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ORAL PRESENTATION (ABSTRACT)

THE POLITICAL ECONOMY OF GREEN DEVELOPMENT

PAYMENTS FOR ENVIRONMENTAL SERVICES: APPLICATION TO COASTAL FISHERIES CONTEXTS IN RIO DE JANEIRO, BRAZIL

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Abstract. Payments for environmental services (PES) have been widely employed to compensate people for the non-use or improved management of natural resources, especially in forestry systems. Such compensation has been used on all continents, particularly in Latin America. PES represent instruments that can be used to compensate users for refraining in part or whole from the process of extraction of natural resources or from cultivating specific areas or cultivating during a specific period of time. PES can serve as a stimulus to gain the support of local inhabitants for the maintenance of biodiversity. PES are of great utility in areas where rural and poor people depend on the use of natural resources for their well-being and for their livelihoods, which is the case for artisanal fishers in Brazil. Small-scale artisanal fisheries are widespread along the Brazilian coast and rivers, and these fisheries generate considerable economic and social value in developing countries. Such fisheries provide a diversity of animal protein through fish resources for local and regional markets. Estuarine and reef fish species, such as snook and groupers, along with the pelagic bluefish, are important sources of protein from Brazilian coastal fisheries. Approximately 50% of all fish production in Brazil comes from artisanal fisheries. In this study, we developed proposals for the application of PES to fishery systems, which was an approach initiated in earlier studies conducted in Arraial do Cabo and in Paraty along the coast of Rio de Janeiro State, Brazil. In the present study, we further develop a PES approach applicable to artisanal fisheries that could employ mechanisms that already exist in Brazilian fisheries, such as the defeso system (off-season salary compensation to artisanal fishers), or that could take other forms, such as partnerships with private enterprises, as developed in Costa Rica. Our proposal to develop PES applied to fisheries considers the following: 1) the importance of artisanal fishing as an economic resource; 2) the importance of the management of artisanal fisheries as part of biodiversity conservation strategies; 3) the occurrence of conflicts between artisanal and industrial fishers; 4) the existence of incipient local property rights definitions to manage artisanal fisheries through rules governing the use of fishing areas; 5) the existence of protected areas; and 6) the possibility of multilevel co-management processes. The system of application of PES to small-scale fisheries takes into consideration co-management

instruments that already exist in Brazilian fisheries such as "fishing agreements" (FAs) that can be meshed with PES.

In this analysis, we explore three small-scale fisheries contexts along the coast of Rio de Janeiro: Arraial do Cabo, an extractive reserve; Sepetiba Bay, an industrial area; and Paraty, a major touristic area. For each case, we elaborate examples that could serve as a foundation upon which to base PES in fisheries. In the case of Arraial do Cabo, there is a pre-existing system of co-management, an 'extractive marine reserve', managed by local communities and the central (federal) governmental agency for the management of protected areas, ICMBio. Therefore, in this area, there are instruments that can be used to manage the fisheries that are based on governmental support. For the case of Sepetiba Bay, a highly industrial site, there are approximately 12 fishing communities that are relatively organized into associations or Fishing Colonies. These communities have access to private corporations that impact their activities and have the power to demand monitoring and management, and these communities might be mobilized to develop more elaborate forms of PES. Finally, in Paraty, a major tourism site, local demands from artisanal fishers might be intermeshed with a scheme to protect areas selected for the maintenance of biodiversity. In short, PES can become a flexible mechanism for dealing with the management of small-scale fisheries in different contexts as well as for reducing conflicts between fishers and other users, including governmental agencies and private resource users.

1. Introduction

Artisanal fish production is very important in tropical countries. For example, in Brazil, approximately half of the national fish production comes from artisanal fisheries (SEAP, 2007). Fish consumption is also extremely important in many Latin American communities; in the Amazon Basin, fish consumption can reach almost 300 kilograms per person-year for certain rural populations (COPESCAL/FAO 2008), and in marine coastal areas, fish can account for approximately 60% of the protein consumed (Begossi 2010).

Artisanal fishers are often poor rural inhabitants who depend on the selling of fish for their living. For example, at Ilha Grande Bay in Rio de Janeiro state, a survey of 34 fishing communities showed that earnings from artisanal fisheries average R$ 660,00 reais per month (approximately 330 US dollars per month) (n=413 fishers, average of 34 years fishing) (Lopes 2010). Because of the dependence of the local population on these fisheries,

collaboration for the conservation of marine aquatic resources has to be embedded in a socio-ecological system. How can conservation be attractive to the poor (Begossi 2010)? What could drive an individual to refrain from catching fish and getting paid today in exchange for benefits that would come tomorrow, for the next generations?

PES, payments for environmental services, are defined by Wunder (2005) and Engel et al (2008) as voluntary transactions or negotiations for a well-defined environmental service that is contracted from a service provider, and that is conditioned on assuring the service provision. In that regard, we expect that fishery systems could perform this transaction through co-management either between fishers and the government or between fishers and industries. For details regarding payments for environmental services in the artisanal fisheries sector, see Vinha et al (2011) and Begossi et al (2011). Beneficiary engagement in the negotiation process, the design of the system and monitoring signify a critical factor in the success of PES (May, 2008). Private companies in Costa Rica have participated in PES payments being channeled to individual land users, but clearly the definition of who participates and the specific measures taken are important (Porras, 2010). Conditionality in service provision is a major stumbling block, since measurement of ecosystem response to management practice improvement is often murky.

Despite limitations, payments for environmental services could function as drivers to stimulate artisanal fishers to contribute toward conservation of the marine environment in Brazilian Coastal areas while improving livelhihoods, a win-win situation (Begossi et al., 2011). Having previously suggested the application of PES to the artisanal fisheries of Arraial do Cabo (Vinha and al., 2011) and Paraty (Ilha Grande Bay) (Begossi et al, 2011), we now address the application of PES to Sepetiba Bay, extending this analysis further along the coast of Rio de Janeiro State, Brazil.

2. Results

The results presented herein are derived from the analysis of the three study sites, the resources, local organizations and the stakeholders. We include the eight principles by Ostrom (2005) to compare areas and to evaluate the possibilities of developing fishery oriented PES schemes..

2.1 Three artisanal fishery systems in the coast of Rio de Janeiro State, Brazil

2.1.1 Arraial do Cabo: RESEX-MAR

The city of Arraial do Cabo is located in the northern part of the State of Rio de Janeiro, located between the coordinates 22º56' e 23º01'S and 41º57'- 42º17' W (Cordeiro 2009). There are diverse uses of the aquatic space in this region, especially fishing, but this space is contested by Navy frigates and submarines, cargo ships, tour boats, divers, and petroleum platforms.

Extractive reserves were created in the 1990s by the Brazilian government to manage biodiversity and to include the local native populations who reside within protected areas in the maintenance of that biodiversity without excluding those peoples from their native areas. The first extractive reserve, the Upper Juruá Extractive Reserve, created in 1990, was the result of collective action by rubber-tappers along the banks of the Juruá and Tejo rivers in the State of Acre, Brazilian Amazon (Begossi 2001). The first Marine Extractive Reserve was Pirajubaé, in Santa Catarina State in Southern Brazil, which was created in 1992 (Decree 533, May 1992).

The Maritime Extractive Reserve (RESEXMAR) of Arraial do Cabo was created in January, 1997, with the intent to garantee that local traditional fishers are able to sustainably manage renewable fisheries resources threatened by industrial trawling. The Extractive Reserve consists of a fishing belt that extends along the Massambaba Beach and Pontal Beach, near to the municipal division with Cabo Frio (Brasil 1997). The area of the RESEXMAR includes an area three nautical miles into the sea and 56,769 ha of water surface area (Figure 1).

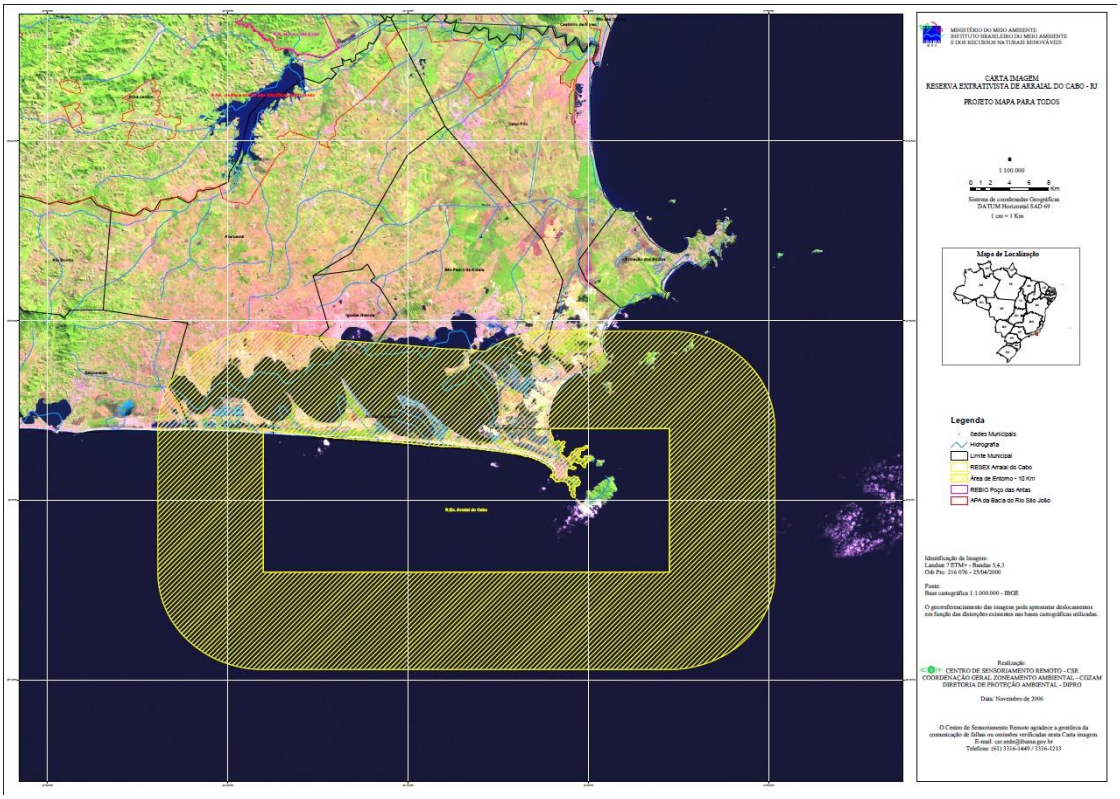

Figure 1a. Arraial do Cabo Resex-Mar:

Fonte: Centro de Sensoriamento Remoto (CSR) – Ibama 2006

Two years after creation of the RESEXMAR, in February 1999, its Utilization Plan was approved (Portaria nº17-N), that has served since that time as the principal management document. This Plan determines those allowed uses associated with local fisheries extraction, so as to assure a sustainable harvest of resources, as well as compliance with environmental laws (MMA 1999).

According to the legislation, it was mandatory to create an association for managing the reserve, jointly with the Chico Mendes Institute for Biodiversity Conservation (ICMBIO), a national agency. This association, called AREMAC (Associação da Reserva Extrativista Marinha de Arraial do Cabo) soon entered into conflict with Colônia Z5, the oldest fishery association of Arraial do Cabo. Other local organizations already present in this region before AREMAC, including the Harbor (Porto do Forno), some beach associations and diving enterprises, also had their interests "confronted" by the Aremac/ICMBIO administration (Seixas, 2007).

Concerning fish production in Arraial do Cabo, from 1992 to 2007, there was a great reduction in the amount of fish caught, with slow recovery after 2003. This pattern contributed to the necessity of an Action Plan to conserve marine biodiversity while maintaining a strong socio-environmental management program (Vinha and Coutinho 2008). According to Cordeiro (2009), in 2008-9 the species captured were predominantly espada (cutlass fish), cavalinha (chub mackerel), enchova (bluefish), sardinha verdadeira (herring) e o bonito pintado (bonito); amberjack (olho de boi) is also cited as being locally important. A variety of nets, as well as longlines and hook-and-line systems, are used by fishermen from Arraial do Cabo.

2.1.2 Sepetiba Bay fisheries

Sepetiba Bay is located in the municipalities of Itaguaí (northern), Itacuruçá, and Mangaratiba (south). The coordinates range from Guaratiba (22 59 S and 43 36 W) to the southern end of Mangaratiba (22° 57′ S, 44° 02′ W), including the long strip of Marambaia and its point (Marambaia Island, 23^{o} 54’ S and 44^{o} 27’W) (Figure 1). This bay has a long history of relatively severe pollution loading by heavy metals, especially zinc. Much of this zinc pollution was the result of metals recycling by Ingá Mercantil SA, which went bankruptin 1996.

Lacerda and Molisane (2006) describe the historical contamination of Sepetiba Bay by Cd and Zn from this large Zn smelting plant, which closed in 1996, and from approximately 400 other factories, primarily metallurgical plants. Navigation, another source of pollution, has also increased. Currently, large scale port facilities are being built by some industries. Domestic discharge is also a concern in this region, especially due to the population growth, some of which is due to industries’ investments and construction. Cynara et al (2006) stress that the water quality in Sepetiba Bay is predominantly affected by local effluent sources and the primary Sepetiba Bay basin tributaries, which include the Guandu River (known as the São Francisco Canal near the Bay), the Guarda River, the Itá Canal (connected to the Guandu–Mirim River), the Piraquê River, the Portinho River, the Mazomba River, and the Caçaõ River. Recently, Bisi et al (2012) compared trophic relationships and mercury flow through the food webs of three tropical coastal ecosystems: the Guanabara, Sepetiba and Ilha Grande Bays. They observed that Sepetiba Bay exhibits an intermediate degree of contamination, but the Sepetiba Bay drainage basin harbors an expanding industrial park, which may result in a worsening of the degradation scenario.

Among the systems considered in the present study, Ilha Grande Bay is the best preserved. Freret-Meuret et al (2010) confirm, in a study on Ribeira Bay and Ilha Grande Bay, that this area is not considered a metal-polluted area. They observe that despite not currently having a significant source of metals inside the Bay, Ilha Grande Bay harbors a shipyard, an oil terminal, and a commercial port, as well as two thermonuclear power plants (Angra I e II), and a third under construction (Angra III) (Figure 2)

Artisanal fishing is very important in Sepetiba Bay, and this type of fishing is practiced by the coastal communities and by communities on the Jaguanum and Itacuruçá Islands. Set gillnets and encircling nets are used for shrimp and fish such as sand drum, mullet and kingfish, among others (Begossi, 2001). Besides fishing activities, aquaculture of oysters is performed by at least three fishing communities of Sepetiba bay.

2.1.3. Ilha Grande Bay: communities and protected areas

The communities of artisanal fishers from Ilha Grande Bay comprise 34 fishing communities living on the coast from the southern end of Trindade ($23^{o}21'$ S and $44^{o}43'$W) to the northern end of Tarituba (23^{o} 02' S and 44^{o} 35' W), with the city of Paraty at its center (23^{o} 13' and 44^{o} 43'). Paraty is a touristic center, where international events occur, such as the FLIP annual literature meeting (Festa Literária Internacional de Paraty, www.flip.org.br). Among the fishing communities, 14 are from Ilha Grande Bay, and 1 is from Gipóia Island. The communities are surrounded by protected areas including the ESEC (Estação Ecológica, Ecological Station) of Tamoios and the Bocaina National Part and the State Park of Serra do Mar, among others. There are conflicts concerning the use of the marine space among artisanal fishers and the authorities that oversee the protected areas

in addition to conflicts between artisanal and industrial fishers, the latter of which use the bay despite current legislation that forbids such use (Begossi et al., 2011). (Figure 2)

Fishing and tourism are very important activities. Fishing occurs using set gillnets, hook-and-line systems, and the cerco (a circle floating and fixed net), along with other specific methods, such as the 'cerco do robalo', which is specific for snook (*Centropomus* spp.). Other important fish in the fisheries of that area are xarelete (bluerunner), enchova (bluefish), pescada (weakfish), cavala (cavala), corvina (sand drum) and reef fishes, such as snappers and groupers (Begossi et al., 2010). Shrimp is very important also in the Ilha Grande Bay fisheries.

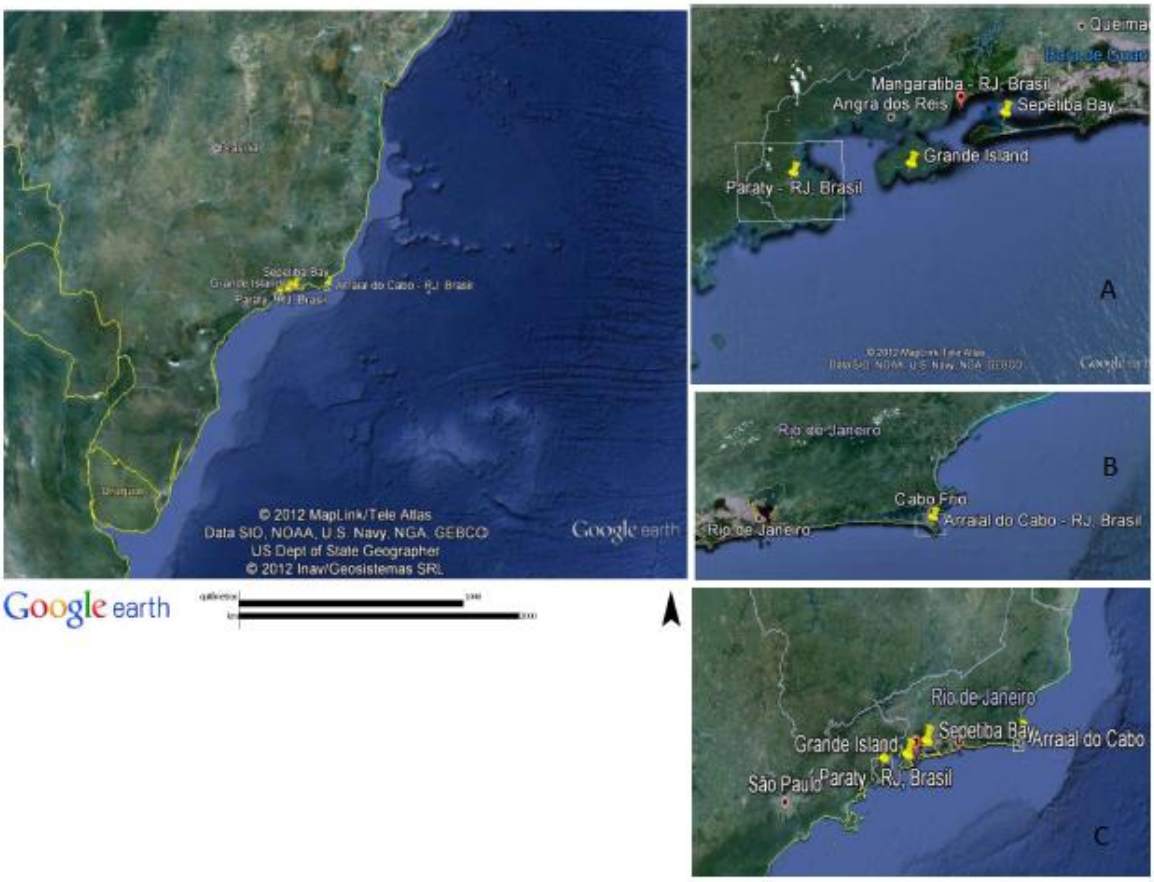

Figure 2. The three fisheries in the coast of Rio de Janeiro State. A: Paraty and Sepetiba bay; B) Arraial do cabo; C) the three fisheries.

3. Comparing the three fisheries systems and application of PES

3.1 The three fishery systems

The Resex-Mar of Arraial do Cabo is an extractive reserve, where local inhabitants, in this case, fishers, have the right to extract resources, and a management plan guides natural resource exploitation. There is local organization, but the one associated with the extractive reserve does not have its roots in the local community. As described above, this organization, AREMAC, was created in 1997 by the Federal environmental agency (ICMBIO) to support the extractive reserve. Together with the local organizations already in existence in Arraial do Cabo, fishers participated in the development of the extractive reserve. There are several stakeholders (Table 1), with the primary economic activities in Arraial do Cabo being tourism, fishing and some industries.

Sepetiba Bay is fairly well locally organized relative to the two other fishery areas covered in this study. There are approximately 12 local associations (including two Colonias de Pescadores – ‘ Fishing Colonies’), and fishers make claims and develop requirements for use of these fishing areas, including reference to impacts caused by industries (Table 1).

Ilha Grande Bay seems to be more dispersed and incipiently organized than the other two fishery systems. There are local associations, but the contact among them is very limited (as opposed to Sepetiba Bay, where the local fishers’ organizations interact and meet with each other regularly). With the exception of Trindade, whose local organizations

have strong leadership and activities, the other communities often stand for themselves, with a few interactive movements. The main conflicts occurring in Ilha Grande bay refers to industrial fishers entering the bay and to authorities from protected areas that interfere in artisanal fisheries, forbidding fishers to fish and to anchor their boats at some islands of the bay (Begossi et al., 2011).

There are thus three fishery systems with different degrees of organization as well as different sources of conflicts and impacts. First, there is Arraial do Cabo, where there is monitoring of the fishery as part of the management system associated with the existence of the extractive reserve. Second, there is a fishery that exists in the heavily industrial and polluted system of Sepetiba Bay, where fishers are very strongly organized into communities that interact. Conflicts are varied and are related to industries, harbors, and industrial fisheries. The last, Ilha Grande Bay, is the most conserved system in terms of natural resources but is very dispersed and not organized. There, conflicts exist regarding protected areas and other groups of fishers (Table 1).

To analyze the contexts related to co-management, and in particular, the possibility of PES, we use variables that may serve as measures of the robustness for a change toward biodiversity conservation or toward a participation in an eco-management system, such as the ‘eight principles’ suggested by Ostrom (2005) (Table 2).

In that regard, according to the variables analyzed in Table 2, Arraial do Cabo and Sepetiba Bay would be more likely to succeed in implementing a PES than Grande Island Bay. The following processes, specific for each of the communities, could stimulate the participation of fishers in the protection of marine aquatic resources:

a) Arraial do Cabo Resex-Mar: PES could be applied by paying fishers to continue to monitor the fishing activities in the reserve, at landing points. This PES system would involve co-management by fishers and the government.
b) Sepetiba Bay: The monitoring of the impacts on the bay due to industries could be performed by fishermen, and this monitoring could be used to detect problems (spills and other impacts). In that case, 'Termos de Ajuste de Conduta' (Terms of Adjustment of Conduct), or compensatory mechanisms for the activities of industries or other enterprises that impact the bay, could be used to support or promote co-management processes. McGrath et al. (2008) suggested such an approach for the Amazon area. In this case, the PES process involves fishers and industries.
c) Ilha Grande Bay, the most dispersed and least organized area, could rely on a relationship between government and fishers through the defeso system, a system of payment of fishers by the government in periods when the fishing of certain species is forbidden (for details, see Begossi et al., 2011).

4. Concluding remarks

The three fishery systems studied herein, Arraial do Cabo, Sepetiba Bay and Ilha Grande Bay, are located along the coast of Rio de Janeiro State. Although they have common features, such as the existence of artisanal fisheries as an important economic activity, tourism, industries and stakeholder conflicts, they differ with respect to important aspects related to the degree of interference of stakeholders in the fishery.

At Arraial do Cabo, the existence of an extractive reserve in which fishers are included guarantees the monitoring of the fishery, which may help support a PES between the ICMBio (governmental agency responsible for the reserve) and fishers.

At Sepetiba Bay, an area that is polluted and impacted by industries and domestic sewage, a PES scheme involving industries and fishers is feasible because local organizations are sufficiently strong, despite (or perhaps due to) seriously degraded environmental quality and associated conflict.

Ilha Grande Bay, the most conserved area in terms of the marine space but the most disperse in terms of fishers' organizations, might support a PES scheme through a defeso system between fishers and the government (in that case, the Fishery Ministry).

In all cases, the PES schemes will help preserve the biodiversity of aquatic resources because fishers will be paid to monitor the area and the resources and to stay alert regarding the impact of industries. Through PES, fishers, a poor economic sector in these areas, can be motivated to help conserve biodiversity.

Table 1. The three fishery systems and PES proposals

Co-Management Context as a variable (from Table 2)	**Resex-Mar Arraial do Cabo**[a]	**Sepetiba Bay**	**Ilha Grande Bay**[b]
Aquatic Resources	Fish and shellfish	Fish, shellfish, aquaculture	Fish, shellfish, aquaculture
Economic Activities	Fishing, tourism, diving	Fishing, several industries: historically a heavily polluted industrial site	Fishing, tourism, diving, nuclear power

Fishers' organization	2,000 full-time fishers	Two fishers' colonies (Z-14 and Z-16) and approximately 10 fishers' associations. Very well organized local fishers communities	34 fishing communities, approximately 817 artisanal fishers (excluding industrial fishers); almost every community is included in either a fishers' association or a residence association
Leadership	Medium: there is local leadership, but the federal government created a local organization, AREMAC	High: fishermen have their own local organizations in each community and make demands to the government and to industries	Low, very disperse fishing communities, except for the community of Trindade, whose leadership and organization has historical roots
Stakeholders	750 fisher families that benefit from Resex-Mar, diving groups, tourism, army marine station, industries, and ICMBIO (ex, IBAMA)	Several: large industries (CSA, MMX), marine army, harbors, tourism, fishers, INEA	Fishermen, Tourism, government, NGOs, Government Environmental agencies from protected areas
Heterogeneity of stakeholders	High, diverse groups use area and resources	Extremely high, because there are different demands from industries, environmental government agencies and fishers	Very high, because there is intense touristic activity with a mix of other local activities in addition to demands form environmental governmental agencies
Conflicts	Fishers, tourism, government	Industries, fishers, government	Among fishers, and between industrial fishing and environmental governmental agencies
Possibilities for PES	Monitoring existing systems by paying fishers through government	Payment from industries that already have social programs for fishing, through compensatory mechanisms	Payment through defeso system, from government, to control entrance into the ESEC Tamoios

[a]Vinha et al (2011).[b]Begossi et al (2010, 2011).

PES = payment for environmental services

CSA =A Companhia Siderúrgica do Atlântico (CSA),

MMX =

INEA=

ICMBIO= Instituto Chico Mendes (ICMBio), ex-IBAMA

Table 2: The eight principles for robustness of common-property institutions (based on Ostrom, 2005)

The Eight Principles	Resex Arraial do Cabo[a]	Sepetiba Bay	Ilha Grande Bay[b]
1) Clearly defined boundaries	YES *: fishers and fishery resources, boundary defined by the extractive reserve	YES: communities have defined fishing areas and defined associations	NO: 34 dispersed communities, fishing areas informally defined
2) Proportional equivalence between costs and benefits	NO: in spite of having rules regarding how, where and how much extractors should obtain, these rules are not clearly stated in the extractive reserve plan concerning the fishery	NO: Costs are still very high due to the impacts of the industries on the environment and on fishing communities	NO: local informal rules for fishing maintain communities without conflicts over spots, but there are costs from industrial fisheries and from the protected areas over artisanal fisheries
3) Collective-choice arrangements	YES: there are mechanisms to discuss and evaluate rules.	YES: communities are organized into approximately 12 communities and associations, plus a regional association is being created	NO: very incipient. Some meetings organized by local politicians, governmental agencies and universities
4) Monitoring	YES	NO	NO
5) Graduated sanctions	Sanctions: yes, through the extractive reserve plan	Relative, through the presence of the INEA (State Environmental Agency)	Relative, through ESEC Tamoios (Federal governmental agency)
6) Conflict resolution mechanisms	YES	YES (Commissions among stakeholders and fishers' associations)	NO
7) Minimal recognition of rights to organize:	YES, the extractive reserve and other local organizations	YES, fishers' associations are relative strong	With the exception of the community of Trindade, organization is relatively

			incipient and weak
8) Nested enterprises:	YES: developed within the processes for the building of the extractive reserve	Being developed and active (regional fishers' association is being created)	NO

[*] Fishery resources are mobile resources, and therefore, it is difficult to establish boundaries. In this case study, boundaries are defined by the boundaries of the system: an extractive reserve. [a]Vinha et al (2011). [b]Begossi et al (2010, 2011).

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