are currently experimenting with community supported fishing (CSF), a market-based initiative that foregrounds environmental and community wellbeing rather than individual profit.

**Governance and Governability: the small scale fisheries of Pulau Rote in eastern Indonesia**

James Prescott, Australian Fisheries Management Authority, Darwin, Australia  
Natasha Stacey, Research Institute for the Environment and Livelihoods, Charles Darwin University, Australia  
James Riwu, Office of Marine Affairs and Fisheries, Rote Ndao District, Indonesia  
Dirk Steenbergen, Research Institute for the Environment and Livelihoods, Charles Darwin University, Australia

Rote is the southern-most Indonesian island with a population of Ca. 120,000. Small-scale fisheries (SSF) are integral to local livelihood strategies here, however these remain largely unregulated. Local catches are highly diverse, which reflects regional biodiversity and mixed fishing strategies. Moreover, Rote’s four mile fishing zone is porous resulting in competition between locals and fishers from outside the district, while beyond these four miles local fishers compete against large-scale fishing operations for declining resources. The major challenges in developing effective governance frameworks for SSF in Rote
include: (i) a lack of quantitative stock assessments, because catch effort and biological data are limited; (ii) complexity of monitoring catches due to the multitude of landing sites and because catch distribution follows multiple channels of subsistence consumption and/or sales on local, national and international markets; and (iii) capacity constraints on local fisheries enforcement due to a lack of trained officers and suitable vessels, and (iv) predominantly restrictive rather than enabling fisheries laws.

To restore fisheries sustainability and fishing-dependant livelihoods, improved governance is needed. Located in the largest and most densely populated archipelagic country in the world, where average household dependency on marine resources is high, Rote’s case provides a useful platform to examine the challenges and opportunities in district-level or archipelago-wide fisheries governance. This can inform practice elsewhere. We examine the implications of governance change regimes which recognise local ownership through a coherent, carefully prioritised, reform scheme of investment and management.

**Assessing inshore fisheries for juveniles while recognizing the key role of survival to spawning**

John F. Caddy, Private Consultant, Fisheries Science.

Many age-based assessment approaches are based on Beverton and Holt’s classical work, which basically gave priority to the rational exploitation of mature or maturing fish, and frowned upon fisheries for juveniles.

A different perspective on assessing juvenile fisheries is considered here, using an M-vector which more realistically reflects the high natural mortality rates which apply to juveniles, and the lower predation rates on adults. For high fecundity, relatively long-lived species, this procedure discards the conventional ‘constant M’ assumption, and recognizes that the attainment of sexual maturity may be achieved by very few individuals, and that these require special protection by fisheries management. Fisheries for juveniles thus call for a higher management priority to be placed on the conservation of a minimum spawning population of mature fish. One approach currently discussed in the Western Mediterranean where inshore fisheries for juveniles are economically important, is the potential use of Refugia or Marine protected areas offshore, to protect a core population of potential spawners.

This approach calls for collaboration between inshore and offshore fisheries in order to establish criteria for exploiting the resources at different life history stages by the respective fleets.

**Assessing vulnerability to fishing process in a critically endangered fish**

Valenzuela–Quiñonez, Fausto (CIBNOR)
Several fish stocks worldwide need to recover from fishery collapse and some of them have been listed as threatened. Full stock assessment requires large amount of information, which is not feasible in data-poor situations. Instead, demographic models enable to advice in situations when long-term information is scarce. They provide information about population status, and the potential effects of life history characteristics on population growth rate by performing perturbation analysis. Totoaba is a long lived fish that represented the first and more important artisanal fishery at the beginning of the last century in the Gulf of California. This species suffered a population collapse in the 70’s; it was banned in 1975 and listed as a critically endangered in 1976. Totoaba life history and demography is scarce; currently there is a social demand to reopen totoaba as sport fishery but no information for management exists. In this study, a demographic model was used to assess whether totoaba is able to grow and if it is able to support fishery mortality. Demographic analysis indicates that totoaba is able to grow in no fishing conditions ($\lambda=1.47$; IC90%: 1.30-1.66). Also, elasticities were larger for survival than fertility; survival elasticities were higher for juvenile and it decreased with age. Risk analysis showed that the risk of exceed PRL [$P(\lambda\leq1)$] decreases when increase the age of first capture. Our study shows that totoaba is able to support moderate fishing mortality; however, future conservation and management measures should be focus to increase juvenile survivals.

A review of the monitoring and assessment methodologies applied in the Chilean TURF system for the management of benthic resources

Carlos Techeira T. Institute for Fisheries Development (IFOP), Chile. carlos.techeira@ifop.cl
Carlos Cortes S. Institute for Fisheries Development. (IFOP), Chile. carlos.cortes@ifop.cl

Abstract

The TURFs implementation in Chile, called locally AMERB, (i.e., Management Areas for the Exploitation of Benthonic Resources), granted to artisanal fishermen organizations, are distributed along 28,000 km of coast and involves 21,000 artisanal fishermen. The management system is based on fishing quotas by resource for each AMERB. The quota estimation is done by means of conducting direct assessments of the resources on an annual basis allowing the status of the resource assemblage to be known in each area. The assessments are conducted by technical consultants hired by fishermen organizations and reported to the management authority represented by the Chilean Fishing and Aquaculture Undersecretary (www.subpesca.cl).
The assessments for the different resources and geographic zones is reviewed looking into aspects such as differences in sampling design, data collection methods, quota estimation, the involvement of fishermen in the collection of information and costs, which in turn are compared with the performance of each TURF, using as criteria the continuity of the fishing activity, the improvement of management's plans, production attributes such as the volume of landings, the need for information integration for its analysis at a bigger scale.

It is concluded that there is a need to standardized methodologies, search for alternatives to optimize the cost of assessments, continuity in the technical assistance to the fisherman organizations and train the fisherman in the principles of sustainability in order to improve the quality of the data.

**Introduction**

The implementation of the TURFs in Chile is an unprecedented case in the world, to be applied from the fishing manager toward fishermen who were exercising their effort on benthic resources in nomadic form, today are implemented through more than 28,000 km coastline and involving more than 21,000 artisanal fishermen.

The original objectives of the implementation were (Subpesca*(Fishing and Aquaculture Undersecretary)*, 2000):

i) Conservation of the benthic resources  
ii) Sustainability of economic activity  
iii) Maintenance and/or recovery of levels of biological production  
iv) Increase knowledge of the benthic ecosystem  
v) Encourage the participatory management

The management system is based on the request of the seafloor spaces with natural banks of the benthic resources by the artisanal fishermen, who are grouped in legal organizations and according to the law, are requested to the fisheries authorities (Fishing and Aquaculture Undersecretary).

This system, initiated in 1998, rapidly increased the number of areas, reaching 761 TURF decreed in 2013, with a total area of 119,974 km$^2$.

The TURF in Chile is based on the controlled extraction of resources contained in the allocated areas, through quota removal, which are defined to each area by technical consultants hired by local fishermen's organizations. In general, the system works on the basis of direct assessment, carried out by the technical consultant with the active participation of the fishermen, which is performed on an annual basis. The results of this evaluation are submitted by the fishermen to the fisheries manager. In addition to the results of the evaluation, the report considers a proposition of quota removal with sustainability criterion on the population exploited. This proposition of quota is evaluated by the fisheries manager, who can approve it with modifications and authorize the removal, with the surveillance of the National Service of Fisheries and Aquaculture.

Through the development of the history of the TURF, in the last few years, the status of their situation points out a decline in the productivity of the main fishery that sustains the system (IFOP*(Institute for Fisheries Development)*, 2013) and the abandonment and operation in doubt (suspension of evaluations and legal harvest) of approximately 37% of the areas with management plans approved, with no diagnosis in this regard.
indicates the condition of areas of TURF in Chile in the year 2013 (SSPA(Fishing and Aquaculture Undersecretary), 2013).

Table 1 State of TURF areas in Chile (SSPA(Fishing and Aquaculture Undersecretary), 2013)

<table>
<thead>
<tr>
<th>State</th>
<th>TURF No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABANDONED</td>
<td>43</td>
</tr>
<tr>
<td>AVAILABLE</td>
<td>218</td>
</tr>
<tr>
<td>OPERATIONAL</td>
<td>351</td>
</tr>
<tr>
<td>OPERATIONAL IN DOUBT</td>
<td>161</td>
</tr>
<tr>
<td>Total</td>
<td>773</td>
</tr>
</tbody>
</table>

This document presents possible effect of the monitoring and evaluation system for the TURF.

**Methods**

In the context of a long-term study of the status of the benthic resources exploited in the TURF, conducted by the Institute for Fisheries Development, a database was generated with the information of historical studies at national level for a total of 200 TURFs. There were selected 20 consultants that concentrated 80% of the studies between the years 1998 and 2012 identifying methodologies in terms of: i) evaluated resources, ii) sampling designs, iii) fishermen participation in the evaluation, iv) re-estimate of rates of exploitation, v) levels of production, vi) correction of the management plans. For a subgroup of 23 areas, the reports of the studies of the management plans were reviewed, generating comparative matrices in terms of fishermen participation, cost of evaluations, implementation of the precautionary approach, operation continuity of the TURF.

**Results**

The historical variation of the number of consultants shows a decrease of these in a 50%, in recent years, with a cumulative total since the beginning of the system of 74. The cadaster of the evaluation methodologies of the consultants selected shows a majority coincidence of random and systematic sampling designs for the different TURFs to the various resources of hard bottoms and geographical areas. The identified predominant designs show to be correctly applied by fishermen, who are involved in the whole of the case studies. Although it is not the objective of the review, a work in progress of the authors et al., based on an analysis of the statistical efficiency of the designs used in the various revised assessments and sample sizes, show deficiencies in the analysis with incidents in the estimates of the evaluations.

The costs of the evaluations, despite being a piece of information with few available records, do not show a correlation with the income of the TURFs, so that there would be a difference of advice associated to the productivity.

The operating status of the TURFs was found to be associated with low and varying levels of production among years, in comparison with the TURFs that are maintained in continuous operation.
The monitoring system shows absence of corrective measures in the Management Plans of the TURFs, which are reflected in the decline in rate of exploitation, quota removal or any other similar measures that will lead to a decline in the financial expectations of the fishermen. In accordance with the foregoing, the values of F estimated for the evaluated TURFs, in their majority are highly above to the recommended by the fisheries manager.

**Discussion and Conclusion**

The active participation of the fishermen in the activity of the field evaluation of the resources, together with the consultants; due to the existing regulation that requires processing and analysis of the data oriented to models of population dynamics, which requires professional advice for each area, methodological alternatives are not applied in favor of a more simple monitoring, which can be made with greater independence by fishermen, which simplify the system of assessment and provide a larger scale supervision.

The existing management system poses that the consultants work for the fishermen's organizations without the fisheries administrator’s supervision until there is an opportunity to review the report. This independence may violate the conservation of resources and the performance of the TURFs, if the fishermen do not have incorporated the principles of sustainability and the precautionary approach for the management of their TURFs that allow the inclusion of corrective actions in the Management Plans of each TURF, that might mean reducing the contributions requested to the fisheries manager.

In recent years, there has been a reduction in the number of consultants, which has led to a concentration of TURFs and geographical areas by consultant. The absence of a standard evaluation methodology has resulted in that each consultant possesses a particular methodology (sampling design and data gathering), that is applied to the TURFs to advice, not recognizing the special features of each, as well as the capabilities of the fishermen's organizations that manage each TURF.

In the absence of a formal system of qualification of the consultants’ job, the quality is not a selection modelby the fishermen's organizations, being the cost of consulting an important element for their hiring, although in general, it was observed a low correlation between the income of the TURF and the cost of the study, concentrating the advice in the resources evaluation.

The absence of corrections in the management plans by the consultants, in lights ofobvious situations of productive deterioration of some management areas, expresses the need for intervention by the fisheries manager, facing the risks of sustainability of the TURFs in that state.

**The optimal fishing pattern for achieving an ecosystem approach to fisheries**

Jeppe Kolding, Department of Biology, University of Bergen, Norway
Richard Law, York Centre for Complex Systems Analysis, University of York, UK
Conventional fisheries management encourages highly selective fishing patterns for various purposes, such as increase relative yield, reduce unwanted bycatch, protect various species or sizes and rebuild ecosystems. Recent empirical and theoretical studies, however, show increasing evidence that selective removals of targeted components have unintended adverse effects on stocks, fish communities and the ecosystem. Based on case studies from artisanal African freshwater fisheries, and results from dynamic size-based models, this chapter supports the renewed suggestion that an application of a more balanced fishing pattern will mitigate adverse effects and enhance food security better than increased selectivity. Contrary to common belief, small-scale unregulated artisanal fisheries, with a high diversity of seasonally adapted fishing methods, are probably the closest empirical examples we have of an optimal exploitation pattern with the least disruptive effects on the structure of the ecosystem. As such they are among the best examples of an ecosystem approach to fisheries that we have.

**Justifying the need for action on gear intensification in small-scale fisheries**

Selgrath, J.C., Project Seahorse | The University of British Columbia Fisheries Centre  
Gergel, S.E., The University of British Columbia  
Vincent, A.C.J., Project Seahorse | The University of British Columbia Fisheries Centre

A critical pressure on the ocean, small-scale fisheries in the Philippines, appears to have become ever more intensive over time. Using a unique data set that spans six decades (1950 – 2010), we analyze the progression of small-scale fishing gears in the context of evolving fisheries governance. We focused on fishing gears because gears influence fisheries’ impacts on ocean ecosystems and gears are often the focus of governance measures. Gear diversity (Simpson’s Index) remained consistently high throughout the study. When policies promoted fishing exploitation, gear richness greatly increased and this increase persisted during subsequent periods. Over time, fishers shifted towards non-selective, active, and destructive gear, leading to an overall intensification of fishing. When co-management was implemented, the fishing intensification trend continued. However, after co-management was supported by capacity building and fisheries legislation (gear restrictions), the use of some intensive methods stabilized or decreased slightly. We will explore the impacts of gear richness and gear intensification on fisheries sustainability, and discuss how gears management and institutional support can be incorporated into marine conservation and the management of small-scale fisheries.
Regular session 6.5: Livelihoods and sustainability

Quality of Life, Well-being and Rural Coastal Livelihoods in Puerto Rico

Carlos G. Garcia-Quijano (Associate Professor of Anthropology, University of Rhode Island)
John Poggie (Professor of Anthropology, University of Rhode Island)

This talk presents the findings of a 3-year collaborative research project on the relationship between small-scale coastal resource (CR) harvesting and the well-being, quality of life, and resilience of people in Southeastern Puerto Rico. Our multi-method approach looks at the real value of CR use in the reproduction of coastal households and communities. We present traditional ethnographic, qualitative/quantitative survey, and scenario modeling results that show the deep and multidimensional entanglements between small-scale coastal resource use and the QoL/WB of coastal residents. In a world where productive uses of the coast are under assault by many de-localizing forces, we ask: What do we lose if coastal resource-engaged communities lose access to the coast they depend on?

Fishermen perceptions and actions toward human health and resources sustainability in artisanal fisheries of the Yucatan Peninsula

Oswaldo Huchim-Lara (Cinvestav)
Silvia Salas (Cinvestav)
Julia Fraga (Cinvestav)
Nina Mendez (CIR UADY)
Walter Chin (UCLA)

Worldwide, millions of people find in fisheries a source of income and food; however, workers of this industry have higher mortality and morbidity rates than any other occupation. Diving with hookah system (HS) as fishing method represents for fishermen important health risks, which could increase due to decrease of target species availability. A study was undertaken in a fishing community of the eastern Yucatan coast to identify health problems perceived due to fishing method and fishers response to preserve marine resources. Focus groups based on a question guide previously validated were conducted for this analysis. Testimonies were recorded, coded and analyzed with the constant comparative method drawn from grounded theory.
Fishermen described decompression sickness as the main health issue, problem associated to dive in deep waters and long time spent underwater, both actions implemented by fisherman in order to make trips profitable, especially when facing resources scarcity or when changes in market demand. Even though fishers recognize that HS built structure and maintenance could also be associated to health problems, they believe that
improvements on the HS are unviable. For resources protection, local efforts are enforced by fishermen to avoid juvenile lobsters caught. Resource scarcity and market demands force fishermen to venture into risk actions in order to attain expected revenues. Social sciences theories and application of fieldwork techniques showed to be helpful to bring participants a forum to express their opinions and suggestions free of judgment and allowing identifying management and health affairs relevant for fisheries assessment and management.

Evaluating restoration strategies for the recovery of an scallop population in the Ensenada de La Paz, Baja California Sur

Nicole Corpuz, Bren School of Environmental Science and Management, University of California, Santa Barbara, USA; ncorpu@gmail.com
Mary Luna, Bren School of Environmental Science and Management, University of California, Santa Barbara, USA; mary.c.luna@gmail.com
Jessica Couture, National Center for Ecological Analysis and Synthesis, USA; jc0uture@umail.ucsb.edu
José Zenteno, Bren School of Environmental Science and Management, University of California, Santa Barbara, USA; jzenteno@bren.ucsb.edu

Abstract
The population of the Catarina scallop, a high value species for artisanal fishers in Baja California Sur, collapsed in 1978 in the Ensenada de La Paz and has not recovered. Habitat degradation and overfishing have been identified as the most important causes of depletion. The non-profit Noroeste Sustentable (NOS) is working with the local El Manglito fishing community to repopulate the Ensenada with scallops, and eventually reopen the fishery. The successful recovery of the Catarina scallop is expected to be a first step for the stewardship of the whole Ensenada ecosystem. Our team developed a simulation model that recreates the socio-ecological system of the scallop restoration to evaluate the benefits from different restoration strategies. These strategies focused in major population bottlenecks for recovery, including illegal fishing, and the lack of scallop habitat and larval supply. Each strategy had a unique combination of varying levels of habitat restoration, aquaculture, surveillance, and population enhancement (i.e. seeding). Our results indicate that suitable habitat has the greatest influence on the population biomass, and that under current production costs aquaculture is not economically feasible. Restoration efforts would also benefit from continued surveillance and Catarina seeding (340,000 scallops/year) for the first three years. However, benefits from the scallop fishery would not be able to meet the economic needs of the local fishermen. Thus, the recovery of other key species would be critical to provide economic incentives for sound management. Future efforts should evaluate the feasibility of different habitat restoration methodologies and current status of available habitat.
Background
To date, roughly 300 million people fish for an income, 90% of which fish in small-scale fishermen (FAO 2014). Small-scale fishermen (SSF) are fishing households that fish locally, use a small amount of capital, and catch food for local consumption (FAO 2014). Most SSFs are situated in small fishing communities and fish as a member of fishing cooperatives (co-ops) or as part of a patron-client relationship (Basurto et al, 2013). In the Gulf of California, it is often the case that environmental stewardship is not a priority among SSFs (Cinti et al, 2014). Coupled with policy failures that inhibit effective management, small-scale fishery stocks are subject to decline (Cinti et al, 2014).

There are popular tools that are used to mitigate declines in stocks. These methods include establishing a Total Allowable Catch (TAC), employing Territorial Use Rights Fishery (TURFs), and implementing Marine Protected Areas (MPAs) (FAO 2014, Basurto et al, 2013). However, in regions where these methods are implemented, political challenges, such as the lack of enforcement, and social challenges, such as the distrust of cooperatives leaders and authorities, prevent these methods from being successfully (Basurto et al, 2013, Pérez-Sánchez and Muir 2003). As a result, implementing these mitigation methods may not be sufficient to recover collapsed populations. Enforcement and trust of cooperative leaders and authorities are a prerequisite for the community management of resources (Ostrom 2000). In areas that distrust authorities and community leaders, resources have a greater chance of recovery through community-based restoration.

![Figure 1. Selection process of aquaculture juvenile scallops at the nursery. The nursery and aquaculture are run by fishermen of the local community.](image)

**Using modeling tools to reduce uncertainty in decision-making**
Often, there are several approaches to restore a depleted resource and it is difficult to determine which approach would be most successful. In order to determine the most effective restoration approach, it is important to identify the major population bottlenecks that inhibit a species recovery. To do this, one must start by analyzing external factors,
such as environmental, social, economic, and political, that may affect the life cycle of a species. Some examples of population bottlenecks include a lack of settlement habitat due to environmental degradation, illegal fishing pressure caused by poor enforcement, and poor water quality due to illegal dumping of wastewater. Implementing one restoration strategy might not be sufficient to restore a target fishery. Often, different restoration strategies may be implemented simultaneously.

Case Study: Restoration of a scallop fishery in the Ensenada de La Paz
Our project focuses on the Catarina scallop, *Argopecten ventricosus*, a species with high cultural and commercial value in Baja California Sur, Mexico (BCS) (Figure 2). The objective of this case study is to identify restoration strategies that would restore the Catarina scallop population in the Ensenada, a cove adjacent to the city of La Paz, BCS, to a sustainable level. Historically abundant in the wild, the fishery today is nearly depleted in BCS. The restoration of the Catarina fishery in the Ensenada could ultimately strengthen the property rights of local fishers, restore the native species to its historical range, support the recovery of other species, such as the pen shell clam, and bring economic benefits to the local fishing community. Additionally this recovery effort would be a first step for promoting stewardship of the whole Ensenada ecosystem among SSFs.

Figure 2. (A) *A. ventricosus* distribution, (B) Ensenada de La Paz study area in the Sea of Cortez in Baja California Sur, Mexico.
The non-profit Noroeste Sustentable (NOS) is currently working with the local El Manglito fishing community to repopulate the Ensenada with scallops, and eventually reopen the fishery (Figure 1). The successful recovery of the Catarina scallop is expected to be a first step for the stewardship of the whole Ensenada ecosystem. However, the project has experimented setbacks due to different sources of uncertainty, such as habitat suitability, economic feasibility, social cohesion and even future environmental conditions. Our objective is to simulate the socio-ecological system of the scallop fishery, and provide recommendations that can ultimately inform decisions on the management of the Catarina scallop and other key fishing resources in the region.

Methods

Bottlenecks
Our first step was to identify major population bottlenecks that may inhibit recovery and also mechanisms that may enhance recovery. We were able to identify many bottlenecks, of which the more important ones were: 1) the lack of suitable habitat in the Ensenada, 2) the persistence of illegal fishing. Among the mechanisms to enhance recovery we identified: 1) a scallop nursery, 2) the size and frequency of the seeding operation and 3) the potential of aquaculture as another mechanism that may enhance recovery. Each population bottleneck and recovery enhancement mechanism identified were summarized as the following restoration actions: 1) Habitat Restoration, 2) Increase Surveillance Pressure, 3) Seeding Amount, 4) Seeding Frequency, 5) Aquaculture.

Next, we created a bioeconomic model to simulate conditions that influence the Catarina scallop population in the lagoon. We used life-cycle parameters and relationships of the scallop to develop an age-structured population model. We considered scallops with a lifespan of 3 years and projected the outcomes of the project up to 50 years. Within the model we tested 15 restoration scenarios, each a unique combination of different levels of habitat restoration, aquaculture intensity, surveillance and seeding. The costs and benefits were analyzed for each restoration scenario:

**Habitat Restoration:** We use recruitment as a proxy for habitat availability. Due to a lack of historical landing data, we used an estimate of the quantity of scallops during the final year the fishery was open as a reference for historical abundance. We consider this baseline to be conservative. We varied the habitat availability at 30%, 60% and 100% to represent current levels of habitat.

**Increase Surveillance Pressure:** We assumed that the intensity of illegal fishing would depend on the level of surveillance and its effectiveness and thus we modeled 3 levels of illegal fishing: 40%, 20% and 5%.

**Seeding Amount and Frequency:** We designed four levels of seeding. Level 1 assumes an annual quantity of 340,000 for one year, level 2 assumes 340,000 scallops per year for three years, level 3 assumes 680,000 scallops per year for three years, and Level 4 assumes 680,000 scallops per year for 6 years.
**Aquaculture Intensity**: We established three levels of aquaculture intensity at 0, 580,000, and 2,320,000. In both these aquaculture levels, the scallops would be matured in the cages to the 56 mm legal size and then harvested for sale.

The 15 scenarios produced outputs of population biomass (B/B₀), average catch value, fishery profits, aquaculture profits, restoration investment, Years to reach carrying capacity (K), and years to 25% population biomass (B/B₀). A sensitivity analysis was used to test the sensitivity of our model to changes in input values known to have high uncertainty. We conducted a Monte Carlo simulation to incorporate the effect of environmental stochasticity into the population biomass. The stochasticity is reflected through natural mortality in the model.

**Results and Discussion**
The scallop population is expected to recover from depletion, but at different rates and achieving different population sizes depending on the restoration strategy used. The highest biomass levels are reached when scallop habitat is restored up to 100% of the historical levels (Figure 3). Alternatively, low-performing scenarios have usually lower levels of suitable habitat, relative to historical levels. We found that the strategies that achieve smaller population sizes reach a stable level faster, and bigger ones take more time to reach their carrying capacity, however, with significant variability.

If the fishery opens, in almost every case the population size stays above the threshold. In our simulation, the fishery opens after the population grows over a threshold of 25% of theoretical virgin conditions. However, in some cases where suitable habitat is low the population is unable to go above the threshold. Not surprisingly, restoration strategies that attain a higher biomass while the fishery remains closed are able to maintain a bigger population that is subject of both legal and illegal fishing. This means that the time the fishery takes to open can affect how the population recovers. Eventually, in all cases the population stabilizes at around 20 years assuming a legal fishing rate of 60% of mature scallops.
Fishermen would obtain in average between US$39,801 and US$124,333 per year from selling the scallop harvest. Here, we assumed an average local market price of US$0.63/K of whole scallops with shell and a legal fishing level of 60% of scallops of legal size. Scenarios with a negative fishery income are scenarios in which the fishery never opens and they do not invest in habitat restoration. The scenarios with the highest fishery income are the ones that make high investments in restoration. The aquaculture profits are directly correlated with the quantity of scallops produced in aquaculture. In contrast, the scenarios with the highest profits maintain a high B/B₀, even after the fishery opens. Habitat restoration investment values range from $0 to $7,584,351.93 while mean catch value per year ranges from $0 to $207,221.68.

Habitat area appears to be the most important factor in restoring the scallop population across the different strategies. However, we assume that the current suitable habitat is at 30% of the 100% historical pre-collapse level. This is an assumption with high uncertainty given that we currently have no evidence to back our assumption that habitat is indeed at 30%. We also find that Illegal fishing has more of an observed effect on population recovery than seeding and aquaculture, but its effects on either population size or rate of recovery seems to be moderated by other restoration variables and by habitat. We found that seeding of juveniles into the wild is extremely important for the recovery of the scallop population in the Ensenada. Once past the initial seeding, our results indicate that after 3 years, seeding has less of an observed effect on population recovery than habitat and surveillance, and a similar effect to that of aquaculture.

The negative values of Aquaculture NPV demonstrate that, under the current costs of production, aquaculture does not provide a profit for the fishermen. Doubling the density or doubling the percentage of aquaculture area may allow fishermen to make a profit,
however, the complexities of transitioning livelihoods from fishing to aquaculture farming should also be considered.

Habitat restoration would be a requirement for the fishery to generate profits. In order to sustain the livelihood of the El Manglito fishing community, the fishery should generate at least $443,077 in revenue per year. Even though the scallop fishery could eventually generate profits, it would not be enough for the fishermen to depend only on the Catarina scallop fishery. Luckily, the Ensenada lagoon is home to many commercially valuable species, which can serve as an alternative to scallop fishing and vice versa.

**Conclusion**
The availability of suitable habitat appears to be the most important factor in restoring the scallop population, according to our model. Here, we assumed that the current suitable habitat is at 30% of the 100% historical pre-collapse level. We also found that Illegal fishing has a higher effect on population recovery than seeding and aquaculture, but its effects on either population size or rate of recovery seems to be moderated by other restoration variables and by habitat. Seeding of juveniles into the wild is extremely important for the recovery of the scallop population in the Ensenada. However, once past the initial seeding, our results indicate that after 3 years seeding has less of an effect on population recovery than habitat and surveillance.

The negative returns of the aquaculture activity demonstrate that, under the current costs of production, aquaculture does not provide a profit for the fishermen. Doubling the density or doubling the percentage of aquaculture area may allow fishermen to make a profit, however, the complexities of transitioning livelihoods from fishing to aquaculture farming should also be considered.

The Catarina fishery has the potential to become economically feasible, especially if restored simultaneously with the highly valuable Pen Shell clam. According to our results, the biggest obstacle in achieving economic feasibility is the capital to complete habitat restoration. Moreover, this project can substantially contribute to the stewardship of the common fishing resources in the Ensenada de la Paz. If successful, the restoration of the scallop fishery can serve as an example of sustainable use and community development.

Future efforts should evaluate the feasibility of different habitat restoration methodologies and current status of available habitat. Finally, community engagement in the vision of restoring the Ensenada and the catarina population, is paramount in making restoration efforts successful in the long term. Nevertheless, we must also continue to recognize that working with community members to create new job sources through the diversification of the use of marine resources is essential in ensuring a successful and long lasting restoration.

**Literature**
Dependence of Yucatan coastal population on small-scale fisheries

Laura Vidal Hernández (UMDI Sisal, UNAM)
Alvaro Hernández (INAPESCA- CRIAP Yucalpeten)
Carmen Monroy (INAPESCA-CRIAP Yucalpeten)

Yucatan´s small scale fisheries employ directly 50% of adult coastal population and generate an average of 92% of fisher´s household incomes. However, economic indicators at household level have been poorly estimated even though the key contribution of this fishery to food security, coastal livelihoods and poverty reduction in the coast. This study quantifies net family income per year, total annual household expenditures, employment, fishing dependence and profitability of small scale fishery in twelve communities of the Yucatan coast. Information used included 2012-2013 official statistics and direct survey of fishing and socioeconomic data. Results show that each fisher household obtains an average annual income of $US 6,111, while 50% of them earn 8% of their income from other activities. Mean annual household expenditures are $US 5,300. 44% of fishers save money mainly from August to November while only 27% of them reported to have debts during the year. We estimate that small scale fishers potentially support up to 52,213 dependents, equivalent to 75.5% of the coastal population in Yucatan or to 2.67% of the State population. Kruskal-Wallis test shows significant differences of net family income and household expenditures among fisher categories (freelance fishers, trade union members with and without fishing gears ownership and license owners) and among coastal communities. Our study shows the importance of small-scale fisheries for livelihoods and wealth of coastal Yucatan.
communities and also highlights the need for more encompassing socio-economic research to enhance fishing economic and social sustainability.

**Gender, Livelihoods and Coastal and Marine Management in East Africa**

Sara Fröcklin, Department of Ecology, Environment and Plant Sciences, Stockholm University

The presented research was conducted between 2009 and 2013 and analyzes gender in coastal livelihoods and coastal/marine management in Zanzibar (Tanzania). Based on both quantitative and qualitative methods from natural and social sciences the findings show that gender inequality is a prevalent feature in both access and use of the seascape, as well as in the management system. First, men had greater access to the whole seascape, whereas women were restricted to shallow areas closer to home. Second, men were primarily engaged in fishing and women in low-paid activities such as gleaning of invertebrates or seaweed farming. Third, seaweed farming was shown to have negative effects on women's health, which was related to poor working conditions and labor intensive work. Fourth, women gleaners had less access to fishing grounds, high-value species, boats, gear and markets compared to men. Unregulated invertebrate fisheries also showed declines in both species richness and abundance over a five year period. Fifth, the greater involvement of women in fish trade, which by tradition is dominated by men, has not to any greater extent challenged traditional gender roles; men dominated commercial channels and revenues of large valuable species such as tuna, kingfish and swordfish, while women mainly had access to species of low economic value directed to local markets and consumption. In addition, analysis of formal management documents showed that Zanzibar's coastal and marine management is androcentric with main focus on coral-reef associated fisheries. In conclusion, by applying a gender lens this work illustrates how gender shapes one's access and use of the seascape, and access to livelihoods assets. It also reveals how the management system tends to overlook such inequalities, with effects on both the environment and human well-being. Since gender equality is a key for improved livelihoods, human well-being and sustainable development, gender should be a focal part of any analysis, policy or management strategy.

**Involving fishing communities in Baja California, Mexico, in the monitoring of their resources to achieve sustainable fisheries and livelihoods**

Jan Freiwald, Reef Check Foundation
Amanda Leijbowicz, Comunidad Y Biodiversidad A.C.
Fiorenza Micheli, Stanford University
Many fisheries along the Baja California, Mexico, coast are organized in fishing cooperatives. Cooperatives have exclusive fishing rights for several commercially important species of invertebrates. Because these exclusive fishing concessions are an area-based approach to resource management and a relatively small group of individuals is exploiting a common resource they are an ideal place for involving stakeholders in resource monitoring and management. Hand in hand with three cooperatives, the Comunidad Y Biodiversidad A.C. (COBI) has developed voluntary no-take zones focused on the recovery of the species of interest. This participatory management approach has extended into participatory science that will inform future management decisions. The Reef Check Foundation trains fishermen and local community members in scientific survey methods to monitor the status of exploited species and the local reef ecosystem as a whole. Community members, in conjunction with research scientists, then collect data that are used to not only inform future management but also to help understand ecosystem responses to impacts other than fishing. For example, in Natividad Island, data collected by local fishermen has helped to demonstrate the difference in resilience of abalone population in response to hypoxic conditions. Abalone populations in marine protected areas showed greater resistance to a low oxygen event than populations in fished areas. Direct involvement of fishers in monitoring and research is contributing to a general understanding of the resilience of these coastal ecosystems to climate variability, and to supporting local environmental stewardships.

**Speed Session 6.6**

**Speaking up for artisanal fisheries: the role of communication and culture in fostering the wellbeing of fishers**

Paula Santos (Universidad Católica del Uruguay - UCU) paulasantosvizcaino@gmail.com
Omar Bentancur (Artisanal fisher from Piriápolis, Uruguay) kchoobdc2013@hotmail.es
Jonny Bouyssounade (Artisanal fisher from Piriápolis, Uruguay) gozila41@gmail.com
Maite De María (Ecology and Evolution Dept, Faculty of Sciences, Universidad de la República - UDELAR, Uruguay) maitedmm@gmail.com
Valentina Franco-Trecu (Pinnipeds Project- Ethology Section, Faculty of Sciences, UDELAR, Uruguay) pinnipedosuy@gmail.com
Alfredo Hargain (Artisanal fisher from Piriápolis, Uruguay) alfredohargain@hotmail.com
Freddy Heredia (Municipal Government of Piriápolis, Uruguay) anavigare9@gmail.com
Patricia Iribarne (Academic Unit, Human Biology Bachelor Degree, UDELAR, Uruguay) patriciairibarne@hotmail.com
Marcelo Kurta (Artisanal fisher from Piriápolis, Uruguay) marcelikur@hotmail.com
Pablo Puig (Artisanal Fisheries Unit, DINARA/National Directorate of Aquatic Resources, Uruguay) ppuig@dinara.gub.uy
Abstract
Culture and communication can play a major role in fostering the wellbeing of vulnerable populations. Giving them “voice” -as a cultural capacity- may improve the terms in which they can be positively differentiated from other sectors in society, thus enabling them to negotiate issues of their interest with other fisheries stakeholders from a more favourable position. Artisanal fishing communities outstand for their profound knowledge of the sea, of its resources, and of the marine environment as a whole. Their practices, orally transmitted from generation to generation, contribute directly to environmental sustainability and food security, among others. For several reasons, this richness remains to be communicated as of the fishers’ own perspective. This could signify a step forward towards improving their complex living conditions. POPA is a participatory research group working in the Piriápolis artisanal fishery, Uruguay. One of its two objectives (proposed by POPA’s fishers) is the valorisation of artisanal fisheries by society. The focus of POPA’s communication actions is to create awareness about their contribution to society among strategic stakeholders and the general public and promote positive behaviours in relation to it. In 2012, POPA organised the First Artisanal Fisheries Festival (nearly 3000 people attended). In this presentation we will share the public communication process of POPA in preparation of the Festival, its reception by the general public, and an analysis of fishers' perceptions of the impact of the activity.

Introduction

In Uruguay, small-scale or artisanal fishers are seen as a vulnerable population that live in difficult socio-economic conditions, have unstable income, low education level, uncertainty in housing, and difficulties in the access to basic services (Puig and Grunwaldt 2008). Recent research in the area of Piriápolis (coastal Río de la Plata) shows that they are under pressure also due to ecological conditions, which are gradually worsening. In addition, they feel rejected by the State agency in charge of fisheries management, and express their need to feel that they are valuable partners in resources management and coastal development (Trimble and Johnson 2013).

In May 2011, the Group POPA (For Artisanal Fisheries) was created in Piriápolis. It integrates artisanal fishers, university researchers, members of the fisheries agency (DINARA - National Directorate of Aquatic Resources), and local government of Piriápolis. Participation in the Group is non-profit and voluntary. Its modality of work is described as a participatory research, or participatory action research initiative (Trimble and Lázaro 2014). Issues tackled by POPA are proposed mainly by participating fishers, always looking for consensus about how to "act". Two of the main objectives of the group
are: (i) to promote the knowledge and appraisal of artisanal fisheries by the society; and (ii) to encourage artisanal fish consumption given growing fish imports. To fulfil these objectives, in February 2012 the Group held the First Artisanal Fisheries Festival. The aims were to: (1) bring together fishers and consumers; (2) value the artisanal fishery as an activity of economic, social and cultural importance; and (3) inform the people so that they could choose to consume more local fish.

In this paper we will present the main features of the six-month communication process of POPA in preparation of the Festival, and of the Festival itself. The goal is to show how the “voice” of the fishers amplified by the Festival contributed to improving their wellbeing as proposed by the WeD approach. We intend to highlight the potential of culture for building the future wellbeing of fishers and how participatory communication can speed up the process.

“Voice”: communicating “the difference” to achieve wellbeing

Vulnerable groups oscillate between the “exit” from society and their “loyalty” to norms that implicitly reproduce their vulnerability. These two concepts taken from economist Albert O. Hirshmann, are proposed by Appadurai (2004) together with the one of “voice” to understand the position of vulnerable people in society.

For “voice” we mean the cultural capacity of people to communicate their views to obtain results in direct relation with their own interests in the debates that concern wellbeing in society. For culture we understand a set of norms, beliefs, and values central to human groups, as specific and diverse designs for social life.

As in other places in the world, fishers in Uruguay fall into a distinctive generic category: “the vulnerable”, a category that calls for global solutions that never come. The concept for “voice” is proposed by Appadurai as cultural affiliation that may enable fishers to re-build local social consensus on a new condition of “different”. Appadurai (2004, p. 64) recalls from Fernandez (1965, 1986) “even in the most "traditional" looking cultures consensus cannot be taken for granted”. He proposes that specific arrangements of action, performances, etc., that we may call cultural, may be especially strategic sites for the production of consensus to advance the own collective long-term interests of fishers (Appadurai 2004).

The First Artisanal Fisheries Festival in Piriápolis can be seen as a specific arrangement of action where fishers raised their “voice”. Communicating their views as of the Group POPA became a tool for re-building local consensus on a new condition of different, thus positioning them in a situation more favourable for negotiating aspects related to their wellbeing.

When talking about wellbeing we refer to the WeD ESRC (Research Group on Wellbeing in Developing Countries) approach to wellbeing, which integrates material, relational and subjective dimensions. To the effect of this work, as proposed by the ESRC: “material
wellbeing refers to economic assets; the relational concerns social interaction. It involves the connections between people and also the making of difference between them. It is the arena of action, which brings the material and subjective to life. The subjective concerns cultural values, ideologies and beliefs and also people’s own perceptions of their situation.” (White 2009, p.10).

To investigate how the amplified “voice” of fishers contributed to their “wellbeing”, we gathered available data on the public communication process of POPA in preparation of the Festival, on the Festival itself, and on POPA fishers’ perceptions about the activity. As a methodological approach, we adopted the WeD concept of wellbeing.

**Did the Artisanal Fisheries Festival contribute to fishers' wellbeing?**

Following POPA’s nature, the communication process of the Festival was characterised by: (1) the participation of the fishers in different or all the stages of the organisation cycle of the event; (2) horizontal dialogue between Group members (instead of vertical transmission of information); (3) the building up of a relation of trust among the organising team, and the search of mutual internal and external understanding among stakeholders (instead of persuasion); (4) the role of experts as facilitators and participants; (5) though it sought for specific results, emphasis was put in the process of communication, approaching communication as an objective in itself; (6) communication was seen as a tool to articulate deeply installed social relations (Inagaki 2007). This positioning of the fishers within the Group is seen as a contribution to their subjective wellbeing.

The Group in preparation of the Festival undertook five different types of actions (Table 1). Support received (financial and in-kind) can be related to material and relational wellbeing.

**Table 1 – Festival preparatory actions in relation to “WeD wellbeing”**

<table>
<thead>
<tr>
<th>Action undertaken</th>
<th>WeD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building of up a network of support (financial and in-kind) of 37 individuals and organizations from the public, private, academic, civil society, and the small-scale fishery sector at the local, national and international levels.</td>
<td>Relational Material</td>
</tr>
<tr>
<td>Declarations of interest by the Ministries of Livestock, Agriculture and Fisheries; Tourism; Education and Culture; and the Uruguayan National Commission for UNESCO.</td>
<td>Relational</td>
</tr>
<tr>
<td>Flyers, 30 promotional posters, 150 stickers in key locations. Street audio announcing the Festival.</td>
<td>Relational</td>
</tr>
<tr>
<td>Social network account with 300 users in 4 months</td>
<td>Relational</td>
</tr>
</tbody>
</table>


Visits by fishers to two local schools. Presentations and interaction with children. Children visited fishers' landing sites.

POPA fishers acted as the spoke persons of the Group. A total of 12 media interviews were performed. On the one hand, the plan enabled a network of direct contacts between fishers and journalists to achieve the general public; on the other, it was a learning process in media management focused on fishers' own needs and interests. Opportunities arose for fluent further contacts. The actions can be said to have tackled positively relational, but also subjective wellbeing.

Regarding the Festival, it included a photographic exhibition about artisanal fishers; an interactive exhibition of fishing gear; paintings by two renowned artists inspired by artisanal fisheries; an exhibition of children drawings; a talk about the benefits of fish consumption by an expert in nutrition; tasting of a wide variety of gastronomic proposals of local fish by Uruguayan and international chefs; and music and dance performance. Nearly 3000 people attended the event, information brochures were distributed, posters on fisheries information shown (Figure 1). Reception of the Festival by attendees is presented in Table 2. Categories arose spontaneously from responding: What is your impression of the Festival? The overall positive judgement can be interpreted as a contribution to fishers' relational wellbeing with society.

Table 2 – Perceptions of assistants to the Festival (February 2012)
<table>
<thead>
<tr>
<th>General</th>
<th>Information</th>
<th>Gastronomy</th>
<th>Art</th>
<th>Tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good (7)</td>
<td>“Learnt new things”</td>
<td>“Very good tastings”</td>
<td>Very nice exhibitions (2)</td>
<td>“Very important for tourism”</td>
</tr>
<tr>
<td>Keep organizing it (6)</td>
<td>“Very educative”</td>
<td>“Learnt to know how to prepare the fish”</td>
<td>“I loved the pictures, very good”</td>
<td></td>
</tr>
<tr>
<td>Well organized (4)</td>
<td>“Very illustrative”</td>
<td>“Wants more information”</td>
<td>“I was impacted by the visual aspects”</td>
<td></td>
</tr>
<tr>
<td>Awesome (4)</td>
<td>“Illustrative because people knows rather the dark side of fishers”</td>
<td>“Took too much time to obtain tastings”</td>
<td>“Loved the pictures and the gillnets”</td>
<td></td>
</tr>
<tr>
<td>Excellent (3)</td>
<td>“Many people ignore artisanal fisheries”</td>
<td>“Fish spines should be taken off”</td>
<td>“Liked very much the music”</td>
<td></td>
</tr>
<tr>
<td>Good (3)</td>
<td></td>
<td></td>
<td>“Liked the painter, the drawings”</td>
<td></td>
</tr>
<tr>
<td>Spectacular (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beautiful</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Successfully</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impeccable</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Marvellous</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Magnificent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very nice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very interesting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A lot of work behind evident</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good service</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good place</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free without pay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Loved the initiative of self-organizing”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of interviewed people: 44. Age range 25-75 years old.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WeD wellbeing: relational</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2. Interaction of supporters with the general public during the Festival

POPA fishers identified “sacrifice” and “hard work” as core elements of their social representation; as per their views, the Festival brought these up. Fishers recognized that the activity promoted their subjective and relational wellbeing.

Table 2 – Perceptions of four POPA fishers about them in relation to the Festival

| Are fishers valued by society? | Poorly valued by society, or not valued at all. “People do not even know we exist.” “Fishers do not exist for authorities”. “Out of society” “They think fish comes from the refrigerator, just like milk” “Slightly more valued at present because people are trying to eat healthy.” |
### What did the Festival put into value?
- Sacrifice, time that takes fishing.
- Effort (e.g., tough climatic conditions).
- Hard work and preparation to bring fish from the sea involving several people.
- Fisheries as source of labour.
- “Many people discovered we exist.”
- Work to obtain a healthy product.
- Fishers “bother”, the Festival showed they can organize themselves.

### Did the Festival change something? In regard to whom?

<table>
<thead>
<tr>
<th>Fishers family</th>
<th>Members of the family first would not get involved in activities, now they do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizations</td>
<td>The Mayor of Piriápolis supported and attended.</td>
</tr>
<tr>
<td></td>
<td>The Mayor of Piriápolis supported loan request by fisher to the Minister for</td>
</tr>
<tr>
<td></td>
<td>Social Development.</td>
</tr>
<tr>
<td>Society in general</td>
<td>“Piriápolis was interested.”</td>
</tr>
<tr>
<td></td>
<td>“Piriápolis discovered fishers, they are starting to listen about them.”</td>
</tr>
<tr>
<td></td>
<td>“People ask when it would be newly organized.”</td>
</tr>
<tr>
<td></td>
<td>“Sales increased for a period”</td>
</tr>
<tr>
<td></td>
<td>“People learnt a lot. Learnt what to do with fish.”</td>
</tr>
<tr>
<td></td>
<td>“People learnt about <em>Pangasius</em>.”</td>
</tr>
<tr>
<td></td>
<td>“For tourists, it was a novelty, something different.”</td>
</tr>
<tr>
<td>Fishers themselves</td>
<td>“We did something to change how others see us”.</td>
</tr>
</tbody>
</table>

Lastly, POPA non-fishers members, when asked if the Festival made possible a certain change, they responded that the Festival was seen as an outstanding effort, “a seed” that undoubtedly fostered a number of changes in the way fishers are seen in Piriápolis. Nevertheless, the Festival should be either performed regularly or be part of a wider communication plan. DINARA representative member of POPA expressed how fishers from another region are taking the Festival as an example and particularly refer at the communication strategy implemented.
Conclusion

In light of Appadurai’s proposal, raising fishers’ “voice” to communicate the richness of their practices as of their own views can become a tool to re-build local consensus on a new condition of “different” of fishers - other than of “vulnerable” in society. This can position them more favourably for negotiating aspects related to their wellbeing.

The Festival, proved to be a participatory contribution mainly to the relational wellbeing of fishers from Piriápolis (Table 3), a “seed” to be further nurtured, a potential case for replication.

Table 3. How the different stages of the Festival related to the three wellbeing dimensions

<table>
<thead>
<tr>
<th>WeD</th>
<th>POPA Group</th>
<th>Festival preparation</th>
<th>Festival execution</th>
<th>Media</th>
<th>Festival reception by fishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
Relational x x x x X
Material x

References


Toward understanding fishing-induced extinctions in the tropics: an Amazonian example

Leandro Castello (Virginia Polytechnic Institute and State University), Caroline Chaves Arantes (Texas A&M University), David Gibbs McGrath (Earth Innovations Institute), Donald James Stewart (State University of New York), Fabio Sarmento de Sousa (Sociedade para a Pesquisa e Proteção do Meio Ambiente)

Bioeconomic theory predictions that economic extinctions prevent biological extinctions influence science and policy in many arenas. Such predictions contradict ample evidence of fishing-induced extinctions and in particular a model, called ‘fishing-down’, that explains historical reductions in mean body size of harvested species in tropical multispecies fisheries through the gradual depletion and extinction of large-bodied species. This paper analyzed data on the Arapaima spp., Osteoglossidae, the largest-bodied, most historically important and overexploited fishes of the Amazon Basin to evaluate whether they supported bioeconomic or fishing-down predictions. The evaluation was based on interview data collected with 182 local fishers with respect to
arapaima populations, fishing practices, and management regulations and on census data on arapaima populations covering 1040 km2 of floodplain area. We found that nineteen percent of the fishers harvested the arapaima through fishing practices that are largely unsustainable, characterized by widespread lack of compliance with minimum size and closed season limits. Arapaima population densities were zero (i.e., locally extinct) in one-fourth of the surveyed areas, and near zero (0.55 ind km\(^{-2}\)) and declining in nearly three-fourths of the areas. The persistence of unsustainable fishing practices over extremely low and declining arapaima populations, including the local extinction of arapaima in one-fourth of the area, supported fishing-down predictions. It is suggested that the fishing-down process appeared occurs not only due to the combined effects of low gear selectivity and larger body-size of target species as originally proposed, but also due to high species value and low fishing costs. Available data on the status of tropical fisheries worldwide suggests that fishing-induced extinctions are more common than previously thought and are going unnoticed because high levels of illegal fishing, geographic heterogeneity, and lack of data make identification of the fishing-down process difficult.

**An unlikely partnership: Data collection in a small scale fishery in the Timor Sea**

James Riwu, Office of Marine Affairs and Fisheries, Rote Ndao District, Indonesia
James Prescott, Australian Fisheries Management Authority, Australia
Natasha Stacey, Research Institute for the Environment and Livelihoods, Charles Darwin University, Australia
Andhika Prasetyo, Research Center for Fisheries Management and Conservation, Ministry of Marine Affairs and Fisheries, Indonesia
Dian Octaviani, Research Center for Capture Fisheries, Ministry of Marine Affairs and Fisheries, Indonesia
Anthony Sisco Panggabean, Research Center for Capture Fisheries, Ministry of Marine Affairs and Fisheries, Indonesia

A fishery catch and effort data collection program conducted by Australian and Indonesian scientists with Indonesian sea cucumber fishers has produced three years (2009, 2011 and 2012) of fine spatial and temporal scale data. These data made possible the first stock assessment of the fishery during its centuries-long existence at Scott Reef in north-western Australian waters. The program also included fisher interviews, capturing details of their social and demographic characteristics and the economic inputs to the fishery. Fishery revenues (and its distribution within crews and between crews and owners) were captured on voluntarily submitted logs when fishers returned to port and sold their catch. The emphasis this program placed on acquiring knowledge of the human aspects of the fishery as well as catches and it’s harnessing of the power of fishers to record relevant data stands in contrast to the independent fishery survey methods used at Scott Reef in the past, as in many of the world’s tropical sea cucumber fisheries. The program’s approach
and the time scientists spent on the fishers’ vessels were key ingredients to the program’s initial success. However, despite the program successfully collecting essential data it has failed to deliver tangible benefits to the fishers who participated in it. Eventually we expect the program must lead to better livelihood and fishery outcomes for the fishers to continue to be successful. Further, a successful data collection and monitoring program is likely to be needed to support the continued existence of this unique fishery that bridges borders and supports household wellbeing.

**Small-scale octopus pot fisheries: from science to reality**

Lorena C. A. Andrade (Federal University of Rio Grande do Norte)  
Jaciana C. Barbosa (Federal University of Rio Grande do Norte)  
Priscila F. M. Lopes (Federal University of Rio Grande do Norte)  
Tatiana S. Leite (Federal University of Rio Grande do Norte)  
Jorge E. Lins Oliveira (Federal University of Rio Grande do Norte)

Octopus fishing (Octopus insularis) represents an important income source for small-scale Brazilian Northeastern fishers, where snorkeling is done during the clear water season and fishers cannot select for the octopus size. Between 2011 and 2012, small-scale fishers supported a fishing experiment in Rio Grande do Norte State using plastic pots (US$ 2 each) attached to longlines. The experiment aimed to check both the viability of octopus fishing in murky shallow waters, where fishers can reach with their small boats, and the potential of selecting larger individuals (>500g). The results showed the feasibility of returning small live octopus to the water and of fishing in low visibility. After the experiment, fishers were interviewed and also registered their own fish landing and the water visibility along a year (Feb 2013 to Feb 2014). Most fishers (78%) said they would like to change to pot fishing, but the stealing of pot gear by other fishers was a deterrent for them (86%). Despite that, from 2012 to 2013 the number of fishers and of pots per fisher went from 25% (86 pots/fishers) to 47% (180 pots/fisher; n=32). Also, as fishers found the plastic pots unreliable and expensive, they created cheaper and durable pots (<US$0.25). Self-annotated landings showed that octopus pot fishing was the most profitable activity in periods of murky water, assuring a steady income in harsher fishing periods. Hence, besides being an alternative for more sustainable fishing, pot fishing could also improve local food security, as long as it is kept as a small-scale activity.

**Integrating local knowledge and practices with management: a collaborative at-sea sampling program for small-scale fisheries**

Carolynn S. Culver (University of California, San Diego and Santa Barbara)  
Caroline Pomeroy (University of California, San Diego and Santa Cruz)  
Stephen C. Schroeter (University of California Santa Barbara)
Cost-effective ways for gathering essential fisheries information (EFI) are critically needed to improve the data-poor state of fisheries throughout California and worldwide. Furthermore, in the United States, several state and federal laws require the engagement of fishermen and others in fisheries management. Collaborative at-sea sampling programs (CASPs), where fishermen gather data while fishing and work with scientists and managers to interpret the data to inform management, address these needs, but to date have not been implemented successfully in California. Our team of lobster fishermen, scientists, and fishery managers has designed and piloted a CASP that integrates local knowledge and fishing practices with fisheries management. Together we developed sampling protocols that work for the diversity of fishing operations and fishing areas. Fishermen used these protocols to collect EFI while fishing, with the data validated at the port and then integrated into management. The collected data reveal area-based differences in size distributions, sex ratios, number of recruits, and CPUE, some of which was not evident from existing data and had implications for management. The demonstrated usefulness of these data has generated support among fishermen, managers and scientists for implementing an ongoing CASP for the lobster fishery. Drawing on experience and insights gained from the present effort and case studies of other such programs, our collaborative team is developing a framework for continuing the program over the long term. The demonstrated success of this pilot CASP for engaging fishermen actively in the management process provides a model for other small-scale fisheries.

Fishing gears in Barra Bonita and Bariri reservoirs (Tietê river basin, sp - Brazil) : familiar technology and social-environmental sustainability

Paula Maria Gênova de Castro (Instituto de Pesca/Secretaria de Agricultura e Abastecimento do Estado de São Paulo - IP/SAA-SP)
Gianmarco Silva David (Agência de Tecnologia dos Agronegócios - APTA - Pólo Centro Oeste de Jaú, SP)
Lidia Sumile Maruyama (Instituto de Pesca/Secretaria de Agricultura e Abastecimento do Estado de São Paulo - IP/SAA-SP)
Edmir Daniel Carvalho (UNESP/Botucatu-SP)

The fishing gears used in Barra Bonita and Bariri reservoirs, Middle Tietê River, were evaluated in order to provide objective information to assess the need for a revision of the legal framework governing this activity. Monitoring of the fishery production was carried out in the main fishing nuclei, collecting data about the catch composition (number and biomass), selectivity of fishing gear and the by-catch. Information about the predominant fishing arts, catch per effort unit and seasonality of fish production, as well as environmental information, were also obtained. Monthly field campaigns for sampling
were done, when the researchers followed the fishing activity, making a detailed record of the catches and the employed fishing gears. It was found that gill net is the least selective among the four modalities practiced, but it is the only one which has legal support. Higher selective fishing gears, such as trawls, cast nets and fishing beat, act mainly on tilapia, a non-native species whose exploitation could be considered beneficial to the conservation of the native fish populations through the reduction of the interspecific competition for resources. Throughout the study period was recorded a decline in the tilapia production, with possible signs of overfishing, which caused the migration of a significant number of artisanal fishermen for other dams. Thus it is suggested the restriction of the use of less selective fishing equipment and the liberation of fishing gear that targets the non-native species of cichlids, aiming to reduce the fishing pressure on indigenous species.

Challenges and opportunities for the development of a sustainable artisanal finfish-fishery in Yucatan, Mexico

Thierry Brulé, CINVESTAV-IPN Unidad Mérida
Ximena Renan, CINVESTAV-IPN Unidad Mérida
Teresa Colás Marrufom, CINVESTAV-IPN Unidad Mérida

Abstract
Small-scale fishery in southern Gulf of Mexico constitutes a major component in the economic sector of Yucatan state. This fishery, exploits different demersal species, particularly octopus (Octopus sp.) and groupers (Epinephelidae; Epinephelinae). Groupers constitute the second most important fishing resource for the state, according to the total volume landings and the revenue it generates. Red grouper or Epinephelus morio is the main target of the small-scale finfish fishery contributing with more than 50% of the total number of captured grouper specimens. Nevertheless, red grouper fishery in Yucatan is currently considered as overexploited and overcapitalized, threatening the sustainability of the entire grouper fishery. Moreover, since the small-scale finfish fishery impact directly the stock juvenile fraction, there is risk of growth overfishing. Observed negative economic and social consequences are getting worse with management regulations such as seasonal closure and size limits, imposed for the grouper fishery. However, a number of less vulnerable and highly priced finfish species (Lutjanidae; Labridae) could be exploited by the small-scale fleet. If these species are sustainable managed, they may act as an alternative fishing resource compensating for heavily exploited stocks.

Introduction
Even though small-scale fishery in Yucatan exploits other managed resources such as octopus (Octopus maya and Octopus vulgaris), lobster (Panulirus argus) and sea cucumber (Isostichopus badionotus), the called “finfish” fraction depends on grouper catches. According to the National Fisheries Chart Yucatan small-scale fishing fleet
captures 84% (10,406 tonnes) of the total Mexican grouper production and generates more than $24 million USD revenue (SAGARPA 2012). This fleet composed by 4,400 outboard-powered vessels (> 8 m long) uses hook and line or long line at 6 to 10 m depths along the coast and targets seven different grouper species from which 73% of the landings are registered to be red grouper Epinephelus morio (Brulé et al. 2009). The small-scale fishery has had a constant increase in number of vessels from 1,500 in 1993, 3,500 in 2006 (DOF 2014) and more 4,400 in 2014 (Monroy C., Centro Regional de Investigación Pesquera de Yucalpeten, personal communication). Conversely Mexican CPUE data shows a 51% grouper volume landings decline from 19,886 to 6,212 tonnes between 1972 and 2011 with slightly improvements in some years (SAGARPA 2012).

Even though red grouper Epinephelus morio from southern Gulf of Mexico is considered overexploited (Burgos and Defeo 2004; Giménez- Hurtado et al. 2005), the fishing effort increment and the fact that small-scale fleet exploits directly groupers juvenile fraction, may be one of the main causes for the landings volume decline. To counteract the overcapitalization and to reduce the risk of growth and recruitment overfishing, local management authorities impose a yearly seasonal closure for all grouper species in the Gulf of Mexico and Caribbean sea, a minimum catch size for red grouper and a ban to issue new fishing permits. As negative economic and social consequences get worse, this document explores the challenges and opportunities for the development of a sustainable small-scale finfish fishery in Yucatan.

Challenges
As in many places within its distribution range, groupers are heavily exploited and many species considered as threatened. Groupers are hermaphroditic protogynous, long-lived and slow to mature species making them particularly sensible to overfishing. In southern Gulf of Mexico, groupers display a bathymetric distribution where adults (sexually mature individuals) inhabit offshore sandy-rocky and reef bottoms whereas juveniles (immatures) occupy inshore seagrass, rocky or reef shallow areas. Therefore, small-scale fleet targets almost exclusively grouper juveniles within their nursery areas (Renán 2005, Renán et al. 2007). The seasonal closure from February 15 to March 15 was implemented to protect red grouper reproductive biomass but was applied for all grouper species and imposed to both Mexican fishing fleets (small-scale and technified), even though small-scale do not impact groupers reproductive fraction. To date, taking into account the fishing closed seasons for other locally important economic marine resources (octopus, lobster and sea cucumber), the small-scale fishery is restrain from fishing any of these resources (including groupers) only during four days per year (from March 12 to 15; Fig. 1).
Nevertheless grouper fishing ban is insufficient to protect adults of red grouper and other grouper species during the peak of their respective spawning season, which threats their recruitment process. Furthermore, to reduce the risk of red grouper growth overfishing, a minimum size of 36.3 cm total length (TL) has been introduced to the fishery but has not been efficiently enforced. Consequently, fishing data shows that at least 27% of the total red grouper catch by the small-scale fleet is landed under this minimum legal size (Brulé et al. 2009). Moreover, the imposed minimum size does not correspond to the size at first sexual maturity (L50: size at which 50% of females were sexually mature) for red grouper from the Campeche Bank, which is 53.3 cm TL (Brulé et al. 1999). If the minimum legal size were established to allow juveniles to reproduce at least once in their lifetime, 94% of the currently red grouper landings by the small-scale fleet would be forbidden (Fig. 2).
Figure 2. Size-frequency distribution of red grouper caught by the small-scale fishery from Yucatan (February 2007 – January 2008). Percent of bycatch specimens caught in accordance to the actual minimum size (A) and for minimum size = L50 (size at which 50% of females are sexually mature; B) are indicated in red. TL = total length.

Thus, the enforcement of a red grouper minimum size of 53.3 cm TL will preclude the small-scale fishery to be a lucrative activity. Moreover, considering the season closures for octopus, lobster and sea cucumber, small- scale fleet would be restrain from fishing any resource for more than three months per year: from March 12 to April 7 (27 days) and from April 15 to June 30 (77 days) (Fig. 3). Fishermen acknowledge that red grouper is a subsistence resource all year round and, without any other alternatives, they are not willing to accept the establishment of a 53.3 cm TL minimum size. To relieve social pressure, State government pays annually more than one million USD in subsidies to fishers during the month of red grouper fishing closed season, which exacerbate the overcapitalization of the fishery because it artificially induce the idea of “profit” even when resource is overfished (Pauly et al. 2002).
Figure 3. Closed and open seasons for the four main commercial marine resources (sea cucumber; lobster; octopus and red grouper) exploited by the small-scale fishery from Yucatan. Black oblique bars indicate the periods during which the small-scale fishery is restrained from fishing any of these resources taking into account the proposed red grouper minimum size = L50 (size at which 50% of females are sexually mature). If minimum size = 53.3 cm TL (total length) were enforced, red grouper fishery would not be lucrative for the small-scale fleet because 94% of the available specimens for this fishery would be undersized.

**Opportunities**

The seasonal closure used to protect red grouper and other grouper adults during their reproductive season, is unnecessary for the small-scale fishery. Indeed, Mexican authorities are considering that a closed season should be enforced only for the technified fleet. But the necessity of a minimum size is critical for the small-scale fleet to avoid the risk of growth (in accordance with size of first maturity) overfishing. One option for the red grouper small-scale fishery to still operate is to consider the creation of a fishing exclusion zone (EZ) all along the Yucatan coast. The creation of a no-take reserve at least 10 km wide along the coast (see Giménez-Hurtado 2005 in López-Rocha and Arreguín-Sánchez 2008), could connect the four protected areas that already exist, two national biosphere reserves: Río Lagartos and Celestun, and two state reserves: Dzilam de Bravo and El Palmar. The management plan for the marine fraction of these protected areas could be easily implemented. A vessel monitoring system “Navic” is already implemented in Yucatan (Euán J. and Salas S. CINVESTAV- I.P.N. Unidad Mérida,
personal communication) to monitor, control and for surveillance of fishery activities within the EZ, which may ease the management and enforcement decisions. This will constrain the small-scale fleet to exploit larger red grouper in deeper coastal waters and provide some fishermen with a different job as monitors within the EZ. The creation of a marine protected area (MPA) with a no-take reserve, combined with a strongly limited effort in the remaining fishable area have shown to be an effective measure to rebuild depleted stocks (Pauly et al. 2002).

Furthermore, other species should be proposed as an alternative to the exploitation of juvenile groupers. Snappers particularly lane snapper (Lutjanus synagris) and yellowtail snapper (Ocyurus chrysurus) are a growing resource for the small-scale fishery. Only in 2012 these two species accounted for 20% (1,100 tonnes) of the total landings for the small-scale fleet with $2 million USD revenue (SAGARPA 2012). Snappers, which are gonochoric species, could be alternative species following a management strategy for a sustainable fishery that may include for lane snapper: a closed season in May and a minimum size of 15.4 cm fork length (LF). For yellowtail snapper the management conditions may include: a closed season from April to May and September and a minimum size of 19.4 cm FL (Trejo 2011, Trejo et al. 2011). These two species are all ready exploited mainly by the small-scale fleet but should be done responsibly. Hogfish Lachnolaimus maximus is another valuable resource for the small-scale fleet. From 2002 to 2004 the annual volume landings for the specie fluctuate from 20 to 223 tonnes with a market price of $11 USD per kg (Rodríguez-Gil 2009). Nevertheless, there is neither scientific information on its biology nor federal CPUE assessments, which may lead to an overexploitation of the specie. A management strategy for this very lucrative species is imperative as the IUCN (Internacional Union for Conservation of Nature, IUCN 2013) already considers hogfish as a vulnerable species (Vulnerable A2bd).

**Conclusion**

Solutions to the social and economic problems arousing from the red grouper volume decline are complex and challenging. Approximately 10,300 fishermen in Yucatan (Munguía 2010) acknowledge the difficulties to economically sustain their families. Government, management authorities, scientists and fishermen are trying to develop a new red grouper management plan to avoid the collapse of the fishery, which may take place according to some projections in 2025 (Munguía 2010). To prevent this the enforcement of a minimum size near size of first maturity is critical. The creation of a MPA with a no-take zone along the Yucatan coast may give alternative jobs to some fishermen forced to leave the activity, protect different marine habitats and optimize export of highly priced species (such as groupers) to adjacent fishing areas (Pauly et al. 2002). Even though MPAs are not a panacea and must be always associated with conventional fishing regulations, different experiences around the world have showed to be the best way towards fisheries sustainability.

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The role of community-based management for sustaining the small-scale fisheries of Pacific Island Countries

Philippa Cohen, WorldFish

Collaborative, community-based strategies (i.e., co-management) are now mainstream approaches for managing small-scale fisheries. Contemporary co-management in the Pacific often leads to ‘hybridisation’ between local (customary) practices and science-based (contemporary) management. However, the form that management ultimately takes, and the impacts on multi-species, multi-method fisheries have rarely been critically analysed. I use an interdisciplinary approach to examine management practices and fisheries outcomes in three Pacific cases of co-management, and focus in particular on reef closures, being a commonly employed measure. In contrast to short and temporary customary closures, contemporary reef closures are periodically-harvested but predominantly closed, reflecting attempts to reduce fishing effort and enhance ecological sustainability. Closures are opened to harvesting for relatively short periods in response to local social and economic needs. Fishing effort during these openings is intense and elevated. Yet, when compared across a full year, effort and total harvested biomass from closures is low to moderate. Catch rates from newly opened areas are higher than from continuously open reefs for gleaning, but not for line fishing or spearfishing. Although a suite of management measures appear in written plans that were developed in consultations between communities and partner NGOs, few resource-use measures are applied in practice. Periodically-harvested closures are the main or, in some cases, the only management measure implemented; but they cover less than 5% of fished reefs. Improvements to the performance or sustainability of small-scale fisheries are likely modest, if any. I discuss recommendations for the Pacific co-management model, and argue that both the potential, and limitations of this model need to be explicitly recognised in policy and practice to ensure that small-scale fisheries can continue to benefit Pacific communities.

Sustainability and changes in the usage pattern of the red grouper (Epinephelus morio) of the Bank of Campeche, by commercial fleets

Mirtha O. Albáñez-Lucero, Instituto Politécnico Nacional, Centro Interdisciplinario de Ciencias Marinas, Apartado Postal 592, La Paz, 23000, Baja California Sur, México, E-mail: malbanez@ipn.mx
Abstract
The red grouper (Epinephelus morio) is a species of great commercial importance in the Bank of Campeche, where the species is exploited by three fleets, a technified of Cuba, a semi-technified or mid-size and an artisanal fleets of Mexico. Annual yields for all fleets have decreased from an average of 18,000 tons per year in the early 1970s, to an average of 8,000t presently, reflecting the declination of the stock abundance. This has encouraged that fleets change their behavior over time, being that in the 1970’s overlapping between artisanal fleet and the semi-technified fleets of Mexico (regarding size composition of catches) was 18%, while today is close to 50%. This behavior is of concern in terms of fish management since the greatest overlap occurs during the reproductive concentration where catchability behavior (as an index of catch efficiency) indicates that the population is more vulnerable to fishing. The behavior of the fleets’ spatial dynamics suggests that the spatial control of fishing operations could be relevant to the sustainability of the fishery.

The red grouper (Epinephelus morio) is a species of great commercial importance in the Bank of Campeche, where the species is exploited by three fleets, one technified of Cuba, a semi-technified or mid-size, and an artisanal fleets of Mexico. Annual yields for all fleets have decreased from an average of 18,000 tons per year in the 1970s to an average of 8,000 t at present, reflecting the decline in stock abundance (Figure 1). Changes in fleet behavior has been observed covering fishing ground areas and reflecting different usage patterns between fleets, which are presently wider than in early decades in the history of the fishery, and has been assumed as response to lower yields. Our hypothesis is that such behavior may have implications on the sustainability of the fishery. In order to taste this hypothesis two approaches were used; 1) changes in the overlap of the fleet by comparing the size structure in the fleet’s catches; and 2) comparing the patterns of catchability with size between fleets. For this we used data from 1970 and 1980 decades, when the fishery is considered to be health, with respect early 2000, when the state of the fishery was declared as overexploited. Data for recentiest years were not used because they are affected by the closure started in 2003. Overlap between fleets was computed by Moreno (1997) for the first period; while Giménez (2005) reported overlap for the second period of time. Catchability-at-length patterns were obtained from Arreguín-Sánchez and Pitcher (1999) for the first period and from Giménez (2005) for the second period.
Figure 1. Historical annual catches for the grouper (*Epinephelus morio*) of the Campeche Bank. Solid lines indicate years where overlap between fleets was evaluated; while dotted line indicates years where closed season operated.

The indicators of the overlap between fleets suggest that the size structure of the catch between medium-Mexico and Cubana fleets had not changed, while the overlap between the coastal fleet with the other two fleets has clearly increased (Table 1). The results suggest that the coastal fleet is showing significant changes in its expansion.

<table>
<thead>
<tr>
<th>Fleets</th>
<th>% Overlap fleets between 1970-1980</th>
<th>% Overlap fleets between 2001-2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Mexico and Cuban</td>
<td>52% - 57%</td>
<td>55%</td>
</tr>
<tr>
<td>Medium Mexico and coastal</td>
<td>60%</td>
<td>90%</td>
</tr>
<tr>
<td>Coastal and Cuban</td>
<td>12% a 18%</td>
<td>53%</td>
</tr>
</tbody>
</table>

The patterns of catchability show significant changes between fleets; for example, in the recent period (2000) catchability for mid-size fleet of Mexico relative to Cuban fleet, shows considerable increase in vulnerability to fishing on juveniles and pre-adults compared to 1980s and 1990s; while for adults catchability remains equal for both fleets and periods. In the case of the relative catchability between the Mexican fleets the pattern of catchability-at-length is similar, with higher vulnerabilities to fishing for juveniles than adults for the artisanal fleet, while this relationship is reversed for adults.

In the case of the relative vulnerability between Cuban and artisanal fleets, catchability of juvenile is higher for juveniles and preadults in all the cases, but strongly increasing for the artisanal fleet in the last period respect to early times. For adults-sizes catchability-at-length remains equal, increasing slightly for Cuban relative to artisanal fleet (Figure 2).
Figure 2. Patterns of catchability's departures between fleets with fish size (TL). A) Mexican mid-size fleet over Cuban fleet; B) mid-size fleet over artisanal fleet, and C) Cuban fleet over artisanal fleet. Negative values indicate catchability for the fleet in the numerator is higher than catchability of the fleet in denominator; and viceversa. Note that always catchability on immature fishes (juveniles and preadults < 50cm TL) is higher for the artisanal fleet than for the other two fleets. Also note that catchability on adult (reproductive) fishes is higher for Cuban and midsized fleet of Mexico than for artisanal fleet. Note that catchability on small immature fish (>50cm TL) is higher for midsize and
artisanal than Cuban fleet at the present than in 1980’s and 1990s decades. This suggest higher vulnerability of growth overfishing after closures. Catchability-at-length for the midsize fleet is higher at the present than for artisanal fleet in 1980s and 1990s decade for all size range captured.

These patterns suggest that at present fishing mortality would be increased for juveniles and pre-adults, with serious risk of growth overfishing and as consequences for the sustainability of the fishery. Arreguín-Sánchez and Pitcher (1999), Giménez (2005) and López-Rocha et al. (2009) have shown that catchability of the species increases significantly in adults at the time of reproductive concentration. Moreover, the National Charter Fishing, CNP (DOF 2012) reports that the resource is over-exploited, having implemented a closure to protect the reproductive process, imposing limits to fishing mortality. On the other hand, at the present it’s known that the stock decreasing trend is also strongly associated with climate change impacts (Arreguín-Sánchez, 2012, Arreguín-Sánchez et al., this volume), and particularly changes in temperature affecting reproductive success (Albañez-Lucero, 2009). If no care is taken adapting levels of fishing effort to the true levels of available stock, overfishing could increase.

Since closure aims to protect recruitment overfishing, even accounting fish reduction on adults because the negative effect of the increasing temperature in recent years, no measures have been taken to avoid growth overfishing. Information on overlapping fleets regarding their catch structure and catchability-at-length patterns suggest that the mid-fleet, but particularly the artisanal fleet are operating with higher incidence on juveniles and pre-adults, coinciding with López-Rocha et al. (2009) who report spatial differences in catchability, locating areas that are characterized by high catchability values, particularly inhabited by juveniles and pre-adults, in the central coastal region of the Yucatan peninsula. The observed fleets behavior, related to the changes in fishing patterns, suggest a higher risk of growth overfishing and on the sustainability of the fishery in consequence.

References


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**The role of small marine protected areas in heavily fished Philippine coral reef ecosystems**

Richard N. Muallil, Melchor R. Deocadez, Renmar Jun S. Martinez, Samuel S. Mamaug, Cleto Nañola and Porfirio M. Aliño

Marine Science Institute, University of the Philippines Diliman, 1101 Quezon City, Philippines; Marine Environment and Resources Foundation, Inc., Marine Science Institute, University of the Philippines Diliman, 1101 Quezon City, Philippines; Mindanao State University – Tawi-Tawi College of Technology and Oceanography, 7500 Bongao, Tawi-Tawi, Philippines; University of the Philippines Mindanao, Mintal, Tugbok District, Davao City, Philippines

Corresponding author: rmuallil@gmail.com +632 433 1806

**Abstract**

The Philippines is part of the Coral Triangle where the most diverse coral reef ecosystems are found. Coral reef fisheries support the livelihoods of millions of coastal population in the country. Thus, its long-term sustainability is crucial for food security and overall well-being of the coastal population. We assessed the status of commercially important coral reef demersal fish in the Philippines and determined whether fish assemblages differ between fished and protected areas. A total of 12,354 individuals belonging to 114 species (Acanthuridae, 33; Scarinae, 27; Lutjanidae, 17; Epinephelinae, 16; Mullidae, 9; Haemulidae, 6; Lethrinidae, 6) were recorded. Acanthuridae, followed by Scarinae and Epinephelinae were the most abundant groups. The density of large fish (i.e. ≥25 cm TL) ranged only from (mean ± sd) 0.02±0.04 to 0.86±1.09 individuals/500m² for Lethrinidae and Scarinae, respectively. More than 80% of the species were found in less than 40% of the sites only. The highly restricted distribution and very low density of most species can be attributed to high fishing pressure in the country. Interestingly, we found more species, higher density and larger fish inside MPAs. However, our study supports previous findings that the current MPAs may not be enough to improve the condition of the
country's coral reef fisheries. We highly recommend the establishment of more, larger and well-enforced MPAs that are well distributed all over the country. With the rapidly growing coastal population and the advancement of fishing technology, the future of coral reef fish may depend on the effectiveness of no-take MPAs.

Introduction

The Philippines is part of the Coral Triangle which harbors the world's most diverse coral reef ecosystems. Coral reef fisheries in the area also support the livelihoods of millions of coastal population. However, the health and productivity of these ecosystems are in great jeopardy due to overfishing and the prevalence of destructive fishing practices in the area. These anthropogenic threats are further aggravated by climate change impacts. Damage to these valuable coral reef ecosystems will have serious implications on food security and overall well-being of the millions of highly resource-dependent coastal population within the Coral Triangle (Cruz-Trinidad et al. 2014).

Establishment of marine protected areas (MPAs) is among the most commonly implemented initiatives for coral reef conservation within the Coral Triangle. The Philippines in particular has already more than 1,600 MPAs, the highest in the world. However, almost 90% of the these MPAs have less than 1 km² area (White et al. 2014) which is hypothetically too small to be effective in achieving the biodiversity conservation and fisheries sustainability goals (Green et al. 2014; Edgar et al. 2014). Weak law enforcement, high fisheries-dependent population density and the prevalence of destructive fishing practices further undermine the effectiveness of these MPAs (Muallil et al. 2014a, 2014b).

In this study, we assessed the status of commercially important reef associated fish in coral reefs all over the Philippines. Specifically, we described species composition, density, size characteristics, spatial distribution and determined whether fish assemblages differ between fished and protected areas.

Materials and Methods

Data collection

The study was conducted in 37 coastal municipalities all over the Philippines (Fig. 1). Each municipality had at least one established locally-managed MPA where reef fish surveys were conducted. Surveys were also conducted in adjacent fished reefs with a distance of at least 200 m from the boundaries of MPAs. All surveys were done from 2012 to 2013.
Figure 1. Map of the Philippines showing the 37 municipalities where the surveys were conducted.

Reef fish were surveyed by SCUBA diving along 50-m long transect lines established on reef crests with depths ranging from 6-12 meters. In each site, 8-12 transect lines were surveyed, half of which were established inside MPAs and the other half on adjacent fished reefs.

Data were collected using a modified non-destructive fish visual census (FVC) technique (English et al. 1997) where a diver swims slowly and stops every 5 meters to record all the fish within a 10m-wide belt (Nañola et al. 2010). Each fish was identified to the species level and total length (TL) was estimated to the nearest cm.

Data analyses

We included in the analyses only fish with at least 5 cm TL belonging to families/groups of commercially important coral reef associated demersal fish such as Scarinae (parrotfish), Acanthuridae (surgeonfish), Serranidae (groupers), Lutjanidae (snappers), Lethrinidae (emperors), Haemulidae (sweetlips) and Mullidae (goatfish), which are primarily caught for food by small-scale fishers in the Philippines. Further, we excluded species belonging to Zebrasoma genus in family Acanthuridae. For Serranidae, only species belonging to commonly caught subfamily Epinephelinae were included in the analysis. Species belonging to other subfamilies of family Serranidae and genus Zebrasoma of family Acanthuridae are not commonly targeted by small-scale fishers in the Philippines.
Nested ANOVA was used to compare the relative densities among different fish groups/families and fish densities between fished and protected areas. Municipalities were treated as random factor in both analyses. *Post-hoc* Tukey's test was used for multiple comparison. In both analyses, fish density was log-transformed in order to normalize outliers.

Sizes of fish were described by assigning each fish to one of the three different size groups, based on TL, (i) small, 5 to 14 cm TL (ii) medium, 15 to 24 cm TL, (iii) ≥25 cm TL. Densities of large fish, by family, were further compared between fished and protected areas.

Each species was described based on three ecological parameters, (i) spatial distribution across sites, (ii) proportion of individuals inside MPAs, and (iii) density. The levels for each parameter are presented in the results.

**Results**

A total of 12,354 individuals belonging to 114 species (Acanthuridae, 33; Scarinae, 27; Lutjanidae, 17; Epinephelinae, 16; Mullidae, 9; Haemulidae, 6; Lethrinidae, 6) of commercially important coral reef associated demersal fish were recorded. The densities of Acanthuridae, Scarinae, Epinephelinae and Lutjanidae were significantly higher inside MPAs (Fig. 2a). Acanthuridae, followed by Scarinae and Epinephelinae had the highest density but did not differ significantly among one another (Fig. 2b). The densities of Acanthuridae and Scarinae, but not Epinephelinae, were significantly higher than the other four groups. The densities of these four groups did not differ significantly with one another.

Sizes of most fish were below 25 cm TL (Fig. 2b). The densities of large fish (i.e. ≥25 cm TL) ranged only from (mean ± sd) 0.02±0.04 individuals/500m$^2$ for Lethrinidae to 0.86±1.09 individuals/500m$^2$ for Scarinae. Most of the large individuals of all fish groups were found inside MPAs (Fig. 2c).
Figure 2. Fish assemblages. a. Proportion of individuals inside MPAs. ***, P<0.001; **, P<0.01; *, P<0.05; O, P<0.1; ns, not significant. b. Density of fish by family/group showing the size frequencies of fish per group. Lines above the bars indicate significant difference at P= 0.05. The densities of individuals of the groups with the same line were not statistically different. Size groups: black = small, <15 cm TL; dark gray = medium, 15-24 cm TL; white = large, ≥25 cm TL. c. The proportion of large individuals by group inside MPAs.

In terms of spatial distribution of the fish, only 2 (Ctenochaetus striatus, Acanthuridae and Chlorurus sordidus, Scarinae) out of 114 species recorded had a very high distribution, i.e. found in more than 80% of the study sites. More than 82% of the species had low to very low spatial distribution (Fig. 3a). In terms of proportion of individuals of a species found inside MPAs, 23%, 26%, 30%, 10% and 11% fell into levels "very high", "high", "moderate", "low" and "very low" levels, respectively (Fig. 3b). In terms of density, almost 75% of the species had "low" density of less than 5 individuals/ha (Fig. 3c).

Discussion

Our study showed that the current MPAs in the Philippines can be effective for conservation of coral reef associated fish despite the overall small sizes and the high threats from overfishing and destructive fishing practices (see Alcala et al. 2006). For example, more individuals of the three most abundant groups (Scarinae, Acanthuridae and Serranidae) were found inside MPAs. Moreover, higher densities of the larger individuals of all fish groups assessed were found inside MPAs. The observed higher density and larger sizes of target fish inside MPAs despite being small can be attributed partly to the impact of MPAs on fish behavior or the nature of the fisheries in the country. With perceived threats, including fishing activities, fish may spend most of the time
inside or close to MPAs if the adjacent areas are heavily fished (Januchowski-Hartley et al. 2011). On the other hand, fishing pressure on target coral reef fish in the Philippines may not be as bad as commonly thought. Muallil et al. (2014b) showed that only about 22% of small-scale fishers in the Philippines are currently directly catching coral reef associated demersal fish. Most fishers catch pelagic fish such as tunas, mackerels and scads or soft-bottom fish such as slipmouths and threadfin breams.

Figure 2. The characteristics of each species based on, a. Spatial distribution across the 37 municipalities. Levels: "Very high", "High", "Moderate", "Low" and "Very Low" when species was present in 81-100%, 61-80%, 41-60%, 21-40% and ≤20% of the sites, respectively. b. Proportion of individuals inside MPAs. Levels: "Very high", "High", "Moderate", "Low" and "Very Low" for 81-100%, 61-80%, 41-60%, 21-40% and ≤20%, respectively, of individuals of a species were found inside MPAs, and c. Density of species. Levels: High > 10 individuals/ha, Moderate = 5-10 individuals/ha, and Low <5 individuals/ha.
Our study highlights the need for more conservation efforts to effectively improve the condition of coral reef fisheries in the country. Fish density is generally very low and most of them are small individuals. Some species, especially those with low density, have more than 80% of their individuals found outside MPAs making them highly vulnerable to exploitation-related local extinction. Further, the majority of the species are found only in less than 20% of the sites despite sampling from eight to twelve 500 m$^2$ belt transects per site. This highly restricted distribution of reef fish can be either due to the impact of overexploitation that caused local extinctions (Lavides et al. 2010; Nañola et al. 2011) or simply due to the highly fragmented nature of coral reef ecosystems in the Philippine archipelago that would naturally result in distinct fish communities (Carpenter and Springer 2005).

In summary, our study revealed that the sustainability of Philippine coral reef fish fisheries is highly threatened unless considerable conservation efforts are done. The observed higher fish density inside MPAs may suggest that MPAs could slow down extirpation of commercially important reef fish but not necessarily improve the fisheries. The current MPAs may not be enough to achieve coral reef fisheries recovery because of small sizes and more importantly weak law enforcement and high fishing pressure (Maliao et al. 2009; Muallil et al. 2014a, 2014b). Thus, to achieve biodiversity and fishery benefits from coral reefs in the country, larger MPAs (e.g. 50-100 ha no-take zones, depending on the socio-ecological attributes of the sites) must be established in all coastal municipalities all over the country. More importantly, enforcement against illegal fishing activities, poaching inside MPAs and socio-economic programs that would reduce the dependency of the population on coral reef ecosystems must be pursued.

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Formal and informal rules as part of Colombia’s artisanal marine fisheries management

Jesús M. Jiménez (Undergraduate Student, Biology Program, University of Magdalena, P. O. Box 2-1-21630, Carrera 32 No. 22 – 08, Santa Marta – Magdalena, Colombia; (57-5)-4301292 – 4301292.
Lina M. Saavedra-Díaz, Ph.D. (Professor, Biology Program, University of Magdalena, P. O. Box 2-1-21630, Carrera 32 No. 22 – 08, Santa Marta – Magdalena, Colombia; (57-5)-4301292 – 4301292.

Colombia has implemented formal and informal fisheries regulations as management tools, however the fishery sector (mainly its artisanal component) is getting weaker over time, not only from an environmental perspective, but also from administrative, socio-cultural and economic perspectives. This situation raises interesting research questions, such as: 1. which fishery resources have been formally regulated and how do they perform at present? 2. what formal and informal rules have worked, and how have they achieved success? and 3. what features should a formal or informal rule have to be successful in the Colombian context? With a thorough grounding in primary and secondary information, the present study addresses these questions. Primary information will be obtained through semi-structural interviews of fishermen from five different marine coastal fishery communities along the Caribbean coast, and of fishery experts from different governmental and non-governmental institutions. Secondary information will be obtained through an exhaustive search of all formal regulations pertaining to the marine artisanal fishery sector at the national level generated since Colombia instituted its first fishery administration over the last six decades. Although research is still in progress, results are expected to provide useful information to decision makers about how and why formal and informal rules work, and why sometimes they don’t? Results will also show how rules may be improved in the context of Colombian fisheries in order to become more effective management tools in the future.

A critical analysis of livelihood of fishermen in Chilika Lake and developing a sustainable livelihood model

Ms Sarita Das, PhD Scholar, Department Of Business Administration, (Utkal University) Odisha, India

The poor fishermen concentrated in and around the Chilika lake adopt traditional method of fishing activities and lead a subsistence living. The study covering 120 households in a cluster of 4 villages revealed a dismal socio-economic picture. About 80 percent households are small and marginal farmers and are too poor to afford motorized boats or any productive investment. Seasonal fishing in Chilika along with encroachment of non-
fishermen limits the scope of local fishermen to earn higher income. To supplement income, many fishermen migrate to outside the state, many others take up non-fishery activities including working as daily wage labourers. As observed, to earn more income by way of catching additional fish through Intensification and Extensification methods found to be neither fully effective nor holistic in nature. Hence to improve socioeconomic conditions and to ensure a standard living, a sustainable livelihood system model for the fishermen has been developed based upon certain earlier tested models. This proposed model will not only help the fishermen to be more productive but also will provide greater employment opportunity round the year. Besides, the model will provide social benefits like mutual understanding, harmonious living, reduction in personal and group conflicts and help in building strong social organisations. The supporting pillars of this organization are (i) Managing Body,(ii) Inputs ie such as finance, infrastructure and capacity building (iii) Self help groups, (iv)Output (v) Marketing The model is comprehensive, self content in nature and free from government intervention. The income can be recycled from bottom to top and vice versa.
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