

# IMPACTS OF INSTITUTIONAL CHANGES AND MPA MANAGEMENT TO INDIGENOUS PEOPLES' LIVELIHOODS AND FOOD SECURITY IN SOUTHERN BRAZIL

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## ABSTRACT

Despite their relevance for biodiversity conservation, marine protected areas (MPAs) cause social impacts, such as loss of livelihood diversity. We evaluated how institutional changes related to fisheries and MPA management affected the livelihoods and food security of isolated and traditional fishing communities (the Caiçaras) in Parana, Southern Brazil. This study was conducted in collaboration with a fishing community (Almeida Island Village, Paranagua Bay) and the Brazilian Protected Area management agency (ICMBio), in order to support the development of strategies to alleviate the conflicts between the two. Data were collected between March and October 2014 through semi-structured surveys with 80 households (95% of total households), and three participatory workshops. Fishing is the main source of income and protein for all households. The swamp ghost crab (*Ucides cordatus*), captured with handcrafted traps, is the main target species. The harvest season lasts only for four months (austral summer) but represents the major source of revenue for the community. Almost all of the household members work in the fishery. Fishing grounds have been reduced since the creation of three MPAs in the 1980s and the expansion of port industries. All mangrove areas, where most of the fishing occurs, have become no-take zones. Fishers also consider the crab closed season and the fishing gear restrictions as a misfit with the local ecosystem dynamics. Compliance of these rules is low; fishers take the risk of being caught by surveillance agencies. Centralized institutional changes restricting fishing activities have caused the abandonment of traditional practices and a high dependency on social programs and government subsidies. The loss of livelihood diversity in isolated and fishery-dependent communities can accelerate food insecurity and poverty traps, while also creating a long-term loss of ecological knowledge about mangroves. Our partnership with fishing communities and ICMBio provides some lessons to strengthen the science-practice-policy interface of fisheries and MPA management, taking into consideration the livelihoods of traditional peoples and their interconnection with the ecosystem dynamics.

**Key-words:** fisheries, mangrove, conservation, participation, swamp ghost crab, SocMon

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## INTRODUCTION

In Brazil, the implementation of Marine Protected Areas (MPAs) originated to preserve remaining ecosystems and natural resources that were starting to show signs of exploitation. The number of protected areas implemented had a significant increase during the 1980s because of the military regime (Medeiros, 2005). The demarcation of these areas was not based on thorough studies; only biotic and ecosystem factors were taken into consideration (Manragon and Agudelo, 2004). In 2000 the National System of Conservation Units (SNUC) was created, providing guidelines and rules for the creation and management of environmental protected areas in Brazil (Brasil, 2000), although with flaws (Medeiros, 2006). Only during the last decade Brazilian MPAs started to have a role for fisheries management (Prates et al, 2000). Nevertheless, many of these areas still do not have their management plan and there are conflicts between indigenous communities and management agencies. The implementation of protected areas marginalized indigenous communities, who were not involved in that process. Indigenous and traditional communities, such as *caiçaras* and *quilombolas*, developed their livelihood and differential cultures based on their isolated context. For these communities, the land is not just their source of income but an important part of their cultural identity (Diegues, 1994; 2000).

On the Southern coast of Brazil, in the Paranaguá Estuarine Complex (Paraná state), three MPAs (two no-take and one of multiples uses) were implemented during the 1980s. The purpose was to protect remnants of rainforest, mangroves and natural heritage (SPVS, 1992). Some of these areas were over devolved land (Manragon and Agudelo, 2004). As more than 30 indigenous or traditional communities live within or around these MPAs, conflicts started to emerge when people were prohibited to continue their livelihood activities.

The law creating the National System of Protected Areas brought participatory spaces for management. These are consultative boards or councils in which different actors (communities, government agencies, non-government organizations, and universities) engage to discuss protected area issues. These boards have “Technical Chambers” (advisory groups) which deal with specific subjects, such as fisheries. ICMBio (the federal agency managing protected areas) is in charge of the consultative boards and associated advisory groups (SNUC, 2000). Our research group from the Center for Marine Studies (Federal University of Parana) participates in the Fisheries Technical Chamber advising the three MPAs in the Paranaguá Estuarine Complex (CEP). It was in one of the meetings where fishers brought their interest to have the fishing rules for ghost crab (*Ucides chordatus*) reviewed. Many conflicts between communities and government agencies originated from differences regarding crab management.

We therefore decided to investigate the dynamics, uses and importance of the crab fishery involving traditional communities inside the CEP, within and around the three MPAs, with the purpose of understanding the human dimensions of this fishery.

## STUDY AREA AND METHODS

The Estuarine Complex of Paranaguá (Figure 1), on the Northern coast of Paraná State, Brazil, is subdivided in two bays (Lana et al, 2001), with different contexts. In the South there are two ports of major importance for Latin America, the Paranaguá and Antonina Ports (Machado and Sá, 2007), with several others large-scale developments planned for the next decade. The North portion of the estuarine complex, on the other hand, is almost fully part of

a multiple-uses MPA, the Environmental Protected Area (APA) of Guaraqueçaba. Two no-take MPAs are within this APA: the Ecological Station (ESEC) of Guaraqueçaba and the National Park (PARNA) of Superagui (IBAMA and SEMA, 1995). Within the CEP there are more than 60 small traditional communities, whose livelihoods are directly linked to fishing; and 34 of these communities are inside the MPAs (Andriguetto - Filho, 1999).

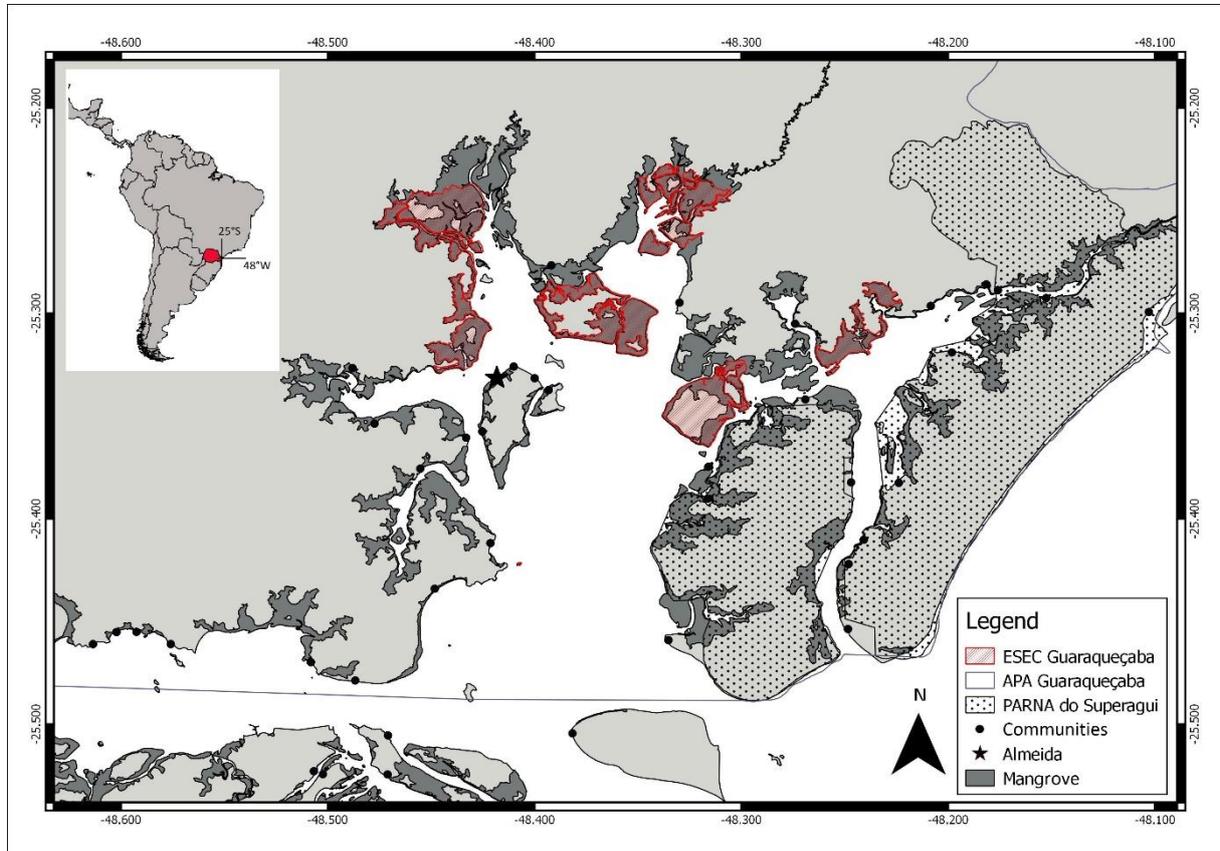


Figure 1. Map of the study area

The research was conducted at the fishing community of Almeida (Figure 1, localized on the Northwest portion of the CEP) because it was appointed as the most representative and dependent on crab fishing in the study area. Data collection followed the SocMon participatory methodology (Socioeconomic Monitoring Program for Coastal Management), whose basic principle is to make rapid and participatory socioeconomic diagnosis based on local demands. The results are targeted towards coastal management, while contributing to community empowerment, and also leading to scientific products (Bunce et al, 2000).

Data collection occurred between March and November of 2014. The community association and community members provided verbal consent for participating in this research. Semi-structured interviews, participatory workshops, and local observations were used to collect qualitative data. Quantitative data was collected through a survey which was applied in 80 households, totalizing 95% of the community. All these methods investigated socioeconomic and cultural aspects of the community, giving particular attention to the crab fishery. Table 1 shows the variables that were investigated through the survey. There was no secondary data available about the dynamics and organization of the crab fishery at CEP, as a social-ecological system involving resources and communities. Throughout the research, the results

were brought back to the community for validation purposes, which informed the next step to take.

Table 1. Variables assessed through the household survey in Almeida community, according to the SocMon classification

Parameter	Variable
<b>Demography</b>	<ul style="list-style-type: none"> <li>· Population (K4)</li> <li>· Household number (K5)</li> <li>· Occupation (K7S1)</li> <li>· Age (k8S2)</li> <li>· Gender (K9S3)</li> <li>· Income source (S10)</li> </ul>
<b>Coastal marine activity</b>	<ul style="list-style-type: none"> <li>· Marine activities (K18S12)</li> <li>· Goods and services (K19S13)</li> <li>· Metodology (K20S20)</li> <li>· Economic importance</li> <li>· Target species (S15)</li> </ul>
<b>Attitudes and perceptions</b>	<ul style="list-style-type: none"> <li>· Perceptions about the resource state (S19)</li> <li>· Threats perceptions (S20)</li> <li>· Consciousness about rules and regulations (S21)</li> <li>· Perception about coastal management, problems and solutions (S24)</li> <li>· Perceptions about community problems (S25)</li> </ul>

Data was analyzed through basic statistics in standard spreadsheets using the socioeconomic surveys. Information from interviews, participatory workshops and observations was used to validate and complement the findings from quantitative data.

## RESULTS

Fishing was the main economic activity in 87% of the households. Some secondary activities were also fisheries-related, such as repairing boats or retirement (old fishers). Other activities included social services to the community, such as educational agents. Among the families that have fishing as the main activity, 10 different fisheries (i.e. 10 species) were observed throughout the year (Table 2). The crab and the shrimp fisheries were indicated as the most profitable by 94% and 24% of the households, respectively. The rest of the species caught are for subsistence only, not being sold.

During the 2013/2014 crab season (December-March, austral summer), 90% of the fishing spots were inside no-take MPAs. Women are involved in the fishery; they go fishing, they process the catch and/or they manufacture of handcrafted traps. The crab fishery differs from the rest because all the catch is sold outside the community, mainly to the state capital, Curitiba. Only crabs of non-commercial size are for consumption at the community. Fishers sell the crabs to middlemen. In the winter time oysters and mussels are extracted by the majority of the household, with involvement of the family unit in different parts of the chain, for subsistence or low income.

Table 2. Proportion of households involved in each fishery in Almeida community

Fisheries (species)	Household %
Crab ( <i>Ucides cordatus</i> )	96%
Perch-likes (Scianidae)	62%
Shrimp ( <i>Litopenaeus schimitii</i> )	54%
Catfish (Ariidae)	33%
Mussel ( <i>Mytella</i> sp.)	32%
Oyster ( <i>Crassostrea rhizophorae</i> )	28%
Mulletts ( <i>Mugil</i> spp.)	17%
Pufferfish (Perciformes)	10%
Soft crab ( <i>Callinectes</i> spp.)	10%
Flatfish ( <i>Paralichthys</i> spp.)	3%

## DISCUSSION AND CONCLUSIONS

The community of Almeida, in the Estuarine Complex of Paranaguá (Brazil) has the artisanal fishery as the main economic activity. Despite the existence of 10 species targeted in the community throughout the year, each household is involved only in some of the fisheries; greater fishing effort is concentrated in a few species, like crab and shrimp.

The crab fishery is affected by the tide variations and the weather. But most importantly, another limiting factor is that the handmade craft used to capture the crab is forbidden by state and federal laws (Brazil, 2003). In addition, more than 80% of the fishing spots are within no-take MPAs. The participation of women and children in the capture and production chain of the crab shows the importance of this fishery for the community; usually the participation of women is limited to oyster and mussel extraction and processing. There is a high dependence of the community on mangrove fisheries that require cheap handcrafted traps or simple tools. However, these fisheries are almost entirely inside no-take MPAs.

Institutional changes associated to fisheries and MPA management prohibiting activities of historical and traditional values, including subsistence, such as agriculture and fishing, lead to a concentration of fishing effort in a few species as well as abandonment of a number of activities. According to Faraco (2012), environmental restrictions were the main cause for these changes in the neighboring traditional communities.

The white shrimp fishery engages 54% of the households. This fishery (inside the bay) is considered by the fishers as scarce and uncertain; it is economically rewarding with high fishing efforts. The government subsidy during the closed period can increase the dependence and vulnerability in the community, once that the dependence on the financial resource becomes more important than the dependence on the biological resource, as pointed out by

Béné (2003). Fishers believe that to alleviate the pressure on crab stocks, government subsidies would be needed during the closed period (nine months a year).

While the crab fishing spots are almost totally inside no-take MPAs, the resources which are relevant for subsistence have become scarce particularly as a consequence of ships accidents linked to the port, on the Southern border of the bay, outside the MPAs (Machado and Sá, 2007). These facts led to reducing exposure and sensitivity to the resource, while bans on fishing practices associated with the implementation of MPA decreases the livelihood diversity and thus the adaptive capacity of the community. The vulnerability, as a qualitative equation (Clanahan et al, 2003), in Almeida seems to be high. This community fits in the vulnerable context for affected communities by MPAs and climate change (Faraco, 2012).

It is necessary to understand at which point in the trajectory of this community, the crab fishery became so important and an essential characteristic. The need to include the human and social dimensions as part of fisheries and coastal management, in Brazil and elsewhere, is more than evident. The effort by ICMBio and the communities to get together to discuss issues around crab fishing showed the importance of dialogue between the different stakeholders.

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