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The loss of fishing territories in coastal areas: the case of seabob-shrimp small-scale fisheries in São Paulo, Brazil

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Abstract

Knowledge of the difficulties, costs, and territorial issues surrounding fishing communities seems crucial to achieve sustainable development goals in marine and coastal zones. However, such knowledge is not always available, sufficient, or even identifiable. The seabob-shrimp small-scale fisheries in the shallow waters of the State of São Paulo, in Southeastern Brazil, plays an important role in coastal livelihoods, providing social and economic benefits for a number of local communities and a premium source of regional seafood. Around 4000 fish-workers produce supplies for restaurants, fishmongers and supermarkets in coastal towns with about 2 million inhabitants. Nevertheless, harbor and naval mooring, the construction of pipelines, sewage disposal, controversial seasonal closures, and marine spatial zoning have all restricted the activity. A territorial approach is here proposed to examine the timeline of vertically implemented laws/regulations that may have resulted in a decrease of territories formerly available to that fisheries, accompanied by a comprehensive outlook of the overall policy context. The shrinkage of fishing territories has been evidenced and the kind of territorial loss detected does not seem to be implicit in cost analysis of fisheries, ecosystem services, or compensation. Top-down policies and a misunderstanding of environmental mitigation programs appear to have been contributing to increasing conflicts, mining multi-stakeholder processes and social justice in contrast to the ascendant economic growth of both the oil and gas and port industries. While economic and political pressures seem to shape current fishing territories, the recognition of the diversity of interests and power asymmetries in coastal zones directs our attention to a vital, often ignored, dimension of social reality. Institutional challenges and recommendations, such as territorial use rights and legal innovations are discussed, adding value to the self-organization of local communities for an effective process of balanced power both within and outside legal marine protected areas.

Keywords: Territorial approach, Coastal stewardship, Environmental policies, Compensation, Marine protected areas, Oil and gas, Dredging, Fishers

Introduction

One of the aspects to be considered in the efforts to enhance stewardship in small-scale fisheries, is the sector's situation in face of the expansion of multiple pressures in coastal zones (Allison et al. 2012; Elliot 2013). Within a multiple-use, common property resource system, not only each extractive and non-extractive use but also the system's ability to

support combined uses should be assessed (Edwards and Stein 1996). Moreover, the context of struggles over access to, and control of resources and space that often emerge from institutional and power inequalities (McCay and Acheson 1987) should not be ignored.

However, there is a clear gap in evaluating the processes and policies that deal specifically with the position of fishing communities in the midst of multiple-use coastal trade-offs, and their related power asymmetries (Huseman et al. 1987; Oekerson 1986). It is unclear whether this is due to the unpopularity of fishing activities among neoliberal environmentally-friendly sectors (Kopnina, 2015), but it seems evident that the reality of small-scale fishers is often invisible to, or disregarded by, both policy makers and the civil society (Gasalla and Tutui 2006; Petersen et al. 2005).

Knowledge on the struggles, costs, and territorial losses of fishing communities seems crucial to fill this gap and achieve sustainable development goals in coastal zones. Furthermore, it is particularly important to the strengthening of environmental stewardship roles and rights at the local level. Nevertheless, this knowledge is not always clear, available, or even identified (Gasalla et al. 2010).

Additionally, it may be difficult to define fishing territories and get them formally recognized by governments, largely due to their volatile physical boundaries, but also because of the increasing competing economic interests for the appropriation of aquatic spaces, land value and real estate in the world's coastal and riverside areas (McNamara et al. 2015). It makes the identification of and claims for formal recognition of fishing territories challenging. These factors may also explain why the real loss or reduction of fishing territories has been poorly documented and why there is a lack of global and regional estimates of their magnitude.

In this paper, we offer an analysis of the territorial marine loss faced by small-scale seabob shrimp fishers off the coast of São Paulo over recent decades, in order to reveal some of the processes behind the current threats to traditional fishing territories along Brazil's coastline.

The seabob-shrimp small-scale fisheries in São Paulo

The Brazilian State of São Paulo is the country's most populated and urbanized area, with around 43 million inhabitants, and therefore, comprises the largest domestic consumer market (IBGE 2013). The seabob shrimp fishery industry along its coast (Fig. 1) shows major regional socio-economic relevance among local fisheries (Mendonça et al. 2013). It contributes to the livelihoods of a number of low-income coastal communities, providing social and economic benefits as well as a premium source of regional seafood for the general population. Around 4000 fish workers and their families rely on the seabob shrimp fisheries, who supply the product to restaurants, fishmongers and supermarkets in several coastal cities with a combined population of two million (IBGE 2013). The seabob shrimp is a key ingredient in the regional cuisine, providing the base of typical recipes and snacks such as "*peixe ao molho*" (fish in shrimp sauce), "*pastel*" (fried filo-pastry pocket), "*empadinha*" (mini pie), and a low price option among local shrimp varieties.

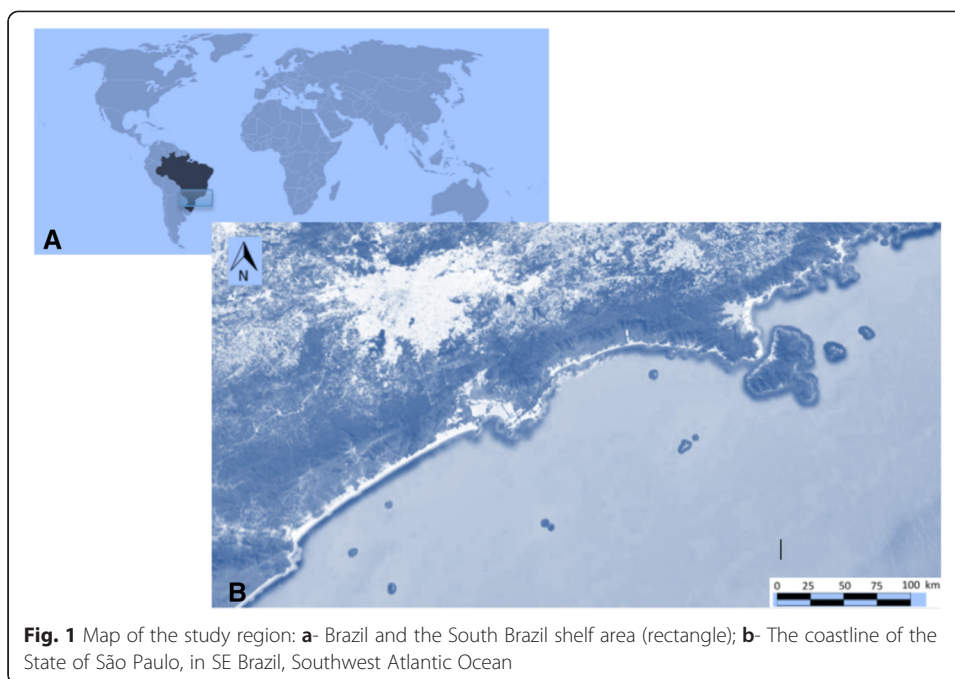
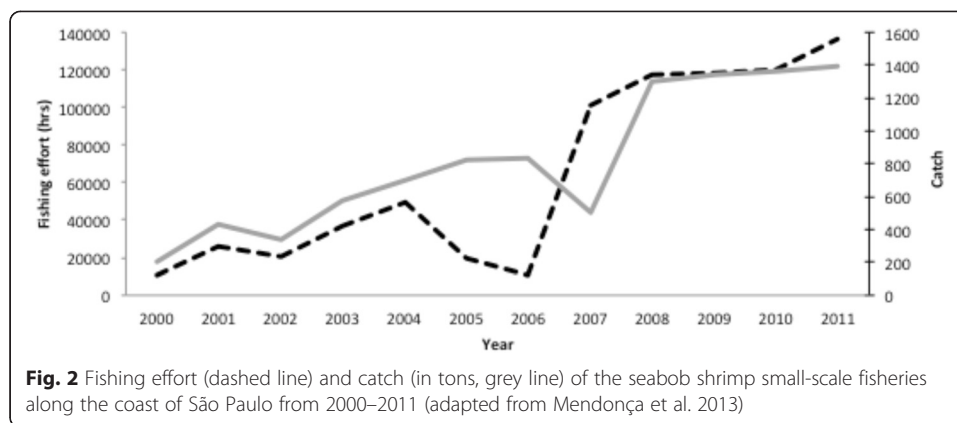


Fig. 1 Map of the study region: **a**- Brazil and the South Brazil shelf area (rectangle); **b**- The coastline of the State of São Paulo, in SE Brazil, Southwest Atlantic Ocean

However, only recently has that fisheries been recognized as the main source of shrimp in São Paulo, following an increase in the coverage of statistics on fisheries' catch data (Mendonça et al. 2013). During the period 2000–2011 it was estimated the seabob shrimp fishery has increased at least ten-fold since 2008. In contrast to what had previously been thought as a predominantly industrial sector, Mendonça et al. (2013) reported that about 75 % of the seabob shrimp fishermen are engaged in small-scale activities responsible for more than 50 % of fishery production in the state. In terms of the fleet, 85 % of the fishing vessels are also classified as small-scale.

The emergence of the seabob-shrimp fishers in São Paulo is quite heterogeneous, ranging from small, traditional, coastal communities (“*caiçaras*”) to more recent entries (Lopes et al. 2009). The latter category mainly comprises of families coming from Southern Brazil (that originally worked as shrimp trawlers), and secondarily, of migrants from the Northeast region of the country that settled in mangrove areas similar to their birthplace. Although some parts of the coast in São Paulo are fairly urbanized (e.g., Guarujá) with a certain influx of fishers to traditional areas, those families seem to rely mostly on the sea to get their animal protein (Lopes et al. 2009). The latest settling of seabob shrimp fishers was reported as being due to invitations from relatives, which also indicates that there is no sign of a declining stock, since the returns from the most recent fishing trips suggests a perception of productivity remaining high (Lopes 2008). Families are the basic unit of production and they are totally dependent on shrimp. Shrimp processing plants, that are usually informal businesses, dominate the local economies (Gasalla et al. 2014a; Ykuta and Gasalla, 2014).

The evolution of the seabob shrimp fisheries over the last decade shows an increasing trend in terms of both catch volumes and fishing effort (Fig. 2). This allowed quite a stable annual catch-per-unit-effort (CPUE), which reached average values of 10 kg per fishing-hour between 2005 and 2007. Although statistical data and human perceptions suggest optimism in relation to the stock, the sector faces several threats in terms of



economic viability and performance (Gasalla et al., 2010; 2014b; Souza et al. 2009a). Access rights seem to be decreasing but possible maritime territorial losses have never been estimated before.

Within this context, the present study aimed to evaluate whether the seabob shrimp fishery in São Paulo has suffered any territorial loss and which mechanisms could possibly be underpinning the issue in terms of investment and policy considerations.

A territorial approach to estimating fishing losses

The assessment and management of marine resources is an increasingly spatial affair, meaning that area-based methods are among modern fishery management practices. Impact analyses of energy and industrial offshore developments primarily focus on spatial displacement and access to place-based resources, whilst marine protected areas (MPAs) are widely seen as a key resource management tool (St. Martin 2001; St. Martin & Hall-Arber 2008; Gasalla 2011). On the other hand, notions of fishing territories at the local level, both formal and informal, exclusive and shared, have received considerable attention and reporting all over the world (Kalland 1999). Fishing territories can be short-term, with temporary territorial rights (Forman 1970) or territorial claims (Cordell 1977), or more permanent, such as when a corporation publicly endorses rights to sea space as an estate.

The term ‘territory’ is used to designate a portion of nature or space that is claimed by a given section of society, aiming to guarantee rights of access to control and use all or part of the resources found there (Godelier 1979; Kalland 1999). A territorial approach may represent a social group whose members act as a legal individual in terms of collective rights to property, and have collective responsibility or other common interests (Keesing 1976). Thus, a territory is more a result of local and regional power than a mere jurisdictional definition (Acheson 1979; Gottmann 1973; Raffestin 1993). Sack (1986) adds a flexible and dynamic temporal dimension to the concept, highlighting the notion that human behavior is influenced by the control of access in a particular territory. The term is also applicable to the notions of (1) governance (interaction and regulation between the actors, institutions, and State); (2) social coordination or coordination of the interest groups that takes place in a determined area (Santos 1999); and (3) development (Sabourin 2002).

In Brazil, territory is also seen and understood, from the perspective of rural development and family-based agriculture, as being the new unit of reference and measurement of the State's actions (Schneider and Peyré-Tartaruga 2004). Similarly, considering what could be called a 'maritime rurality' of the *caiçara* communities (Diegues and Moreira 2001), the concept of territory adopted here represents "a space determined by power relationships where the boundaries are sometimes evident (easy to determine) but sometimes not explicit (not manifested), and have the use of space, coexistence, and the co-presence of each person and their activity, as well as the establishment of their relationships as references".

In order to provide a territorial approach to the small-scale seabob shrimp fisheries, an estimate of the fishing area losses was undertaken. Such investigation was limited to an analysis of the formally restricted access to those particular fisheries, although other activities that have not yet been documented scientifically or legally exist in both land and sea areas, suggesting additional conflict of use.

The policy analysis was based on a compilation and examination of laws and regulations that have been affecting the seabob-shrimp small-scale fisheries in São Paulo. The norms that had restricted fishing access were brought together in a GIS database resulting in shape files (SHP) (Fig. 3). The identified areas were uploaded to Google Earth Pro, and their sum was spatially referenced in hectares (ha). This allowed for an area-based estimate to be used as a reference for exploring a territorial approach aimed at identifying "non-apparent" fishing losses. This was followed by the total restriction estimate in relation to formerly available areas, based on the total maritime area stratified per isobaths (30, 20, 15 m depth) and divided by the area of total territorial lost.

The policy analysis was complemented by a comprehensive review of the management system, state of the resource, and interacting norms. This also took into account conflicts and competition between different interests located in history and social systems, including the interactions promoted or sanctioned by central government authorities (McCay and Acheson, 1987),

Policies driving fishing territories loss

Several policies resulted in spatial restrictions to the seabob shrimp fisheries in São Paulo, although they were not necessarily implemented to reduce fishing impacts on the ecosystem. In Table 1, the multiple factors affecting fishing territories were classified according to the level of government intervention and policy sector, i.e.

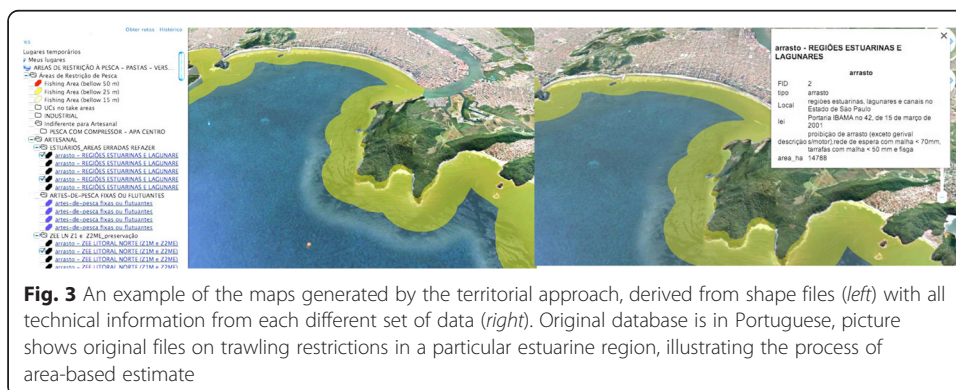


Fig. 3 An example of the maps generated by the territorial approach, derived from shape files (*left*) with all technical information from each different set of data (*right*). Original database is in Portuguese, picture shows original files on trawling restrictions in a particular estuarine region, illustrating the process of area-based estimate

Table 1 Summary of the area-based fishing restrictions data considered in the study, including estimates of total coverage (in hectares) and its relative importance

Regulation type	Level	Number of regulations	Area coverage (he)	Relative importance (%)	Data source	
Federal Fishing Law	Federal	10	6367,2	9,94	São Paulo State Map Data Bank IBAMA/SUDEPE (1967–2004); IBAMA (2010)	Several fishing restrictions norms plus no-take protected areas (MPA) created from the Federal level
Navy Law	Federal	1	1527	0,02	Decree law 9.760/45 (1945); Marinha do Brasil	Military area
Total Federal Regulations	Federal	11	7894,2	12,32		
State Marine Protected Areas	State	5	10517	16,42	São Paulo State Map Data Bank (1987–2013); SMA (2008)	No-take areas in MPAs created from the State level
State Zoning Plan	State	2	37381	58,36	São Paulo State Fishing Map Data Bank (1987–2013); SMA (2008)	Ecological Economic Zone created from Coastal Management Plan
Total State Regulations	State	7	47898	74,78		
Dredged Material Disposal Area	Federal/State	1	3940	6,15	Polygon defined by federal/state agencies (1995–2012)	See text
São Sebastião Harbour Area	Federal	1	1350	2,11	Decree (2007)	Port enterprise
Santos Harbour Area	Federal	1	1916	2,99	Decree (Portaria-MT 94/95) (1995)	Port enterprise
Sewage Disposal Area	State	6	1052,94	1,64	Sewage location maps (1990–2008); area calculated from 6 infrastructure projects along the coastal zone.	Sewage pipeline disposal
Total infrastructure projects (fishing exclusion areas)		9	8258,94	12,89		
Total	Total	27	64051,1	100,00		

fishing-related regulations, MPAs, coastal zoning, naval activity, and norms due to infrastructure works (enterprise-related no-fishing zones), and the corresponding areas are shown.

In general, Federal-based regulations appeared to be more diverse, ranging from corporations' exclusive zones, marine protected areas (MPAs), and "other fisheries" regulations. The State level regulations fell into two main categories: coastal zoning (ecological-economic zoning established by a formal plan) and marine environmental protection areas (APA) (Table 1). Most of the regulations found are not sea-bob shrimp fisheries-specific, although they do all affect it. In terms of the norms deriving from infrastructure activities, the definition of "dredged material disposal areas" (Santos harbor) has been shared by both Federal and State agencies, which was not the case with fisheries-related regulations.

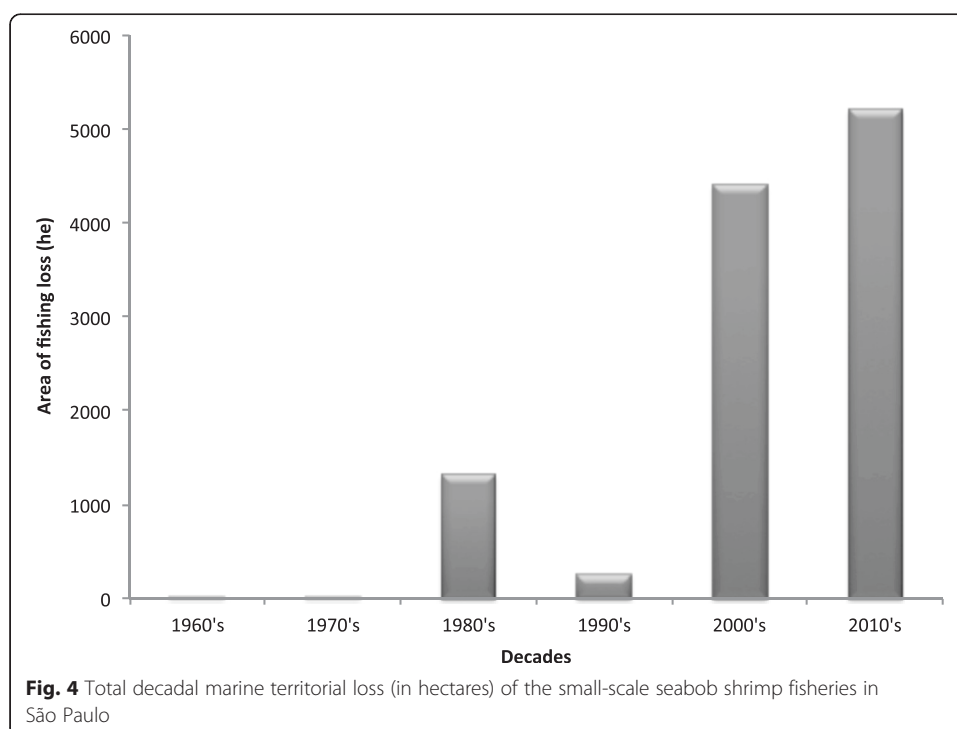
Overall, the São Paulo State Economic Ecological Zoning Plan was responsible for more than a half (66 %) of all the area-based restrictions that were imposed over a period of almost 50 years (Table 1). Moreover, along the São Paulo coastal zone, multiple corporations had legal right to occupy marine areas and to control exclusive zones around their boundaries where fishing is prohibited (13 % of restricted areas).

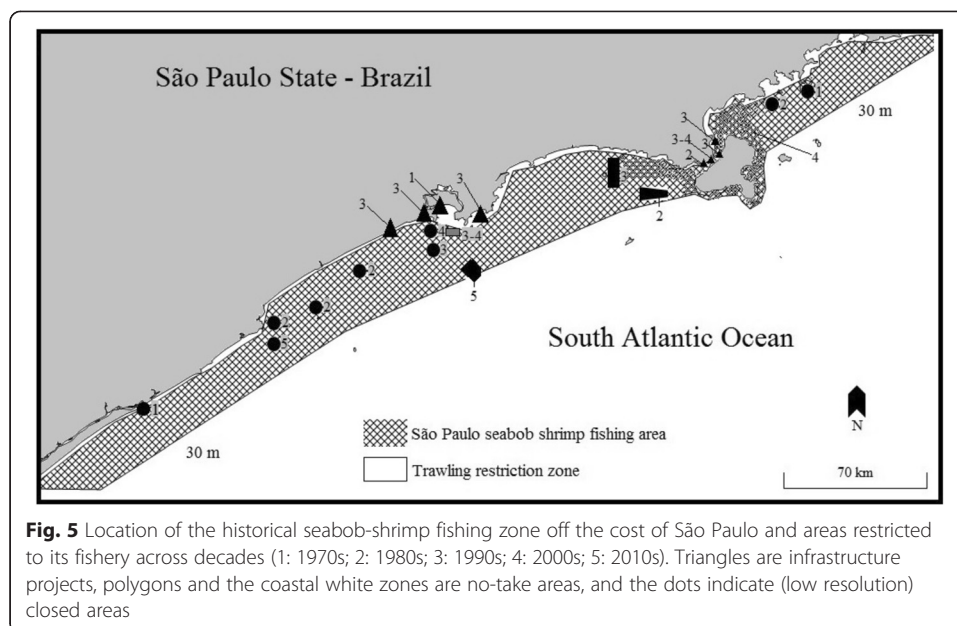
The MPAs recognized as being restrictive to the seabob-fisheries in São Paulo were found to originate from both Federal and State levels and were defined as ‘no-take’ areas. The other set of fishing regulations that was found arose from both the Federal level and from zoning plans at State level (Table 1).

On the whole, since 1967, the State of São Paulo has imposed several area-restrictions with 27 norms increasing quantitatively over time in terms of the total restricted area. Restricted area has progressively increased and intensified between 2000–2014 (Fig. 4). Currently these restrictions amount to about 15 % of the entire coastal area of São Paulo state up to the 15 m isobath, 10 % of the 25 m isobaths, and 3 % of the 30 m isobathic area.

Considering the percentage of fishing restrictions in the different depth zones in relation to the whole fishing area previously used by seabob shrimp vessels (from 3 to 30 meters in depth), it appears that the shallower the water, the greater the impact of the policies has been in terms of territorial loss. Therefore, the smaller the scale of the fisheries, the more restrictive the outcome has been.

The fishing area historically operated by the seabob-shrimp fishery is shown in Fig. 5. The dynamics of the maritime territorial transformation in the region can be understood by taking into account the location of “restriction zones” implemented in each decade (Fig. 5). The total loss of fishing territories was estimated to add up to more





than 64,000 hectares (Table 1), currently evidencing a correlation between the restriction of fishing areas and the loss of fishing territories as understood by the fishers.

Discussion

The expansion of large-scale industries within fishing territories and the ecological deterioration of the water have triggered heated disputes between enterprises, fishing communities, and the state (Camargo 2014). This study reveals an estimate of the fishing territories formerly available to the seabob-shrimp fisheries that have been reduced as a result of access restrictions due to several distinct reasons beyond conservation. It also reveals a not often recognized state role that imposes restrictions on the small-scale fisheries sector but seems to offer no counterpart of any kind whatsoever for the directly or indirectly decrease in income. The analysis has been limited to the territorial aspect, i.e. the formal area-restrictions imposed on fishing itself. Thus, if environmental health problems that also generate economic losses for fishing communities such as the quality of seawater and seabed (CETESB 2005) are taken into account, the potential impact on fishing territories (or other marine ecosystem service) can be much larger.

Human activities in natural systems that shares common resources (i.e. common pool resources or CPRs) often face two key dilemmas: (a) the 'exclusion problem' (i.e. the exclusion of potential users or the control of access is difficult), and (b) the 'subtractability problem' (i.e. each user is capable of subtracting from the welfare of all the others) (Feeny et al. 1990, Ostrom 1990). In Brazil, the sea and its resources are public assets regulated by the Federal government (Federal Constitution 1988, Art.20). The right to fish is often shared among users divided into different sectors according to licensing criteria defined by national agencies. Access to a fishing area, however, depends on other sea-based activities. The multiple activities that make use of marine areas can be divided into those that depend on the health of the ecosystem and those that are not related to ecological integrity. The former category includes the small-scale fisheries, aquaculture, and sports-related nautical activities as well as non-fishing activities such

as community-based tourism, the small-scale hotel sector, agricultural activities, and restaurants serving sea products. The latter group includes several infrastructure projects that require and occupy the competing maritime space for “industrial logistics” such as ports, oil and gas, traffic, disposal of sewage/run-off, seabed extraction and materials dredged from harbors (Elliot 2013).

Among the several trade-offs in coastal management, we should highlight two important issues: 1) the *limits* of alterations that can be supported in such a way that the development of activities that rely on healthy marine ecosystems may be maintained and allowed; and 2) how far contemporary society can *neglect* a renewable-based economy (which, if well managed, can be sustained for an indefinite period of time) to the detriment of a market-oriented logic that compromises ecosystem services and depends on external factors and motivations far beyond local communities’ desires. These dilemmas are clearly observed in the case of the small-scale seabob shrimp fisheries in São Paulo. While both government and civil society make efforts to organize themselves to discuss which institutional arrangement might be best placed to address the tradeoffs abovementioned, the persistence of the invisibility of fishing territorial loss limits the accountability of the economic and environmental policies in generating additional costs for fishing communities, and therefore the development of new policies able to correct this burden.

The reduction of the fishing territories of the seabob shrimp fisheries in São Paulo over the last 50 years were identified as originating from two main factors: 1) the top-down environmental policies, including the creation of MPAs and regulations for other fisheries; and 2) the environmental concession process for the building of enterprise/corporations infrastructures within the coastal zone.

With regards to the former, the process for the foundation of both protected areas and fishing regulations in São Paulo involved very little community participation until 2008, and conflicts with fishing communities were widely reported (Diegues 1973, 1996). Selected participation has taken place since 2002, but only in the State’s coastal management zoning plan with the fisheries sector not being well represented. Some defense arguments were however eventually presented by non-governmental organizations (NGOs), but they represented to less than 5 % of the management councils composition. The creation of the ‘Marine APA’ (a category of State-level MPA) is relatively recent (2008) which does not play a role in the regulation of the seabob-shrimp fishing but has potential for the development of participative mechanisms if well implemented. In some other developing countries, for example in Southern Pacific states, “locally-managed marine areas” have proven to result in a successful effort for spatial management based upon *de facto* communities’ participation and agreement (Govan, 2009).

With regard to the territorial losses for fishing due to enterprises and infrastructure, it should be noted that in Brazil an environmental impact assessment is required in order to approve an environmental license (CONAMA Resolution 01/86). However, increasing impact in coastal zones has been heavily criticized in recent decades since the growth of business and infrastructure has occurred faster than that of environmental legislation (Ab’Saber 2001). Although some assessments have attempted to evaluate the impact on fishing areas, in reality, fishing territories have been affected and reduced, and mitigation and compensation mechanisms have been worthless or weakly instituted with insufficient fishers’ participation.

This study reveals that the smaller the fishing boat, the more impact it will have felt from public policies (see section 2). This conclusion raises a serious issue concerning equity and social justice. Small-scale fishers have less fishing power as they cannot go beyond exclusion zones, resulting in higher vulnerability to the current regulations that have resulted in about 15 % of territorial loss. Such vulnerability may be seen as a drawback on sustainable development goals (SDGs) and human rights (SDSN 2015). Justice is an important condition for governability, increasing the overall capacity for governance of any societal entity or system (Kooiman 2008; Jentoft 2013). Under injustice, stakeholders are likely to revolt against government efforts to sustain the resource or promoting sustainable development (Jentoft 2013). This also reinforces the view that power and authority are central issues in the analysis.

Fisheries assessment overview: the seabob shrimp stock and its current management

In the study area, there are still controversies over the size of seabob-shrimp populations, as well as over spawning and recruitment seasons. The species is distributed over a wide geographical area and different research groups along Brazil's coastline have reached different conclusions, somehow reflecting the nature of the species which seems to be biogeographically diverse. There is currently a closure season (March-May) in compliance with a legal norm (IBAMA, 2008) that covers the Southern region from Espírito Santo to Rio Grande do Sul States. However, this geographical area is considered excessively large and, according to genetic studies, it comprises more than one different stock/population (Gusmão et al. 2006, 2013; Franscisco 2009, Piergiorgio et al. 2014). Moreover, the closure season was originally established rather to protect the pink-shrimp (*Farfantepenaeus paulensis*, *F. brasiliensis*) from the estuaries to the ocean (D'Incao 1991). However, in São Paulo, pink-shrimp is less abundant in the estuaries and seabob shrimp's dominates the coastal zone (Graça-Lopes et al. 1997). Therefore, the time frame currently stipulated by the legislation is also controversial since the current closing period was developed for another shrimp stock with different behavior and population patterns. In fact, Heckler et al. (2013) show the existence of two main periods of female maturation, suggesting that closure for the seabob-shrimp should be brought forward if protection of the spawning season is desired. In terms of the recruitment period, Severino Rodrigues et al. (1992) reported that recruitment of the seabob-shrimp starts as of the species' 20th or 30th month of life and fishery catches contain a considerable amount of young individuals. Notably, adults and juveniles of the stock share areas of equal depth, and the high variability of recruits in the shallow water, resulting from meteo-oceanographic dynamics coupled with the larval survival period, seems to complicate recruitment estimates, while environmental variability might strongly affect stock abundance.

Souza et al. (2009b) report the fishers' frustration towards the continuous changes in the regulations, and highlight the need for further extension work. There seems to be a feeling of betrayal within the sector, since the State creates regulations that are different to those agreed upon at numerous meetings with representatives. Although Azevedo (2013) reminds us that the review of the closure season was fulfilled as part of a participative process, the regulation (IBAMA 2008, IN 189/2008) did not seem to meet

the wishes of either the fishers or the scientific sectors in terms of regionalizing and adjusting the closure to a more appropriate geographical scale. All these factors appear to contribute to an erosion and mistrust of the current fishing regulation process. Apart from the disputes, the management of this fishery seems to have remained static and dated, and is certainly in need of reform.

Despite all the problems, the seabob shrimp stock's CPUE has remained reasonably stable over the last decade, suggesting that overfishing is not in place at least for the target species (Mendonça et al. 2013; Kolling and Avila-da-Silva 2014). A minimum revenue of R\$3.00 per kilogram caught by the small-scale fleet was reported as an average in 2008 (Souza et al. 2009a). More recent economic assessments (2012–2014) showed a much higher price variation for the seabob shrimp, suggesting that under extreme conditions of small shrimp catches, the price may vary by up to 500 % during a single year (Gasalla et al. 2014b).

From the perspective of its gastronomic value, the seabob shrimp seems irreplaceable in several of Brazil's most popular dishes. Even in low quantities (such as in 2014), it may acquire a special economic value. Such a substantial price increase would move the seabob shrimp from its traditional category as a "cheap shrimp" to the position of an "irreplaceable shrimp". The gastronomic value and demand is no less important than the biological aspects since its new "status" may increase the small-scale fishers' bargaining power - as an important asset - in the whole coastal management process. Despite the difficulties faced because of the value-chain with a low rate of revenue for the fishers and the lack of collective or public infrastructure (i.e. anchorage piers, refrigeration chambers, subsidized fuel, and small, locally-based shipyards), these fisheries are labor intensive in comparison to other coastal seasonal activities or those that rely on a constant turnover of personnel.

However, participatory approaches may still be considered as being very poor and inefficient. Recently, an oil accident in the Santos Harbor, leading to economic loss for fishers, revealed difficulties in estimating local fisheries yields within the impacted area, constraining fishers to negotiate compensation (Gandini, 2014). The process has been dragged into the courts, which could be avoided should communities have access to, and control of, fisheries information, which seems likely only through participative monitoring (FAO, 1998).

Ways forward

Considering the current fisheries scenario, we argue that community-based participatory monitoring and management could be potentially decisive in preventing the process of reduction of fishing territories that also seem important to seafood supply. In addition to this, we intend to highlight and explore two of the main developments related to the major factors identified by the territorial approach: (i) the territorial use rights for fisheries and a new way of handling fishing communities under coastal MPA regimes; and (ii) the legal innovation for conciliatory dialogue regarding the impacts felt from private enterprises.

Territorial use rights for fisheries and Marine Protected Areas

Notions of exclusive fishing territories at the local level have received much attention worldwide (e.g. Japan, France, New Zealand, and North and South America). The

concept of territory as an area occupied more or less exclusively by an individual or group by means of repulsion through over-defense, or some form of communication, has been tested by ecological models. For example, several authors found correlation between ecological factors and the existence of fishing territories using cost-benefit models developed to analyze territoriality. Dyson-Hudson and Smith (1978), who employ an ecological model to discuss the existence of territories among hunters-gatherers and pastoralists, suggest that territories only exist where the costs involved in defending them are considerably less than the rewards. This fact should help to understand the (non-) territorial nature of fisheries in general.

However, an *a priori* recognition of the existence of fishing territories in certain situations would be a more efficient means of limiting fishing efforts (Kalland, 1999). With smaller territories people are in a better position to influence the resource base on which their future rests, whether the territories are formally recognized and supported by the state or not. Community-controlled territories enhance the efficiency of sanctions, not least because activities at sea cannot be isolated from those on land. Open access seems beneficial only to the more powerful fishers who, with large, efficient vessels, can fish one area after another, and fishing regulations have widely been more of a response to exclusive territories than to the ecological factors themselves (Kalland 1996, 1999).

Mainly because of this, governance over common goods and services has often been transferred from governments to civil society in several fishing area-based cases. For example, Kurien et al. (2006) reported the legal aspects and the social organization process of the aquarian reform (re-territorialization) that has been underway in Cambodia since the beginning of the last decade, as part of which state properties started being regulated locally, resulting in better community access and usufruct rights. In the South Pacific, both the network of “locally-managed marine areas” (LMMAs) in western island states (Govan, 2009), and territorial use rights for fisheries (TURFs) in Chile (Gelcich et al. 2012), have been encouraging fishers to increase their governance powers. Although TURFs cannot be seen as a panacea for solving all fisheries’ governance problems, (showing, as they do, constraints beyond the management of benthic resources - Aburto et al. 2014), the concept shows a potential for the context of seabob shrimp fisheries in São Paulo, especially under and within local MPAs.

In 2008, following a quite controversial process, the State of São Paulo created a *continuum* of three APAs where fishing is allowed (Dias and Máximo 2010). However, both the APAs and the coastal fisheries are still threatened by non-fishing impacts such as pollution, oil, sewage disposal, the construction of infrastructure and the effects of large scale tourism. Moreover, progress with respect to the fisheries in these areas has been dismal, even though fishers’ knowledge has been well-evidenced as being extremely useful for ecosystem-based fisheries management on the Northern coast (Leite and Gasalla 2013).

Overall, the major weakness in the coastal and fisheries management models found by the present analysis is that they mainly rely upon command-and-control mechanisms, with the adoption of static measures with limited mechanisms for adaptation or updating in the short-term. This has created a great deal of discomfort in the sector. The fishers’ distrust in the current bureaucratic management system (e.g. establishment of a closure season different from that agreed upon), the harsh and oppressive manner in which these measures are applied by the State, and the loss of fishing territories that have been found, emphasize the serious need for a series of reforms (Table 2).

Firstly, the current *fora* instituted under the MPAs (APA) management councils could be optimized in a way that promotes a review of the current marine plan under the State's Ecological Economic Zoning (ZEE) as well as the seabob closure season at a more regional level. A new direction to protect the environment and establish territorial use rights for fishers based on genuine and consistent community-based processes at the local level would be recommended. Also, although some MPAs have evidenced real benefits for biodiversity conservation in coral reef ecosystems, it should be mentioned that São Paulo's APAs have a very particular coastal setting and social structure (e.g. a non-reef ecosystems, located in a large portion of the country's coastal zone with stronger social-environmental disputes and economic power which has been gathering public attention due to recent oil and pre-salt discoveries). In this sense, their approach to natural resource management should instead be inspired by other MPA categories within the Brazilian legal framework (SNUC 2000) more appropriated to the socioenvironmental context, such as the Marine Extractive Reserves (RESEX) and Sustainable Development Reserves (RDS) (e.g. see Gasalla 2011).

Lastly, it has been demonstrated that spatially-oriented community-based measures such as TURFs (Panayoutou 1982) or LMMAs could be of particular help in contributing to an increase in the sustainability of fisheries, ecosystem stewardship, and local social wellbeing. If both the food production rights and poverty alleviation needs are recognized in territorial approaches, new ways of governability may advocate for participatory processes (Gasalla 2011; FAO 2014) that should be characterized by transparency, accountability, cohesiveness, and inclusiveness (Jentoft 2013).

Enterprises and legal innovation for public policies

Coastal zone infrastructure projects demand marine space for their activities, using it as logistics channels and an area for deposits, imposing 'subtractability' on fishing areas and excluding other incompatible activities. For example, underwater dredging, sewage and the limitations on the access imposed by port activities and by the oil and gas sector may indirectly create offsets for small-scale fishers. In Guanabara Bay, in Rio de

Table 2 Key observations and suggestions for a participative management of the seabob shrimp small-scale fisheries along the São Paulo coast

Observed facts	Suggested/required action
1. Closures were set in a geographical area that is too large and which do not contemplate the lifecycle characteristics of <i>Xiphopenaeus kroyerii</i> neither fishers' knowledge along the São Paulo coastline.	There is a need for more regional and legitimate fishing closures for the target stock.
2. Fishing area entirely within MPAs (marine APA), with conditions to develop self-monitoring and regulation (co-management).	Review and create specific agreements and actions within the marine APAs, since this is an area of legal jurisdiction.
3. Fishermen have participated in the formulation of wide-reaching fishing regulations, but in the case of the seabob shrimp closure they feel betrayed due to not having been consulted or listened to.	Repeal or review of Decree nr. 58.996 (March 25, 2013), and define spatial and temporal regulations based upon collective agreements that need to be reached.
4. Small-scale fishing is responsible for most of the shrimp production along the São Paulo coast, but the current management model, based on police command-and-control, has not shown itself to be applicable or effective whilst it also cannot be understood by the sector.	The implementation of a participative and territorial approach (in the sense proposed by this study) with the recognition of territorial use rights for fishers should enhance coastal stewardship. New policy formulation on environmental licensing should contribute to ethical improvements with this sector.

Janeiro, 75 % of the whole artisanal fishing area has been lost to oil and gas, ports, and infrastructure construction (Chaves 2011). These projects as a whole, often financed by public resources, fall into the accepted practices of environmental licensing that, as a rule, lead to socio-environmental damage, which is hard to equate within the licensing procedure. In the so-called “green economy” paradigm, it should lead to financial compensation and reimbursements in the process of valuing biodiversity as part of business or market values. In Brazil, entrepreneurs are required by law to develop programs for the “socio-environmental compensation” of each of their different projects in order to maintain their environmental licenses. However, these programs are created or designed from the entrepreneurs’ perspective with no input from those who suffer the consequent damages. Characterized by a major conflict of interests between those who need the compensation, those who have to pay for it, and those who usually implement the process, a reformulation of such procedures has been recommended (Gasalla 2011). Further analysis suggests that more independent social-environmental programs based on specific territorial use rights, funded and paid for by the enterprise responsible for the loss of fishing territory, and which include non-monetary compensation for the fishing communities, may be an important way forward.

Furthermore, there is a clear opportunity for social innovation (e.g. projects based upon communities’ demands) amongst governmental environmental agencies, since it is a public attribution to consider and accept proposals from third parties (e.g. fishing communities). This is something that is already happening, as can be seen in the case of the mangrove areas around Santos Harbour (CETESB 2012).

Another innovation presently under way in Brazil, which is developing in the legal Federal sphere, involves the judiciary’s understanding of “mediation” as a method for bringing interests together. A legal development should occur with the approval of the Mediation Law, a new piece of legislation which requires that a negotiation between conflicting parties be part of procedural rites so that environmental injustices are solved extra-judicially based on conciliatory dialogue (Gandini 2014). It is expected that this sort of legal innovation, applied in the social-ecological field, will be a landmark in the field of disputes over spatial use in Brazil and will certainly benefit by a territorial approach to fishing.

In summary, the ways forward embrace the need for a more in-depth territorial approach to fisheries, especially from the perspectives of present coastal zoning, MPAs and the blue-economy. It should include effective participation, the recognition of fishing territories, and innovative processes for environmental licensing, adaptation, mitigation, and compensation. Such participatory approach to fishing (re)territorialization seems to move towards the nationwide mobilizations led by the *‘Movimento de Pescadores e Pescadoras’* (‘Fishermen’s and Fisherwomen’s Movement’ - MPP) which defends a Brazilian version of territorial use rights as a way to deliver societal benefits and achieve ecological and socio-economic goals in fisheries (MPP, 2012). This also shows a certain amount of agreement with what was proposed by the Citizenship Territories Policy (*‘Programa Territórios de Cidadania’*) in Brazil in around 2008, which failed to get implemented in the fisheries and aquaculture sector.

Concluding remarks

Fishing activities in the seawaters of the State of São Paulo have been restricted by different policies associated with the installation of specific businesses and aims that go beyond habitat conservation. Despite this, an estimate of the affected (compared to the potential) areas likely to be used by the small-scale fisheries has not previously been conducted.

An examination of non-explicit territories and the related inequalities has assisted this analysis by directing attention to the relevant, but sometimes ignored, social dimension of fisheries in coastal zones. This study has shown that around 15 % of the potential fishing areas of the seabob shrimp has now limited or prohibited entry due to the implementation of a set of coastal zoning policies, and port, oil and gas, and infrastructure projects. These types of zoning goals are considered to be legitimate by the different interest groups, including conservation, but nevertheless mitigation and compensation mechanisms for the small-scale fisheries sector are either weak, undirected, or even non-existent. The kind of territorial loss detected does not seem implicit in a cost-analysis of fisheries and ecosystem services. Fishers' territorial losses amount to more than 64 thousand hectares over time, which took place mostly in the last 15 years.

A more in-depth understanding of the small-scale fisheries sector's real position in multi-goal coastal zone management seems essential in order to enhance its eventual ecosystem stewardship role. The issues revealed here have been discussed within the context of overall policy while a set of recommendations and envisioned directions was presented. A reorientation of investments starting with the country's infrastructure projects leading to innovation in compensation mechanisms and novel environmental mediation methods, an evolution from command-and-control instruments to participative approaches, and the definition of territorial use rights for fisheries were highlighted.

Public interests seem integral to property regimes, and power plays in the distribution of benefits account for institutional change. The facts raised here seem to encourage small-scale fishers to become important players in the coastal zone and fisheries management scenarios. As long as fishing territories are seen, recognized, and granted, a maritime 'rurality', even in more urbanized areas, shows the potential to grant high quality protein in the food production system and to collaborate in both poverty alleviation and the green-economy. It would now be expected that the development of local, territorial approaches and legal innovation in public policies should become a new focus in natural resource and coastal management in Brazil, where "compassionate conservation" (*sensu* Koprina, 2015) and the recognition of fishing territories can take place.

Our findings might also contribute as "food for thought" in the analysis of the equity and power relationship within coastal policies and conservation goals, the concession of use rights for traditional communities, and on the progressive loss of fishing territories elsewhere.

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