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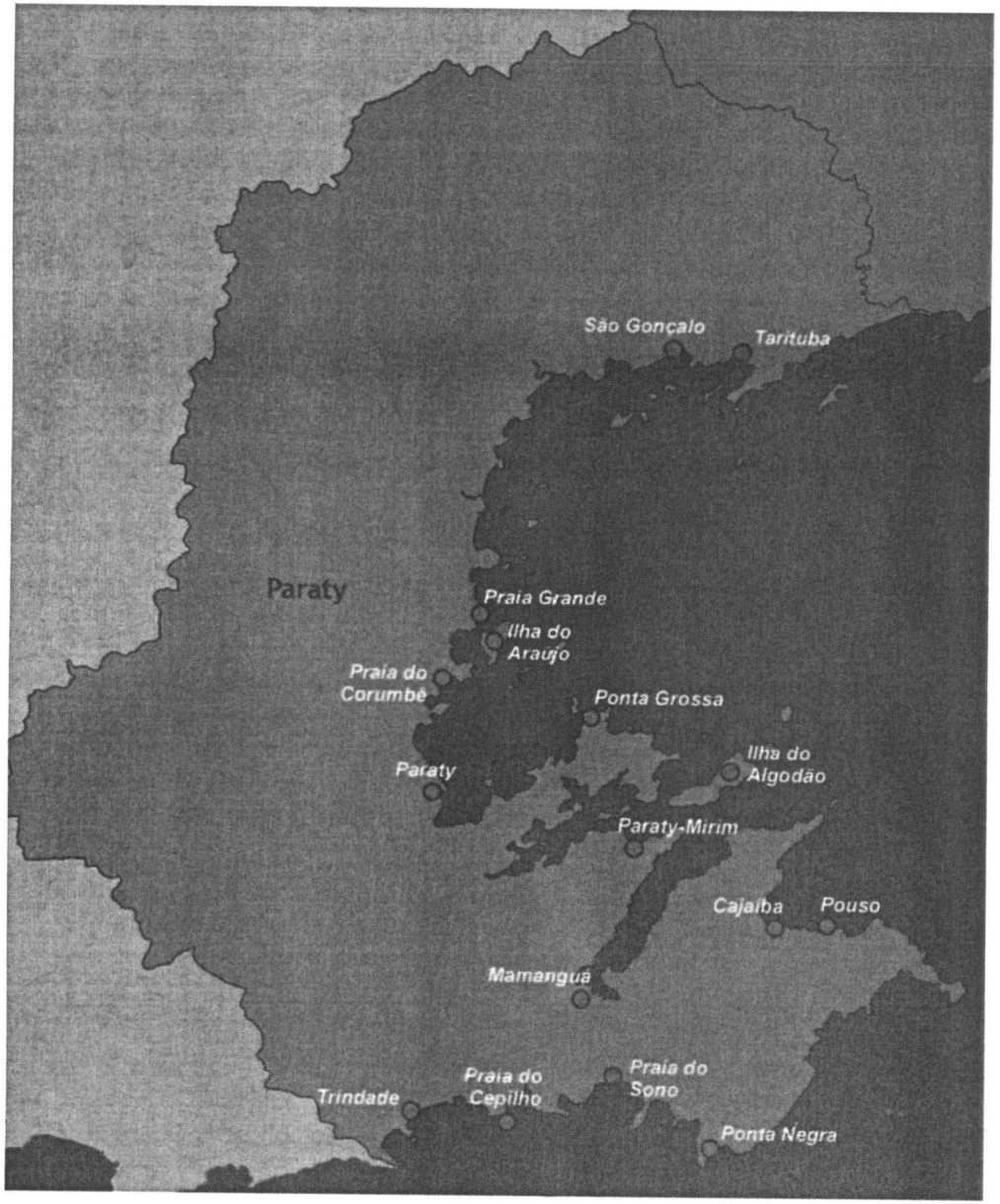
Sumário



The Paraty fishery in the context of co-management and Latin America fisheries

Alpina Begossi, Fikret Berkes, Fábio de Castro, Priscila F. M. Lopes, Cristiana Seixas and Renato A. M. Silvano

The primary objective of this chapter is to embed the understanding of the Paraty fishery in a more general context of fisheries in Brazil and Latin America, relating them to environmental conservation demands, especially the establishment of marine protected areas (MPAs), which are associated to local conflicts (Lopes et al. 2013a; Lopes et al. 2013b). In particular, we intend to look at Paraty trying to reach different ecological scales, but with a background in Latin American fisheries. We keep in mind that, as other artisanal fisheries in the world, the Paraty fishery can be considered of the "S" type: small-scale, spatially structured, targeting sedentary stocks (Orensanz et al. 2005). Spatially structured refers to the dependence of these inshore fisheries on the coastline; in Paraty, for example, whereas groupers (sedentary species) are caught in the bay of Praia Grande, in the open-sea community of Trindade pelagic species are very important catches. This chapter serves to introduce readers in co-management within the Latin American context associated with this book content, on small-scale fisheries from Paraty, Rio de Janeiro, Brazil.

Fisheries and conservation

In Brazil, conservation and development policies have often been at odds. Conservation policies tend to emphasize restrictions on the use of natural resources in specific ecosystems, while development policies can favor activities that have a high environmental impact, such as large-scale infrastructure developments (e.g., highways, ports and dams) and intensive production systems for export-oriented markets (e.g., cattle, industrial fishing and soybean production). As a result, conservationists perceive development projects as being a major driver of environmental degradation, where developers claim that conservation policies are a barrier to development. Rural populations, including small-scale fishing communities, have been seriously affected by both policy strategies, as they are squeezed between intensive production systems and restrictive measures that limit their access to natural resources and ecosystems. The small-scale fisheries of Paraty are in such

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context of pressures that comes from different scales leaving fishers and their livelihoods squeezed primarily between governmental environmental demands and industrial fishing (Begossi et al. 2011; Begossi et al. 2012b; Lopes et al. 2013a).

Fishers have gradually been excluded from productive fishing systems and deprived of legal access to aquatic ecosystems, to an extent that fishers are increasingly treated as poachers by their own communities. The invisibility of fishers to both conservation and development policy strategies nullifies their potential to participate in the design, implementation, and monitoring of sustainable resource use strategies. Besides reducing the transaction costs of management, fishers could provide local knowledge and support the monitoring of ecosystems and resources (Begossi 2008; Berkes 2012; Silvano and Begossi 2012).

As part of the democratization process in the last decades, hybrid policies combining conservation, development, and social justice have been developed in Brazil. Government agencies in charge of conservation have developed new institutions, legal instruments, and procedures. The goals have been to promote decentralized decision-making, increase stakeholder participation and foster collaborations among actors. The primary question that has been raised from this new trend is how effective the initiatives are in terms of promoting sustainability, local and regional development, and social inclusion (empowerment and improved livelihood). The extent to which these initiatives are still part of top-down models and their legitimacy among fishers are unknown.

Co-management

Co-management can be understood as one of the possible institutional arrangements that can result in sustainable systems, as definitions in Table 1 shown. Berkes (2002) addresses some of these institutional arrangements, including (in addition to co-management) multi-task groups, citizen science, and worldwide networks of social movements. There are a variety of models that encourage people to develop more sustainable resource use systems. Instead of looking for the single best model, sustainability can be achieved through multiple strategies that should be chosen according to the characteristics of the resource and its users (Dietz et al. 2002), as Table 1 illustrates.

Co-management is one strategy that has been employed in resource management of Latin American fisheries, but other forms of institutional arrangements can also be found in the region, such as cooperatives in Central America (Begossi et al. 2010) (Box 1). Even co-management itself can assume multiple forms. For example, in Brazil, a variety of co-management arrangements occur, such as reserves established by the government that allow sustainable use and accords (or agreements) between users and the government (such as the named "fishing accords" or "fishing agreements") (Lopes et al. 2011).

Table 1 Selected definitions and concepts of co-management.

Definitions, origins, and concepts of co-management	Reference	Core aspects of the definition
Co-management is a collaborative and participatory process of regulatory decision-making among representatives from user groups, government agencies, research institutions, and other stakeholders.	(Jentoft 2003)	Power-sharing and partnerships
Co-management involves at least the right to participate in making key decisions about how, when, where, how much, and by whom fishing will occur.	(Pinkerton 2003)	The level of power in access to resources
Co-management emerged as a partnership arrangement that relies on the capacities and interests of the local fishers and community to complement the government's ability to provide legislation, policy, enforcement, and other functions and types of assistance to various stakeholders.	(Pomeroy 2003)	The role of the state in institutional arrangements
In co-management systems, the state supplies legitimacy and various forms of support to local groups that are familiar with the area and can communicate efficiently and respond quickly to new management needs. In the intersection with scale, conflict is the life force of co-management.	(Wilson 2002; Wilson 2003)	Communication is an important process in co-management and conflict could act as a driver to these processes
Co-management is a political claim to share management power and responsibility with the state and to develop power sharing partnerships between the government and local users.	(Armitage et al. 2007), based on several authors	Power-sharing
Co-management has been approached in diverse ways, including a form of power sharing, a challenge to capacity building, a mechanism for implementing aboriginal rights, and an arena in which different systems of knowledge can be brought together. Co-management is a "catch-all" term.	(Berkes 2007; Berkes et al. 1991)	Power sharing, cooperation, partnerships (at different levels), capacity building, defining rights, linking knowledge

The small-scale fisheries in Latin America

Small-scale fisheries in Latin America (LA) are highly important compared to fisheries in non-tropical areas. In many Latin American countries, small-scale fisheries represent approximately half of the national catch, and livelihoods are dependent on those catches for food and commerce (Begossi et al. 2010). In the marine environment, the fisheries target: (1) tunas (Scombridae) and other

migratory fish; (2) anchovetas (Engraulidae) and other small schooling fish; (3) ground fish on the continental shelves; and (4) marine inshore fisheries (Christy 1997). Fresh water artisanal fisheries are also highly important, especially in Brazil, Colombia, Mexico, Peru and Venezuela (Valbo-Jorgensen et al. 2008; Arnason et al. 2009).

LA fisheries management has been part of international programs by FAO and the World Bank, which were primarily aimed to support fishing cooperatives (Pollnac 1981) by providing loans and credit (Box 1).

Box 1 Cooperatives and marine protected areas in Central America.

Fishery management in Central America has followed basically two pathways: the management of cooperatives that also manage natural resources (in addition to economic and social management) and the establishment of MPAs. Fishing cooperatives were developed primarily in Central America, especially in Belize, Costa Rica, Honduras and Panama, although there are also examples in Mexico, Ecuador and Peru (Pollnac 1977; McGoodwin 1980; Aguerro 1991; Pollnac and Poggie 1991). These cooperatives were developed in the seventies and eighties as part of a general trend of international and national government programs, such as the ones promoted by the World Bank (Pollnac and Poggie 1991).

Belize cooperatives, in particular, which emerged in the sixties, became a model of fishery co-management in Central America (Begossi and Brown 2003), as these cooperatives provided better prices for their fishing products, and access to low-interest loans (Price 1987). More recently, Belize included MPAs as a fishery management tool. Other cooperatives have experienced problems, such as in Mexico, Sinaloa, where government-imposed programs ignored local rules or management processes and failed to enforce rules that prevented invasion of inshore fishing spots by industrial fishers (McGoodwin 1980). In Nicaragua (Pearl Lagoon), cooperatives were organized during the Sandinista regime (Christie et al. 2000), but there were problems, such as the incursion of fishermen from outside the cooperative. Historically, cooperatives have been responsible for better yields and earnings in land systems, and more recently, they have collaborated to control against resource depletion. These benefits are exemplified in the case of 'environmental cooperatives' in Honduras (Ruben 1997). Recently, McCay et al. (2013) reviewed results of 10 cooperatives in Western Mexico showing their capacity of co-managing fisheries, by following some "design principles" (see the study for details).

LA fisheries have their own peculiarities if compared with the better known temperate fisheries, such as: a) the local scale of resource use by small-scale fishing communities; b) the geographic dispersion of fisheries; c) the existence of local rules regarding the use and sharing of resources, such as territories and food taboos; d) the scarcity of available data about aquatic resources; e) fishermen's local ecological knowledge, which is not exclusive of LA, but has been shown to be important; and f) current levels of poverty and social needs that make small-scale fisheries relevant for local food security and livelihoods (Begossi 2010). These fisheries are also distinguished due to the use of multiple gears and boats, low levels of capital investment by fishermen, the presence of several landing sites, the seasonal use of fishing resources, the supply of protein and jobs, the attraction of migrants, the limited power of fishermen, and a lack of social mechanisms to protect fishermen's health and employment (Salas et al. 2007). These factors are important because for any management process to be effective, it must rely on local participation, a 'participatory building' process, and must develop effective actions that address economic and cultural issues.

As common to most tropical fisheries, LA fishers suffer from basic limitations. For example, there is a widespread lack of basic data on catches, which is an obstacle for temporal comparisons. Also, there is often no knowledge about the status of vulnerable species that are commercially important (Begossi 2010). For example, rocky marine fish, such as groupers and snappers, are important commercial fish in many countries. Some groupers (e.g.: *Epinephelus* and *Mycteroperca* spp.) are on the IUCN Red List of Threatened Species (Froese and Pauly 2011; IUCN 2012), but one of these species *(Epinephelus marginatus)* has been continuously caught by artisanal fishers of Copacabana, Rio de Janeiro, including catches of individuals smaller than the minimal reproductive size (Begossi and Silvano 2008). This suggests an ongoing or near future overfishing of this and other commercial reef fish species (Begossi et al. 2012a). Indirect indicators, such as those above mentioned, are sometimes the only basis for the evaluation of fish stocks in LA.

Co-management in the southern cone of South America

South America followed a different pattern than Central America. In its southern cone, which includes the Pacific and Atlantic Oceans and four countries (Paraguay, Chile, Uruguay and Argentina), some co-management systems have been implemented to regulate small-scale fisheries. Some of these co-management arrangements, notably those of benthic shellfish in the Chilean coast, have been successful and are regarded as a promising way to avoid overfishing (Castilla and Fernandez 1998; Castilla and Defeo 2001; Castilla and Defeo 2005; Defeo and Castilla 2005; Castilla et al. 2007; McClanahan et al. 2009). In Chile, co-management was first proposed by the government and fisheries managers (top-down). These programs transferred property rights and responsibilities to existing organizations of local fishers, therefore sharing power with them (Castilla and Defeo 2001; Defeo and Castilla 2005). See Box 2 for some examples of the Pacific South America.

Box 2 The Pacific South American fisheries

The Pacific Chilean shellfish fisheries of benthic invertebrates, especially those that target the muricid gastropod *Concholepas concholepas (loco)*, are among the most studied and most successful examples of co-management in southern LA (Castilla et al. 1998; Defeo and Castilla 2005; Castilla et al. 2007; Gelcich et al. 2008a; Gelcich et al. 2008b; Gelcich et al. 2009). The loco fisheries in Chile have experienced distinct phases, from fishing mostly for domestic consumption through overfishing and recovery of shellfish stocks following a co-management arrangement (Castilla and Defeo 2001). This well succeeded co-management involved the definition of exclusive rights of local fishing associations to manage and exploit coastal areas with defined boundaries (designated as management and exploitable areas for benthic resources – MEABRs), and granting fishing associations (syndicates) territorial user rights for fisheries (TURFs) in these areas (Castilla et al. 2007). These MEABRs delivered positive ecological and socio-economic outcomes, and the number of MEABRs experienced a sharp increase along the Chilean coast (Gelcich et al. 2008a; Gelcich et al. 2008b; Gelcich et al. 2009). Despite these achievements, MEABRs have also caused socio-economic problems and conflicts: some fishers have been excluded from large coastal areas and many remaining open-access areas have been over-exploited (Castilla et al. 2007). However, these problems, which should be addressed in the near future, have usually been outweighed by the benefits of MEABRs. Further improvements of the current Chilean MEABR system would be the implementation of a network of connected MEABRs and MPAs and an ecosystem-based management framework (Castilla and Defeo 2001; Castilla et al. 2007).

With the exception of shellfish extraction in Patagonia, where scallops are the primary exploited resource (Orensanz et al. 2005), there are limited data on Argentinean small-scale coastal fisheries. Argentinean fisheries widely exploit the extensive coast, but primarily through an industrial fleet (Cepparo et al. 2007). Artisanal fisheries are primarily located in continental waters, especially along important rivers such as the Paraná and the La Plata and their associated reservoirs (Araya et al. 2009).

Most likely as a result of over-fishing and resource failure (Bisbal 1993), Patagonia currently represents the only place in Argentina where there is a co-management situation that focuses on small-scale shellfish extraction (scallops, clams and mussels) (Parma et al. 2003). With the support of fishers and processing plants, co-management measures were established in 2001 to limit the harvest rates by closing most of the fishing grounds, rotating the fishing areas, assessing the pre-harvest biomass and monitoring the depletion during the fishing season; these measures recovered the scallop fishery (Orensanz et al. 2005).

Co-management and the Paraty fishery: how this book may be helpful

Trends in Latin American fishery management are represented in Brazil through initiatives from local demands and grass-roots movements. These include the creation of extractive reserves (Begossi and Brown 2003), sustainable development reserves (Lima 1999), and fishing accords (Castro and McGrath 2003), among others. Although several variables can be useful to analyze management or co-management, we were inspired by the social-ecological systems (SES) model by (Ostrom 2007). This model can be used to facilitate thinking and understanding the data presented here about the Paraty fishery, including its context of being mostly formed by a rural population, who practices small-scale fishery, and where biodiversity conservation demands are high.

Paraty: A Latin American fishery in a high-biodiversity environment

Paraty presents a situation in which fisheries are squeezed among protected areas, resulting in conflicts between fishers and government agencies, and between small-scale and industrial fisheries.

In a comparison between the Piriápolis (Uruguay) and the Paraty small scale fisheries, the context and changes that took place in both seem to have similar outcomes (Trimble and Johnson 2013). It is then important to understand Paraty at a regional, national and Latin American scale, as multiple attributes are likely to have affected it. The main exploited resources (fish) are highly mobile compared to Chilean fisheries (Castilla and Defeo 2001), for example, which makes management a challenging process. However, bays and islands are common, and this could contribute to identification of boundaries for specific co-managed areas.

In Box 3 we summarize the Paraty social-ecological systems that are relevant for the subsequent chapters of this book. Chapters 1, 2, 3 and 4 deal with resources, such as aquatic resources (primarily fish and turtles); chapters 5, 6, 7, 8, 9, 10 and 11 link livelihood with resource access (foraging, livelihood, health, markets and tourism); chapters 12 and 13, along with conclusions, discuss management and provide suggestions for the management of the fisheries in Paraty. These and various other aspects of Paraty fisheries are carefully detailed in this book, which we expect to be useful for a variety of readers.

We hope, especially, that this book would be useful to the fishers and their families, in order to live a better life in Paraty, associated with the biodiversity that emerges from the forest and the sea.

Box 3 The Paraty fishery as an SES system (summary based on Begossi et al. 2012b and the data addressed in this book) (see Ostrom 2007).

I. Social, Economic, and Political Settings (S)

S1 – *Economic development*: livelihoods depend on natural resources; Caiçaras of SE Atlantic Forest coast; small-scale agriculture to fishing and tourism. For that aspect, see **Chapter 2 and 5 on fishing, Chapter 4 on turtles, Chapters 7 and 8 on plants and agriculture, and 11 on tourism.** Also (Hanazaki et al. 2013), the livelihoods of Paraty.
S2 – *Demographic trends*: descendants are primarily from Native Indians and Portuguese colonizers. Local populations of caiçaras have not increased because of out migration. Coastal populations have increased because of migration from cities such as Rio de Janeiro and São Paulo.
S3 – *Political stability*: accompanies the political context of the country.
S4 – *Government settlement:* policies cause conflicts between the caiçaras and the government's protection of protected areas, such as the prohibition of cultivation of manioc and restrictions on fishing on some islands (see **Chapters 12 and 13).**
S5 – *Market incentives:* credit for fishing, tourism-related activities and propositions of payments for environmental services (PES) – Begossi et al. (2011) and **Chapter 10**.
S6 – *Media organization*: there is no organized information on media information.

II. Resource System (RS)

RS1 – *Sector*: fish **(Chapters 1 and 2)**
RS2 – *Clarity of system boundaries*: the informal division of fishing spots includes intrusions from industrial fisheries (Begossi et al. 2011, **Introduction**).
RS3 – *Size of resource system*: fish catches, 30-60 kg, annual production of 529.586.40 kg (Begossi et al. 2012b) **(Introduction)**.
RS4 – *Human-constructed facilities*: fish stores, markets, restaurants, elementary schools, a high school, and a hospital **(Chapter 10)**.
RS5 – *Productivity of the system:* fish productivity appears to be decreasing for some species **(Chapter 5)**.
RS6 – *Equilibrium properties:* unpredictable systems, the fishery.
RS7 – *Predictability of system:* unpredictable.
RS8 – *Storage characteristics*: fish markets with ice and freezers; fish storage varies among communities **(Chapter 10)**.
RS9 – *Location*: Tropical, high biodiversity, Atlantic Forest coast.

III. Governance System (GS)

GS1 – *Government organizations*: protected environmental areas that are created by the government **(Chapter 13)**.
GS2 – *Non-government organizations:* associations and fishers´ associations **(Chapter 12)**.
GS3 – *Network structure*: no strong communication channels, fragile.
GS4 – *Property-rights systems*: incipient property-rights systems **(Chapters 12 and 13)**.
GS5 – *Operational rules*: informal acceptance among fishers, but no recognition of local rules by other users (industrial fishers) or by the government (protected areas) **(Conclusions)**.
GS6 – *Collective choice rules*: proposed, but not existing *de facto* (fishing agreements, payments for environmental services). Also (Lopes et al. 2013a) **(Conclusions)**.
GS7 – *Constitutional rules*: formally and from the government (law).
GS8 – *Monitoring and sanctioning processes:* among fishers and as part of the government.

IV. Resource Units (RU)

RU1 – *Resource unit mobility*: very mobile.
RU2 – *Growth or replacement:* variable, low for some target species.
RU3 – *Interaction among resource units:* very interactive, knowledge on target species.
RU4 – *Economic value*: very high, as livelihoods depend on resources **(Chapter 10)**.
RU5 – *Size*: Not estimated, uncertain and highly variable.
RU6 – *Distinctive markings*: catches have distinctive markings.
RU7 – *Spatial and temporal distribution:* patches and periods; fish schools, islands with reef fish **(Chapter 1)**, and growth and reproduction.

V. Users (U)

U1 – *Number of users*: estimation of artisanal fishermen: 485 (Begossi et al. 2010).
U2 – *Socioeconomic attributes:* variable among communities.
U3 – *History of use*: participation in the economic cycles of the region (Begossi et al. 2012a; Begossi 2013).
U4 – *Location*: Coastal tropical areas in the Southeast Atlantic, Brazil.
U5 – *Leadership/entrepreneurship*: weak compared to Amazon and other coastal areas.
U6 – *Norms/social capital:* local knowledge is relatively strong.
U7 – *Knowledge of SES/mental models:* local ecological knowledge is important **(Chapter 4)**.
U8 – *Dependence on resource*: very high.
U9 – *Technology used*: varies **(Chapters 2 and 5)**

VI. Interactions (I) Outcomes (O)

I1- *Harvesting levels of diverse users:* management of the fishery at Paraty should consider the diverse fishing technologies and techniques **(Chapters 2, 4 and 5)**.
I2 – *Information sharing among users:* still weak compared to other fishing areas.
I3 – *Deliberation processes*: non-explicit.
I4 – *Conflicts among users*: high conflicts between artisanal and industrial fishers and between artisanal fishers and government agencies **(Chapters 12 and 13)**.
I5 – *Investment activities*: tourism, international meetings (FLIP) **(Chapter 11)**.
I6 – *Lobbying activities*: no data.
O1 – *Social performance:* efficiency and equity.
O2 – *Ecological performance:* catch diversity and resilience through a) economic returns; b) perceptions of fishermen; c) management rules in fishing; and d) substitutability of activities **(Chapters 5, 10, 12 and 13)**.
O3 – *Externalities to other SESs*: externalities from the fishery affect the conservation of biodiversity; protected areas affect fishers'earnings.

VII. Related Ecosystems (ECO)

ECO1 – *Climate patterns*: tropical, including a rainy season (summer) and a dry season (winter).

ECO2 – *Pollution patterns:* organic discharges from domestic sewage, small harbors, and shipyards.
ECO3 – *Flows into and outof the focal SES:* a trade-off analysis for biodiversity conservation and the economic temptation of the fishers to increase catches and earnings (see Begossi *et al.* 2012b for details).

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