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Fisheries, tourism, and marine protected areas: Conflicting or synergistic interactions?

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ABSTRACT

Most coastal degradation has been caused by anthropogenic actions, threatening the ecosystem services (ESs) humans depend on. Marine protected areas are a solution to protect ESs, such as fish stocks, although this could potentially lead to conflicts with fisheries and tourism. We investigated how fisheries and tourism in the SE Brazil interact with conservation, evaluating their potential for synergistic interactions. We sampled fish landings ($n=823$) in two villages and performed interviews with fishers and middlemen regarding fisheries and tourism, besides using secondary information regarding the MPA effectiveness. Fish production was high outside the MPA (9.25 t/day), and could be profitable, resulting in reduced fishing pressure, but a faulty market chain prevents this. Fishers involved with coastal tourism had better incomes than those who engaged in only fisheries. Tourism 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. Nonconflicting uses of ESs can be achieved by assuring that the local poor population benefits from more than one ES in a sustainable way, but that requires alternatives such as adding value to ESs and paying for environmental services.

1. Introduction

1.1. Ecosystem services in tropical developing countries

Since the rise of awareness about habitat loss and species extinction, a great deal of scientific effort has focused on maintaining the remaining biodiversity. For researchers, it was important to assure that nature would follow, as much as possible, its natural course (Mitra, 1982; Tallis et al., 2008). While this approach has led to important conservation initiatives, such as the designation of species conservation targets or the establishment of protected areas, it overlooked the dependency humans have on ecosystems and the help people can provide for conservation (Sheil and Lawrence, 2004).

Ecosystems provide people with direct and indirect goods and services, such as crop pollination, water and air filtering and purification, waste treatment, fish, game, and many others. Life, as we know it, would not be possible without these services (Costanza et al., 1997). Humans, in fact, depend on several kinds of ecosystem services (ESs). Although there are multiple definitions for ESs, most of them agree to some degree that these services represent functions, products, or processes provided by nature that humans use for their well-being (Fisher et al., 2009). The renewed interest in researching and developing the appropriate use of these services resulted in the publication of the millennium ecosystem assessment (MEA, 2005). Since then, multiple studies have tried to better identify, contextualize, quantify, value (Brenner et al., 2010), and assess changes in ESs (Brenner et al., 2010; Fisher et al., 2009).

The rural poor usually have a stronger and more direct dependency on nature and their ESs, especially those related to food security (Daw et al., 2011; Fisher et al., 2014). However, by no means does such intense dependency, by rich or poor, imply the appropriate use of these services. In fact, conflicting, intense, and misguided use threatens the maintenance of such goods and services: the MEA pointed out that 15 of the 24 services investigated were in decline with likely negative consequences for human welfare (MEA, 2005).

Most of the poor around the world live in areas of high biodiversity and threatened ecosystems, so-called hotspots (Fisher and Christopher, 2007), which are mostly in the tropics or in the

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subtropics. This suggests that ESs in hotspots are mainly used directly in the form of timber, coal, game, fish, and food extraction in general. This type of use, if carried out intensively, could threaten not only the replenishment rate of such products, but also other services provided by the ecosystem, such as carbon sequestration and water purification, among others (Barbier et al., 2010). Hence, the dependence that some poor tropical countries have on direct-use ESs could represent a trade-off for the maintenance of other services and of the biodiversity (Tallis et al., 2008). Finding alternatives to solve these conflicts without impairing the livelihoods of the poor is an important goal to pursue.

The ecosystem-based management (EBM) approach could be one of the first steps to maintain ESs and decrease conflicts over their multiple uses, in case overexploitation is identified. EBM implies integrated management that encompasses the whole ecosystem, including humans, in such a way that the ESs are provided in a healthy and resilient way (McLeod et al., 2009). This approach promotes the long-term maintenance of ESs rather than the typical maximization of goals (Rosenberg and McLeod, 2005), implying that at least initially people have to reduce their resource exploitation rate or even stop exploiting some direct ecosystem services until they recover. However, only slowing down exploitation may not be an alternative for people who face resource shortages (Scherl, 2004), a situation that sometimes requires compensatory mechanisms. One such mechanism that has been widely proposed is the use of payment for environmental services (PES) (Begossi et al., 2011), where the ones in charge of the maintenance of these services are paid by people (or the overall society) who benefit from these services (Engel et al., 2008). Other alternatives include adding value to the market chain (Hallwass et al., 2014) or diversifying the economy with activities such as community-based tourism (Okazaki, 2008), which can be highly prized in places with tropical beaches, reefs, and forests.

In this study we aimed to investigate potential synergistic or antagonistic interactions between direct-use (fish), indirect-use (tourism) ESs and marine conservation. For that purpose, we drew on a case study from the Brazilian coast. We also investigated how synergistic or antagonistic interactions among distinct services are influenced by management decisions regarding conservation and by the distinct use made by poor people of these ESs.

1.2. A case study of Brazil's Green Coast: Tourism, fisheries, and biodiversity conservation

The state of Rio de Janeiro is part of Brazil's so-called Green Coast (Costa Verde). Specifically, the area encompassed by Ilha Grande Bay (mainly the municipalities of Paraty and Angra dos Reis) (Fig. 1) has great tourism potential, given its multitude of islands and islets and the lush Atlantic Forest with its multiple rivers flowing into the calm and relatively clear waters of the ocean (Wunder, 2003). For the same reasons, the area is important for biodiversity conservation (with multiple parks protecting large areas) and for fisheries, both subsistence and commercial (Begossi et al., 2010; Lopes et al., 2013a, 2013b).

Although there are no clear conflicts between tourism and fisheries in the Green Coast region, the different segments of the fishery industry have undergone conflicts over fishing spots for decades. In some nearby areas, small-scale fishers have disputed space with shrimp trawlers, while in others commercial fishers have violated minimum distances from the coast, invading spots traditionally used by small-scale fishers from various islands and villages (Begossi, 1995). Some of these conflicts have recently gotten the attention of the government through the Ministry of Fisheries and Aquaculture, which has been helping fishers to establish fishery agreements in which boundaries, allowable equipment, and other rules can be decided in a participatory way as long as fishers respect federal laws (Trimble et al., 2014). However, such an agreement would have limited effectiveness because a local no-take marine protected area (MPA) (Tamoios Ecological Station) forbids fishing around 29 islands in the region, thus reducing the area traditionally used by small-scale fishers. At the same time, the MPA also limits tourism since diving and anchoring are not allowed around these 29 islands or in their 1 km buffer zones.

Even though it was established in 1990, this MPA did not give rise to conflicts until 2006, when the restrictions started being enforced (Lopes et al., 2013a). To decrease conflicts, the MPA managers proposed a *commitment term* that grants permission for small-scale fishers to fish around some of the now protected islands, based on individual agreements between fishers and the managers of the MPA (Trimble et al., 2014). One of the proposals is the deployment of anchoring buoys that may be used by any boat in case of bad weather as long as they inform the MPA office by radio or phone about their anchorage. These adjustments are provisional and still under discussion, but if done in a participatory way they could, for example, lead to changing the status of the MPA (or parts of it) from a no-take to an extractive reserve.

Agreements of this type have the potential to reduce the main conflicts over the anchoring limitations and the prohibition of fishing close to fishers' homes. Fishers that take part in the agreement are also expected to watch over the area, which could increase enforcement and compliance in a more legitimate way, decreasing the alleged antagonism of the police toward the fishers. If the users of the bay can reach a no-conflict situation, benefits are expected for fisheries and possibly even for biodiversity conservation through increased compliance on the part of the fishers (Karper and Lopes, 2014).

Despite its huge potential, the development of tourism has not been taken into consideration by the managers of the MPA. Undeterred by the prohibitions, professional companies in the bay have been conducting tours whether a particular island is protected or not. These trips usually take tourists on day trips to islands and coastal beaches. Dive companies also take tourists to specific diving spots, some of which overlap with fishing grounds. Tourist operators are ill prepared to explain the biodiversity of the coastal and terrestrial ecosystems, and they usually do not mention the nearby MPA in their trips even though an effective MPA would be expected to increase the abundance of fish in its surroundings, making diving sites more attractive.

2. Data collection

Over a four-year period (2010–2013), we recorded data on fish, fisheries, the fish market chain, general livelihood aspects, and tourism in Paraty Bay, a smaller bay in the larger Ilha Grande Bay (Begossi et al., 2012; Lopes et al., 2013a, 2013b). Most of our sampling effort was concentrated in two villages, Trindade and Praia Grande. The latter also included a nearby island community, Araújo, since Praia Grande serves as its main port, but its data were treated together with Praia Grande. The villages of Trindade and Praia Grande differ regarding their potential for fisheries and tourism. Trindade became famous in the 1960s, and since then has been recognized mostly for its alternative development with pristine ocean beaches, waterfalls, natural pools, and forest trails. Praia Grande is a more central beach, secluded by islands, closer to Paraty, and more subjected to traditional development and tourism. The fact that Trindade faces the open water whereas Praia Grande is on a bay surrounded by islands affects the type of fishing practiced in these villages as well (Begossi et al., 2012; Lopes et al., 2013b).

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