



Management of gillnet fisheries in the south coast of the state of São Paulo, Brazil

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ABSTRACT

Gillnetting is one of the most practiced fishing methods adopted in the South of Brazil and has been increasingly expanding over the last years. This paper presents the characterization of the activity and discusses its management, in accordance to results from the discussions on the development of regulations on net fisheries in the South Coast Marine Protected Area (APAMLS) in the state of São Paulo. Gillnet fleets are formed by small-scale boats, with low autonomy, and lower fishing capacity, when compared to boats from other ports in the South and Southeast. However, the number of fishing units is high, reaching 1,709 units operating in the South coast of São Paulo in 2010. This kind of fleet uses several types of gillnets, and the activity may be classified according to the fishery type (industrial, coastal artisanal and estuarine artisanal). The activity was discussed in the APAMLS and the fishing industry, with the participation of all segments, and a proposal for gillnetting regulation was reached. The results suggested that gillnet length for industrial fisheries should be reduced by 30%. It must be emphasized that without effective inspection measures leading the fishing industry to believe in the enforcement of the proposal, private interests of the most influential political sectors may cause the process to retrocede.

Key words: conservation unit, co-management, Brazil, gillnet, fishery assessment, APA Marine South.

INTRODUCTION

Gillnet is one of the most primitive types of fishing gear. Records show that its use dates back to Neolithic Period (Diegues 1983). It is the most widely used fishing gear in the South and Southeast coast of Brazil, for both industrial and artisanal fisheries. It has become popular in artisanal fisheries in recent years, due to its lower cost operation when compared to other fishing gears (Valentini and Pezzuto 2006).

There are records of gillnet use in the coast of the state of São Paulo from the beginning of the 20th century, when the trammel net was introduced with paddle powered canoes (Diegues 1983).

Due to the increase in the number of fishing units that generally use gillnet in estuaries and coastal areas, the activity must be properly managed (Alves et al. 2009). An adequate fishing management requires that fishing gears catch adult fish and allow juvenile fish to escape (Armstrong et al. 1990), ensuring the possibility of reproduction and renewal of

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the population (Tomás et al. 2006). Therefore, the characterization and management of this activity in any ecosystem is essential.

As gillnetting fishing is mostly concentrated in the coastal area, resulting in the catch of large volumes of demersal species, it is necessary to manage the activity to guarantee its sustainability (Tomás 2003). In addition to the said reasons, this type of fishery implies great physical and harvesting changes, a large number of people involved and a substantial fishing production (Ávila-Da-Silva and Paiva 2011).

The south coast of the São Paulo has one of the largest concentrations of fish stocks available in the South and Southeast coast of Brazil, owing to the high degree of preservation of the existing ecosystems in the region (Machado and Mendonça 2007). Gillnetting is the region's main activity, implying a high fishing effort on stocks that already show signs of overfishing.

The activity takes place in the South and Southeast coast of São Paulo, the country's most preserved area, nationally and internationally recognized as the third most productive ecosystem in the South Atlantic (Adaime 1985). Due to their very well preserved environmental characteristics, this area was considered as the biosphere reserve of the Atlantic forest in 1993 (UNESCO 2005), as well as the World Natural Heritage site of the scientific knowledge and the preservation of human values and traditional knowledge with aims sustainable development models (UNESCO 1999).

The aforementioned characteristics of the region caused the creation and implementation of several protected areas, both terrestrial and marine. Marine areas include the Environmental Protected Area of Cananéia, Iguape and Peruíbe (*Área de Proteção Ambiental-APA-CIP*), the federal Sustainable Use Conservation Unit and two other protected areas, both State units: the South Coast Environmental Protected Marine Area (*Área de Proteção Ambiental Marinha-APAMLS*) and Ilha Comprida Environmental Protected Area (*Área de Proteção Ambiental-APA Ilha Comprida*). These three units account for approximately 80% of the whole south coast area.

This paper presents the process of discussion on gillnet fisheries management within the South Coast Marine Protected Area of the State of São Paulo, based on the characteristics of gillnetting in the South Coast of São Paulo.

MATERIALS AND METHODS

The study was developed in the South coast of São Paulo, in the cities of Cananéia, Iguape and Ilha Comprida (Fig. 1), where fisheries landing occurred. The characterization of the boats and fishing gears were obtained through interviews with fishermen and boat owners and through the records of the three cities in the Port Authority (Brazil's Marine) from 2009 to 2010. The information collected covered:

Boats: total length (m), gross tonnage (GT), hull material, existence of cabin, means of storage, year of construction, number of crew, type of propulsion, fishing area.

Fishing gear: full length (m), mesh size (measured between opposing knots on a stretched mesh) (mm), height of the net (m), types of operation.

The information on production, number of fishing trips and number of fishing units using gillnet were obtained through interviews during the boat landings, at landing sites and/or with the fishermen in the period from 1997 to 2010. During all landings was an interview with the fishermen for the production, fishing effort and fishing location of each trip in the three counties of the south coast of São Paulo, according to the methodology of Mendonça and Cordeiro (2010). The landings were separated according to the fishing area; with the georeference of each landing, divided according to the type of fishing (artisanal or industrial) and fishing location (coastal or estuarine).

The prices of the first sale of fishing products were obtained with the fishermen during landings in 2011. The calculation of boats revenue was obtained first by the record of the average landings. The average landing was divided by the number of major species in order to obtain the average

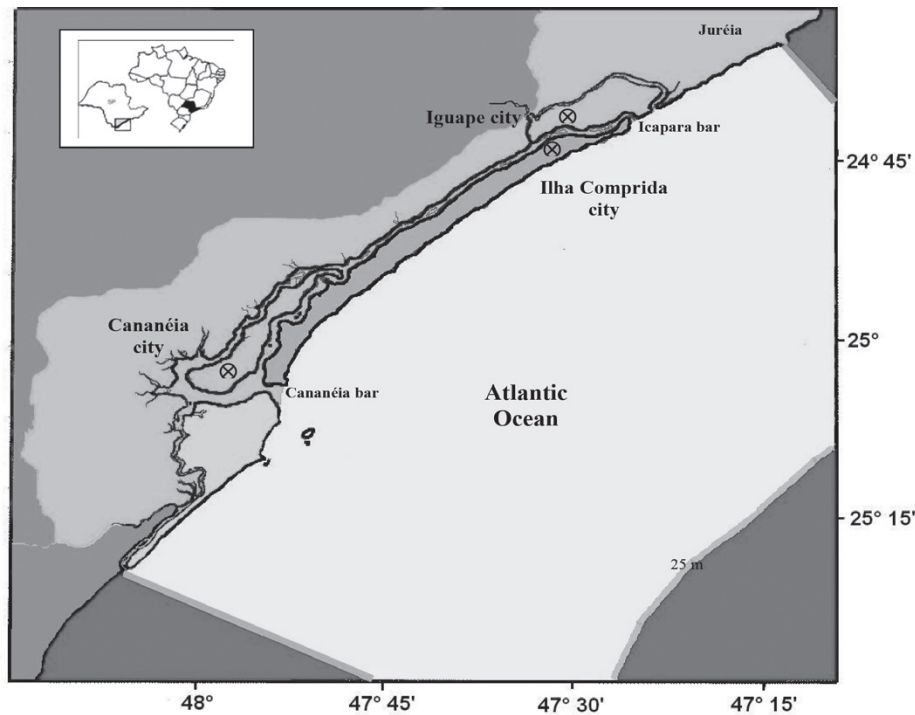


Figure 1 - São Paulo South Coast, emphasizing protected areas. APA-CIP (●), Ilha Comprida APA (●) and APAMLS (○).

production of each main species. The result was multiplied by the average product price. Through the financial performance of industrial fishing vessels by length of nets (\$/meters) used was set a percentage reduction or adjustment of the dimensions so that they can meet the law or assist in its update.

Due to the fact that gillnetting in the region is developed within conservation units, influence of these areas management, the information on the fishing management system in the south coast of São Paulo was obtained from the minutes of the meetings of the managing councils and thematic chambers of the three conservation units (APA-CIP, APAMLS and Ilha Comprida APA), on themes involving gillnetting, by the survey of actions that influence the activity.

RESULTS

CHARACTERISTICS OF GILLNET FISHERIES

In general, professional fishing in the South coast of São Paulo may be divided into industrial and artisanal

fishing. Artisanal fishing is practiced in coastal and estuarine areas, whereas industrial fishing takes place in the coast area above 6 meters isobath. Industrial fishing is operated by the *baleeiras* and artisanal fishery uses canoes, *voadeiras* and *bateiras*. Canoes account for 43.9% of the fishing units, *voadeiras*, 37.3%, *bateiras*, 15.3% and *baleeiras*, 3.4%.

The number of fishing units (boats and fisherman) using gillnet is high, reaching 1,709 units operating in 2010, with an increasing trend throughout the period of study. In industrial fisheries, the number of fishing units is approximately 44 annual units, whereas in artisanal fisheries it exceeds 1,665 units. Artisanal fisheries operate in the coastal and estuarine areas, the latter has shown a larger number of fishing units, totaling 1,432 units last year, while in coastal areas it reached 475 units. It is worth mentioning that several fishermen operate during certain periods of the year in the estuary and on other periods in the coastal area, particularly in the municipality of Iguape, because in the summer

time fishermen fish in the estuarine area targeting broadband anchovy and the rest of the year they fish in the coastal area to catch other types of fish.

INDUSTRIAL FISHERIES

In industrial fisheries the number of operational units is close to 44 annual units, being called *baleeiras* in the coastal area (below 20 meters isobath) up to above 100 meters isobaths. They are wooden boats with engines ranging from 45 HP to 366 HP, and measuring an average length of 13.7 meters (± 2.3 m).

Industrial fishery uses only two types of gillnets: bottom gillnets and surface gillnets (Table I). In *pescada-foguete* or King weakfish (*Macrodon atricauda*) gillnets, the size of mesh ranged from 70 to 180 mm, and they were used to catch, *corvina* or Whitemouth croaker (*Micropogonias furnieri*) and *betara* or Southern king croaker (*Menticirrhus americanus*), and surface gillnet ranged from 100 to 180 mm, targeting *sororoca* or Serra Spanish mackerel (*Scomberomorus brasiliensis*) and *guaivira* or Castin (*Oligoplites saliens*). All boats have bottom gillnets with mesh size measuring 70 mm and 51% have 120 mm mesh sizes. The nets with mesh size of 70 mm have an average length of 8,270 m ($\pm 3,116$ m). The maximum gillnet size registered was 16,500 m in length, to catch King Weakfish. For gillnets with mesh size of 120 mm, the average length was 6,000 m ($\pm 2,440$ m), and a maximum length of 16,660 m was reported, targeting the capture of Whitemouth croaker and Southern King croaker. The mesh size of surface gillnets ranged from 100 mm to 180 mm, and mesh size of 120 mm was the most common sized net registered in the boats (85.7% of the boats). These gillnets have an average length of 4,000 m ($\pm 1,960$ m), with a maximum length of 7,400 m. Surface gillnets have average heights of 11.8 m (± 2.2 m), and can reach up to 20 m. The industrial fleet in the south coast operates preferably between Bom Abrigo island and Icapara Bar (in front of Ilha Comprida), accounting for 34% of the landings, and

in the northern side of the region between Icapara Bar and Juréia, accounting for 23% of the landings.

The most commons species found in industrial fisheries landing were Whitemouth croaker (*Micropogonias furnieri*), followed by King weakfish (*Macrodon atricauda*) and King croaker (*Menticirrhus americanus*), which together represented 58% of the landings.

ARTISANAL FISHERIES

The fishing units presented in 1,665, that working in the coastal and/or estuarine area. It must be pointed out that several fishermen operate during certain periods in the estuary, while at other times they operate in the coastal area. It is especially common in the city of Iguape, because in the summer fishermen operate in the estuary, fishing Broadband anchovy, and the rest of the year they operate off the coastal area aiming at other fishing stocks.

Artisanal fisheries are operated in the estuary and shore with canoes made of wood or fiber with an average length of 6.65 meters (± 1.1 m), and most of them being paddle propelled. They operate in the estuary and close to the beach. The *voadeiras* are generally used in small-scale fisheries in the estuary, although some fishermen operate them near the shore area. They are aluminum boats with an average length of 5.6 meters (± 0.7 m) in average length and usually have outboard engine. The main fishing area is located in the Ribeira river (31%), followed by the central area of the estuary (13%) and the Ararapira Channel (13%).

The *bateiras* are little boats predominantly used for coastal artisanal fishing (operating up to 15 meters isobath), however, it is possible to find some fisheries in the estuary, especially when sea conditions are unsuitable for fishing in the coastal area. Most of them are made of wood and some of fiber, with an average length of 7.5 meters (± 1.4 m). Almost all of them are equipped with center engines. Coastal artisanal fishing typically operates in depths ranging from 10 to 16 meters, and in distances from

1 to 40 meters isobath. The main inshore fishing area is in front of Ilha Comprida (from Bom Abrigo island to Icapara) (47%), but concentrate around the mouths of the estuary (Icapara and Cananéia Bars) or in front of the fishing communities (Boqueirão Sul and Ribeira Sandbanks).

Artisanal fisheries use seven different types of gillnet: surface and bottom gillnet, fixed gillnet, *rede de batida*, beach net, trammel net and drift net fishing for Broadband anchovy (Table II). Fishermen generally use the surface gillnet or bottom gillnet, or might own both. The *rede de batida*, fixed gillnet and beach nets are variations of bottom or surface gillnets, with modified operating system.

In small-scale fisheries the main species landed was Broadband anchovy (*Anchoviella lepidentostole*),

followed by White sea catfish (*Genidens barbatus*), King weakfish (*Macrodon atricauda*) and Lebranche mullet (*Mugil liza*), representing 72% of landings over the studied period.

The gillnet production recorded over the 14-year study showed an increasing trend, with the largest production in 2010, landing more than 2,950 tonnes (Fig. 2). From that total, 49% corresponded to artisanal fisheries landings and 51% to industrial fisheries. The average monthly production was 1,998 tonnes (± 811 t) with higher landings during hot months, due to the period of broadband anchovy season. Industrial fishing showed an average production per trip of 3.6 tonnes in recent years and the artisanal fisheries reported 40 kilograms per fishing trip. The average prices of main products landed in 2011 were:

Bottom gillnet							
Mesh Size	% occurrence	Lengths				Heights	
		Average	Standard Deviation	Maximum	Minimum	Average	Standard Deviation
7	100.0	8270	3116	16470	556	1.5	0.0
10	4.7	4630	0	4630	4630	2.8	0.4
11	32.6	6181	1769	9620	1480	2.3	0.5
12	51.2	6029	2440	16660	1480	2.3	0.5
13	2.3	7408	0	7408	7408	3.0	0.0
18	2.3	3838	275	4250	3700	2.0	0.0

Surface gillnet							
Mesh Size	% occurrence	Lengths				Heights	
		Average	Standard Deviation	Maximum	Minimum	Average	Standard Deviation
10	14.3	710	52	740	650	8.7	0.6
11	14.3	4160	1966	5550	2770	10.0	0.0
12	85.7	3057	1861	7400	1852	11.8	2.2
13	14.3	4396	2961	7400	1852	9.0	3.5
14	14.3	1852	0	1852	1852	6.0	0.0
18	14.3	4396	2961	7400	1852	9.0	3.5

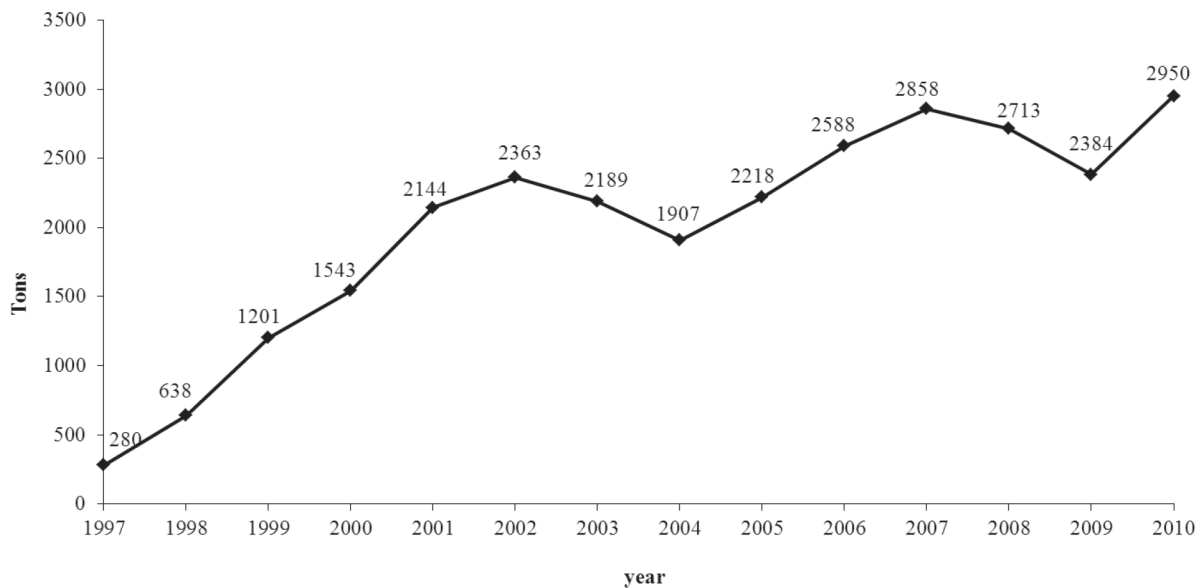


Figure 2 - Yield annual of gillnet in the south coast of São Paulo, from 1997 to 2010.

A total of 116 and 132 species were recorded in landings of industrial and artisanal fishing, respectively. Teleost fish were prevalent, both in the industrial and artisanal fishing, accounting for more than 78.7% of individuals, followed by elasmobranch fish (20.3%), crustaceans (0.5%) and mollusks (0.6%). The occurrence of crustaceans and mollusks in the gillnet landings is due to bycatch of white-shrimp (*Litopenaeus schmitti*) and squid (*Loligo* sp).

According to the fishing entrepreneurs of the municipality of Cananéia, costs per trip vary according to the type of boat, but presents an average cost close to US\$ 3,000. The average revenue per trip of industrial fishing vessels in 2010 was US\$ 7,000 gross and US\$ 4,000 net, with a discount of US\$ 3,000 for costs.

MANAGEMENT OF FISHERIES RESOURCES IN THE SOUTH COAST OF SÃO PAULO

The South coast of São Paulo has a high degree of environmental and cultural conservation, being the most preserved region of the state. It has a large number of conservation units. Accordingly, all fishing activity is developed in some conservation unit (UC), particularly in the Protected Area of Cananéia, Iguape

and Ilha Comprida (APA-CIP, Federal UC), South Coast Marine Protected Area (South Coast APA, State UC) and Ilha Comprida State Protected Area (Ilha Comprida APA, State UC), involving 90% of the entire area where gillnet fisheries boats operate.

The APA-CIP has jurisdiction in the estuarine area, while the South Coast APA encompasses the entire coastal area. Lastly, Ilha Comprida APA manages the island of Ilha Comprida (Fig. 1). The conservation units are obliged by law to have management plans and managing councils (SNUC 2000), which in practice become the guidelines of the activities and discussion forums for the use of natural resources to be developed within the units. The councils of the major conservation units where gillnetting is practiced are advisory, supporting management in the conservation units and developing actions for the maintenance of the fish stocks exploited by fisheries.

Ninety-one documents of meetings of thematic chambers and managing councils from conservation units were analyzed. Sixty-five documents were related to APA-CIP meetings, 14 belonged to Ilha Comprida APA and 12 to South Coast APA.

From 2004 to 2006, the APA-CIP held several discussions aiming at the development of fishing activity such as the Broadband anchovy fisheries management (IN IBAMA n.33, June 16, 2004), cast net fisheries on the beach (IN IBAMA n. 49, September 14, 2004) and *iriko* fisheries (IN IBAMA n. 15, June 16, 2005). However, the Council is currently inactive and the entire fish stocks management in the unit is suspended. The current regulations on the Broadband anchovy fisheries management defines the dimensions of the drift gillnet (surface) at lengths of 300 meters and 24 mm of mesh size.

The Ilha Comprida APA Council, despite having been created in 1987, started its activities only in 2010, when it was set up. It currently holds periodical meetings. However, so far no measure has been taken in relation to gillnetting.

The South Coast APA was created in 2009, and its managing council activities have been most effective, with specific studies on gillnet fishing. Thirteen meetings were held in the council to discuss the activity within the conservation unit. Two of them occurred in the council, six in the thematic chamber, and five meetings were held with the productive sector, to draw up a proposal for management of the activity in the unit. The proposal for the management of the activity is in annex I, and so far it has been under evaluation by the unit managing council.

The gillnet fishery was studied in this proposal and classified according to different types, as micro, small, medium and large scales. The micro scale refers to the estuarine artisanal fisheries, that also operate near the beach and around estuary mouths. Small scale refers to coastal artisanal fisheries, and medium scale refers to the industrial fisheries landing on the South Coast of São Paulo. Large-scale fisheries are not found in the landings of the region, but occur in the conservation unit and their landings are registered in ports of other regions.

DISCUSSION

The gillnet fishing fleet operating in the South coast of São Paulo is considered small-scale with low autonomy, and lower power of capture, when compared to boats of other ports of the region of the state of São Paulo (Tiago et al. 1995, Alves et al. 2009). According to the characteristics of the boats and their type of fisheries, the difference of environments where the fleet operates is very clear. The fleet operates in three types of fisheries: industrial, coastal artisanal and estuarine artisanal, different from Alves et al. (*op.cit.*) who classified the fisheries in the region as large, medium and small scale, in accordance with the structural characteristics of the boats.

Industrial fishing vessels have characteristics that allow an increased potential of capture, due to the greater length of fishing nets and longer travel days. Although accounting for only 2.6% of boats in the region, those vessels are responsible for 51% of landings due to their storage capacity and fishing power. Their fishing power is attributed to the number of nets carried per trip. The lengths of both surface and bottom gillnets are far above the size permitted by law, which is limited to 2,500 meters in length (IBAMA Ordinance n. 121, August 24, 1998). Noncompliance with current legislation is caused by the need for high production, sufficient to cover travel costs and to provide profits to fishermen. The fishing industry argues that the legal maximum length of gillnets is impossible to be respected, because it does enable enough catch activity to cover travel costs. With the decline of fish stocks, several industrial vessels gradually increased the length of their nets, as well as the duration of fishing trips, consequently increasing the fishing effort and the impacts on the stocks, which could lead to overexploitation over time, as is the case with other fisheries (Boffo and Reis 2003).

The results of this study show that industrial fishing has an average production of 3.6 tonnes per trip, with an average profit of US\$ 4,000 in each trip, with the use of nets six times larger on average

than that permitted by law. This survey shows that a reduction in the net length of at least 30% of what is currently the average, is necessary. Namely, reducing the maximum length of the nets to 10,000 meters, the average profit of the vessels would be close to US\$ 2,800 per trip.

According to artisanal fisheries characteristics, nets are not disrespecting the existing legislation, and do not need adjustments to the lengths of their nets.

Noncompliance with the law in Brazil is most commonly due to lack of conditions of public agencies to manage the activity, allowing increased quantities of fish to be captured quantities of fish higher which are greater than what stocks support. Excessive fishing effort is one of the main causes of the sustainability crisis of major national fishery resources (Marrul-Filho 2001), causing productivity decline and increasing disrespect for legal rules applicable to the activity.

The industrial fishing fleet studied operates around Bom Abrigo and Icapara, as its displacement power is lower than that of the industrial fleet from the rest the state of São Paulo and operates in areas already known to be productive, where most of the industrial fleet of other ports of the state also operate (Carneiro et al. 2000, Tomás 2003).

The artisanal fisheries operating in the south coast present great diversity of fishing gears and techniques, as a result of their dependence by on seasonality of fish stocks, which is typical of traditional fishing in the coast of São Paulo (Bertozzi 2002, Mendonça and Miranda 2008). Despite the diversity of methodologies, it is possible to classify their artisanal fishing according to the environment of their fishing areas. Fisheries operated in coastal region (coastal artisanal modality) use larger boats, with capacities ranging from 4 to 9 tonnes of gross tonnage (GT), being typically being fiber or wooden canoes, dinghies or *bateiras*. Fisheries in the estuarine region are operated by smaller boats, with GT under 4 tonnes, typically being by fiber or wooden canoes and aluminum boats.

The choice of the fishing area not only depends on the physical structure of the boat, but it is also influenced by the conditions of the sea and catches of fishery products, which in turn depends on the life cycle of the species. This corroborates with Carneiro et al. (2000) who found a dynamic industrial fleet as a reflection of oceanographic conditions, life cycle of target species and the application of management measures.

In estuarine areas, Broadband anchovy fishery is emphasized, which is exclusive of Iguape, and for most of the fishermen this is the single harvest resource to be exploited throughout the year, however, operation is limited to the months of October to April. This type of fishing considerably increases the quantity of people practicing gillnetting, because fishing machine used to be the drift gillnet (surface), representing 34% of artisanal fishermen. Sixty-six percent of all artisanal fishermen operating in the estuary use other types of gillnet like bottom, surface, fixed gillnet and trammel. They primarily aim at Lebranche mullet (*tainha*), Fat snook (*robalo*), White sea catfish, White mullet (*parati*), tripletail (*prejeba*) (*Lobotes surinamensis*) and Mojarra (*carapeba*) (*Diapterus* spp.). The use of a certain type of gillnet is determined by the availability of the resource and the financial condition of the fisherman to obtain the fishing gear.

Fishing is an extraction activity that affects fishing stocks, causing impacts that can lead the resource to extinction, in biological and economic terms. As gillnetting involves the capture of large volumes of demersal species, management analysis and spatial planning of this activity is crucial (Tomás 2003). Artisanal fishery, despite of its lower fishing power, has a very large fleet, with the highest level of fishermen employment, operating near the coast and estuaries in critical periods of the life cycle of the target species. Due to the aforementioned reasons, these types of fisheries need monitoring to support the creation of effective management plans in order to

ensure the sustainability of stocks (Alves et al. 2009). Its management becomes essential for the maintenance of ecosystem resources and fishing itself, because without the resource the activity will also vanish.

In developing countries fisheries evaluation and management are usually inadequate or even non-existent and are far from improving social development (Andrew et al. 2007). It may be said that, in Brazil, access to resources is virtually free, and there are difficulties in establishing effective regulations as well as in enforcing the law. There are several factors that cause these problems, among them the structural difficulties of the management institutions; the understanding that the exploitation of these resources permits free access to every citizen, coped with the erroneous notion of the real status of the abundance of stocks that is overestimated due to the immensity of the Brazilian coast. In addition, there is the persistent contradiction among governmental agencies, which have, in some instances, policies encouraging increased fishing effort, worsening the panorama of the activity (Machado and Mendonça 2007). Currently, the fishing activity in the country has been undergoing an economic, social and environmental crisis. The Brazilian government is the main cause of this crisis, failing in the mission of promoting the sustainable use of fisheries resources (Dias-Neto 2010).

Gillnetting, due to targeting at overexploited stocks, must be carefully managed, and its expansion should not be encouraged (Tomás et al. 2006). Despite their enactment, laws limiting the maximum size of the mesh are not enforced, greatly increasing the fishing effort on the overexploited resources, evidencing the huge lack of management of the activity, also motivated by the inefficient law enforcement. Failure to manage this activity leads to the disorganization of the sector, where the level of exploitation will depend on the financial power of the boat owner, causing the inevitable overexploitation of resources.

Fishery management in Brazil has been accomplished by environmental agencies mainly by measures planned and implemented on a centralized basis, through traditional methods, such as the establishment of periods of fishing prohibition season and regulation of mesh sizes. The participation of users (fishermen and entrepreneurs) as co-managers of this process is limited to few cases (Kalikoski et al. 2009). As a result, regulatory measures ultimately become more an element of social conflict, rather than a contribution to the sustainable exploitation of living resources (IBAMA 2001).

The system of stocks management implemented by conservation units brings benefits, because they create discussion forums with the participation of the governmental sector, including management, research, licensing and inspection agencies with the productive sector and civil society. The creation of these institutional arrangements of co-management has been easy to a certain extent, but the big challenge is to implement and maintain said measures. The political strengthening of fishing communities and the training of government agents for institutional aid are crucial to this implementation (Kalikoski et al. 2009).

There is evidence that artisanal fishing has a greater condition of reaching sustainability (Cardoso 2001). In addition artisanal fisheries have more facility to handle resources management because of their greater cultural identification and commitment to fishing activity than the industrial fishermen. More problems are identified in the structure of management organisms than in the fishing sector. The same happens with gillnet fishing in the south coast of São Paulo. Although almost all the gillnet activity occurs in protected areas, their management is not yet effective, and it is done by federal regulations that encompass wide areas, limiting sizes of nets and meshes and some fishing areas.

Gillnet fishing in the coast south can be considered practically artisanal, representing 97% of fishing units landing in the region. Over the last years their production can be compared to that of

industrial fleet. Consequently, for the south coast of São Paulo, an efficient planning should take into account the number of people involved and as well as production. The actions affecting artisanal fishing are very important because they involve a higher number of people and lower investment costs for jobs (Bekers et al. 2006).

Despite the existence of a proposal for the management of gillnet fishing in the South Coast Marine APA based on co-management, with discussion and construction with the entire fishing sector, it must be pointed out that because of the large number of users, In Brazil, the law is not always respected, requiring stricter oversight. Therefore, it is necessary to monitor the activity so that the fishing sector will believe in the seriousness of the proposal made by government managing agencies. Otherwise management processes may retrocede due to the private interests of more politically influential sectors.

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RESUMO

A pesca com redes de emalhe é uma das mais praticadas no litoral sudeste-sul do Brasil, e tem crescido muito nos últimos anos. O presente trabalho apresenta uma caracterização da atividade e discute sua gestão, tomando como exemplo o processo de discussão do ordenamento da atividade na APA Marinha do Litoral Sul de São Paulo. A frota de pesca com rede de emalhe é de pequeno porte com baixa autonomia de mar e menor poder de captura, quando comparada a embarcações de outros portos da região sudeste-sul. Mas o número de unidades produtivas é alto, chegando a 1709 unidades produtivas em 2010, que desembarca no litoral sul de São Paulo. Esta frota apresenta diversos tipos de redes

de emalhe, podendo ser sua atividade categorizada de acordo com ambiente de trabalho (industrial, artesanal costeira e artesanal estuarina). A atividade foi discutida no Conselho, através da Câmara Temática da APA e com o setor pesqueiro, com manifestação de todos os setores e chegaram a uma proposta de ordenamento. Os resultados mostram a possibilidade de diminuição de 30% no comprimento das redes da pesca industrial. Salienta-se que sem uma fiscalização efetiva de modo que o setor pesqueiro acredite na seriedade da proposta e devido a interesses particulares de setores mais influentes politicamente o processo pode retroceder.

Palavras-chave: unidade de conservação, co-manejo, Brasil, rede de emalhar, avaliação pesqueira, APA Marinha do Litoral Sul.

REFERENCES

- ADAIME RR. 1985. Produção do bosque de mangue da Gamboa Nóbrega (Cananéia, 25°S-Brasil). Dissertação de Mestrado, Universidade de São Paulo, Instituto Oceanográfico. São Paulo, 305 p. (Unpublished).
- ALVES PMF, ARFELLI CA AND TOMÁS AR. 2009. Caracterização da pesca de emalhe do litoral do Estado de São Paulo, Brasil. B Inst Pesca São Paulo 35(1): 17-27.
- ANDREW NL, BÉNE C, HALL SJ, ALLISOY EH, HECK S AND RATNER BD. 2007. Diagnostic and management of small-scale fisheries in development countries. Fish and Fisheries 8: 227-240.
- ARMSTRONG DW, FERRO RST, MACLENNAN DN AND REEVES SA. 1990. Gear selectivity and the conservation of fish. J Fish Biol 37A: 261-262.
- ÁVILA-DA-SILVA AO AND PAIVA J. 2011. Análise dos padrões de captura com redes de emalhar no Estado de São Paulo. In: V Simpósio Brasileiro de Oceanografia. Oceanografia e Políticas Públicas. Santos, SP.
- BERKES F, MAHON R, MCCONNEY P, POLLNAC R AND POMEROY R. 2006. In: Kalikoski DC (Org), Gestão da pesca de pequena escala: diretrizes e métodos alternativos. Ed. FURG, Rio Grande, 360 p.
- BERTOZZI CP. 2002. Análise da pesca artesanal na região da Praia Grande (SP), no período de 1999 – 2001. Dissertação de Mestrado do Instituto Oceanográfico – USP, São Paulo, 226 p. (Unpublished).
- BOFFO MS AND REIS EG. 2003. Atividade pesqueira da frota de média escala no extremo sul do Brasil. Atlântica Rio Grande 25(2): 171-178.
- CARDOSO ES. 2001. Geografia e pesca: aportes para um modelo de gestão. Revista do Departamento de Geografia da Universidade de São Paulo 14: 79-88.

- CARNEIRO MH, FAGUNDES L, ÁVILA-DA-SILVA AO AND SOUZA MR. 2000. Ambientes marinhos explorados pelas frotas pesqueiras de Santos e Guarujá. In: Anais do V Simpósio de Ecossistemas Brasileiros: conservação. Vitória (ES). Outubro, p. 83-91.
- DIEGUES ACS. 1983. Pescadores, camponeses e trabalhadores do mar. Ed. Ática, Série Ensaios, São Paulo, nº 94, 287 p.
- DIAS-NETO J. 2010. Gestão do uso dos recursos pesqueiros marinhos no Brasil. Brasília: Ibama, 242 p.
- IBAMA. 2001. Ata da Reunião Técnica sobre Ordenamento da Pesca de Arrasto na Região Sudeste-Sul; CEPESUL/IBAMA, Itajaí – SC; 07 a 11 de maio de 2001.
- KALIKOSKI DC, SEIXAS CS AND ALMUDI T. 2009. Gestão compartilhada e comunitária da pesca no Brasil: avanços e desafios. *Ambiente & Sociedade* Campinas 7(1): 211-222.
- MACHADO IC AND MENDONÇA JT. 2007. Gestão pesqueira participativa do Complexo Estuarino-lagunar de Cananéia, Iguape e Ilha Comprida e Área Costeira Adjacente. Áreas aquáticas protegidas como instrumento de gestão pesqueira. Ana P. Prates, Danielle Blanc. Brasília, MMA/SBF. Série Áreas Protegidas do Brasil 4: 79-98.
- MARRUL-FILHO S. 2001. Crise e sustentabilidade no uso dos recursos pesqueiros. Dissertação de Mestrado da Universidade de Brasília – Centro de Desenvolvimento Sustentável. Brasília, 100 p. (Unpublished).
- MENDONÇA JT AND CORDEIRO AG. 2010. Estatística Pesqueira do Litoral Sul de São Paulo - Metodologia e Resultados. In: SILVA RB e MING LC (Eds), Relatos de Pesquisas e Outras Experiências Vividas No Vale do Ribeira, Capítulo 9: 171-190.
- MENDONÇA JT AND MIRANDA LV. 2008. Estatística pesqueira do litoral sul do estado de São Paulo: subsídios para gestão compartilhada. *Pan-American Journal of Aquatic Sciences* 3(3): 152-173
- SNUC – Sistema Nacional de Unidades de Conservação. 2000. Cadernos da Reserva da Biosfera da Mata Atlântica: Série conservação e áreas protegidas, 18, 2ª edição ampliada, 76 p.
- TIAGO GG, TUTUI SLS, VON SECKENDORFF RW, GRASSI RTB AND INÁCIO MLS. 1995. Análise da frota pesqueira sediada em Ubatuba, estado de São Paulo, Brasil. *B Inst Pesca* 22(2): 71-83.
- TOMÁS ARG. 2003. Dinâmica da frota de emalhe do Estado de São Paulo. In: CERGOL MC and ROSSI-WONGTSCHOUSKI CLDB (Eds), Dinâmica das frotas pesqueiras: análise das principais pescarias comerciais do sudeste-sul do Brasil. Programa Revizee/Score Sul. MMA e CIRM. Ed. Evoluir, São Paulo, p. 299-314.
- TOMÁS ARG, ALVES PMF, MIRANDA LV, MENDONÇA JT, RICCIOTTI-DOS-ANJOS D, LOTFI TH AND DARDAQUE-MUCINHATO CM. 2006. A pesca de emalhe e seus impactos sobre os principais recursos pesqueiros no Estado de São Paulo. In: Anais do Seminário de gestão ambiental para o desenvolvimento da aquicultura e da pesca no Brasil. COPPE/UFRJ, Rio de Janeiro, 29 de novembro a 03 de dezembro. CD Vol. 2.
- UNESCO. 1999. World Heritage Nomination – IUCN Technical Evaluation Atlhantic Forests (southeast) Brazil. UNESCO, p. 1-8.
- UNESCO. 2005. World Network Of Biosphere Reserves – SC/EES – June 2005. The MAB Program, 19 p.
- VALENTINI H AND PEZZUTO PR. 2006. Análise das principais pescarias comerciais da região sudeste-sul do Brasil com base na produção controlada do período 1986-2004. Série Documentos Revizee: Score Sul / responsável ROSSI-WONGTSCHOUSKI CLDB, 56 p.