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Fisheries and Conflicts in Guanabara Bay, Rio de Janeiro, Brazil

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ABSTRACT

Despite the magnitude of domestic and industrial pollution, fishery yield registered in several landing points at Guanabara Bay, between April 2001 and March 2002 was slightly over 19,000 tons, corresponding to a value of US$ 4.8 million. When considered only the fish directed to the food market, the total catch amounted to about 6,300 tons and a value of US$ 3.7 million. Only a few fish species reached expressive densities compatible with commercial fisheries. Among small pelagic fish, Atlantic anchoveta and Brazilian sardinella were the dominant species, while in terms of demersal fish, croakers, mullets and catfishes comprised the main part of the catch. The absence of landing data previous to the spilling of 1.3 million liters of oil in January 2000 led to claims by fishermen representative organizations of values corresponding to about 50 years of fish harvest in the bay. Possibly, a data collection network could be established in a participative way with the main fishermen local associations. The relatively stabilized fisheries in the bay suggested that reasonable inferences could be made, without, necessarily having a complete coverage of all landing points.

Key words: Fisheries, fisheries statistics, Guanabara Bay, Brazil

INTRODUCTION

Due to its peculiar geographical situation, Guanabara Bay, located in Rio de Janeiro state, receives an expressive amount of organic and inorganic pollution generated by the domestic and industrial park of the metropolitan region and adjacent municipalities. The number of inhabitants around the bay was 10.2 million people, occupying a watershed of 4,081 km^2. The bay has a water surface area of 381 km^2, with depths, average and maximum, of 7.6 and 50 meters, respectively (Semads, 2001). Average water discharge to the bay is around 350 m^3/s (Amador, 1997). The remanescent mangrove area is approximately of 82 km^2, where 65 km^2 are located inside the "Environmental Protectection Area" (APA) of Guapimirim. (A.L.A. Cavallieri, Fundação Estadual de Engenharia e Meio Ambiente - FEEMA-RJ, pers. comm. 2002).

The *in natura* domestic sewage discharged in the bay was 17 m^3/s; Biochemical Oxygen Demand-BOD from industrial sources was 4,700 kg/day, with a daily estimate of 11 kg of heavy metals (lead, chrome, zinc and mercury). Uncontrolled solid waste discharges were about 1,000 t/day (Semads, 2001). However, in spite of the intense pollution, the bay supports important fisheries and a large number of fishermen in activity.

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So far, available information at the Brazilian Institute for the Environment and Natural Renewable Resources - IBAMA in Rio de Janeiro, considered only two to three landing points for the whole Guanabara bay, suggesting a total production of around 1,300 t/year for the bay (Ibama, 2000). This value seemed to be an underestimation. For example, in spite of the marked differences in species composition, fleet characteristics and oceanographic conditions, the total catch in the bay of Todos os Santos in the state of Bahia was around 20,000 t in 2002 (Bahia Pesca, 2003). This bay, located 12º of latitude to the north, has an area of 1,086 km^2 (Lima et al., 2000), and, like the Guanabara, is characterized by a sand and mud bottom. There was an estimated number of 5,000 to 18,000 fishermen in Guanabara bay, including both registered and unregistered (Cantarino and Sousa, 1997; CIDS, 2000).

Fixed fish traps ("Stationary uncovered pound nets" or "currais") make up an important fishing gear type used in the bay. A survey carried out a few years ago (Petrobras, 2000) registered 208 fish traps, owned by 61 fishermen. The traps are fixed gears, made of bamboo screens and moored by wood stakes. The old practice of using mangrove trees has been replaced by the use of eucalyptus timber. The logs are moored in shallow waters 30 cm apart from each other and a bamboo screen is placed between them to prevent fish from escaping.

In January, 2000, an accident with a pipeline caused a spill of about 1.3 million liters of oil in the most inner part of the bay, contaminating beaches, rocky shores and mangroves, damaging tourism and fisheries, especially the fish traps. Compensations offered by the responsible company were not considered sufficient by the fishermen, leading to lawsuits of US$ 250 millions (US$ 1 = R$ 3, in June, 2004).

In this paper we present new estimates for the total landings in the Guanabara bay (and their corresponding value for the first selling); as well as for the total number of boats, fishing gears and fishermen in activity, between April 2001 and March 2002. We also evaluated crab harvesting in mangroves and mussel harvesting in rocky shores and characterized the fish selling process and discussed the importance of landing data as an essential tool to evaluate economically the activity and get a sound basis to set up compensations in case of conflicts.

MATERIAL AND METHODS

Data collectors located at 32 landing points in the Guanabara bay registered the catch per group of usual commercial species for each boat and trip, as well as the average prices paid to fishermen in each locality. Characteristics of the boats (length, tonnage and fishing gear), fishing effort (trip duration, number of gears used), number of fishermen and approximate fishing area were also registered. Whenever identified, landings derived from fishing grounds outside the bay were disregarded. The only exception was for mussel harvesting, which was performed in a more or less continuous manner in rocky shores near the mouth of the bay and also in adjacent open sea islands. The number of fishermen in activity was inferred from the number of boats and the average crew for each type of gear in use.

It was not possible to keep a complete coverage in all the landing points during the twelve months of the project. In such a way, for those places with less significant landings we decided to alternate data collection, while keeping fixed teams in the main landing points. Nevertheless, for all points we had at least two months of direct survey. For those places temporarily without coverage, inferences concerning catch composition and fleet characteristics were made based on landing points with a similar fleet and gear profile.

Data quality was not uniform for all species and localities. For fish, the more centralized landings facilitated a more strict control. However, for the swimming crab, processed by hand for meat extraction, and the mangrove crabs collected and sold alive, there were no well defined landing points. In this case, the total catch was inferred from interviews within the fishing communities. A total of 50,315 landings were registered during the whole study period, with an average of around 4,200 forms collected each month. Even for those categories sold by the unit (like crabs) or after processing (swimming crab and mussels), landings were computed in weight to facilitate summaries. For crabs, we considered an individual weight of 180 g. For swimming crabs sold as "packed meat", we used a conversion factor of 4.5 (4.5 kg of living crabs to produce 1 kg of meat); and, finally, for mussels, we considered a conversion factor of 10 to 1 (10 kg of living mussels to produce 1 kg of meat).

Prices were recorded according to the commercialization pattern - values paid per unit of

crab or "ropes" with a fixed number of individuals; and per weight of swimming crab or mussel meat. In all cases prices were converted to living weight following the relationships above described.

RESULTS

Fishermen and boats

Fig. 1 shows the main fish landing points in Guanabara Bay. Besides the points shown in the figure, landings were also detected in a few points in Governador island, but in small quantities. Moreover few localities in Magé, even provided with docking facilities, did not show systematic landings.

Table 1 indicates number of boats operating in the bay, classified by gear type. Around 62% of the boats employed gillnets (fixed or drifting); purse seiners comprised 8% of the fleet; hand-line 7%; and trawlers 6%. Nevertheless the fleet profile was not static, since it was relatively simple to change gears according to the seasonality of target species. Purse seiners were the largest boats in activity, varying in length between 7 and 15 meters, with an average crew of 10 fishermen. For the other gear types, boats had an average length of 6, 8 and 8.5 m for gillnets, trawl and hand line, respectively. Trawling was carried out with a single net, although bottom pair trawling were registered in a few occasions.

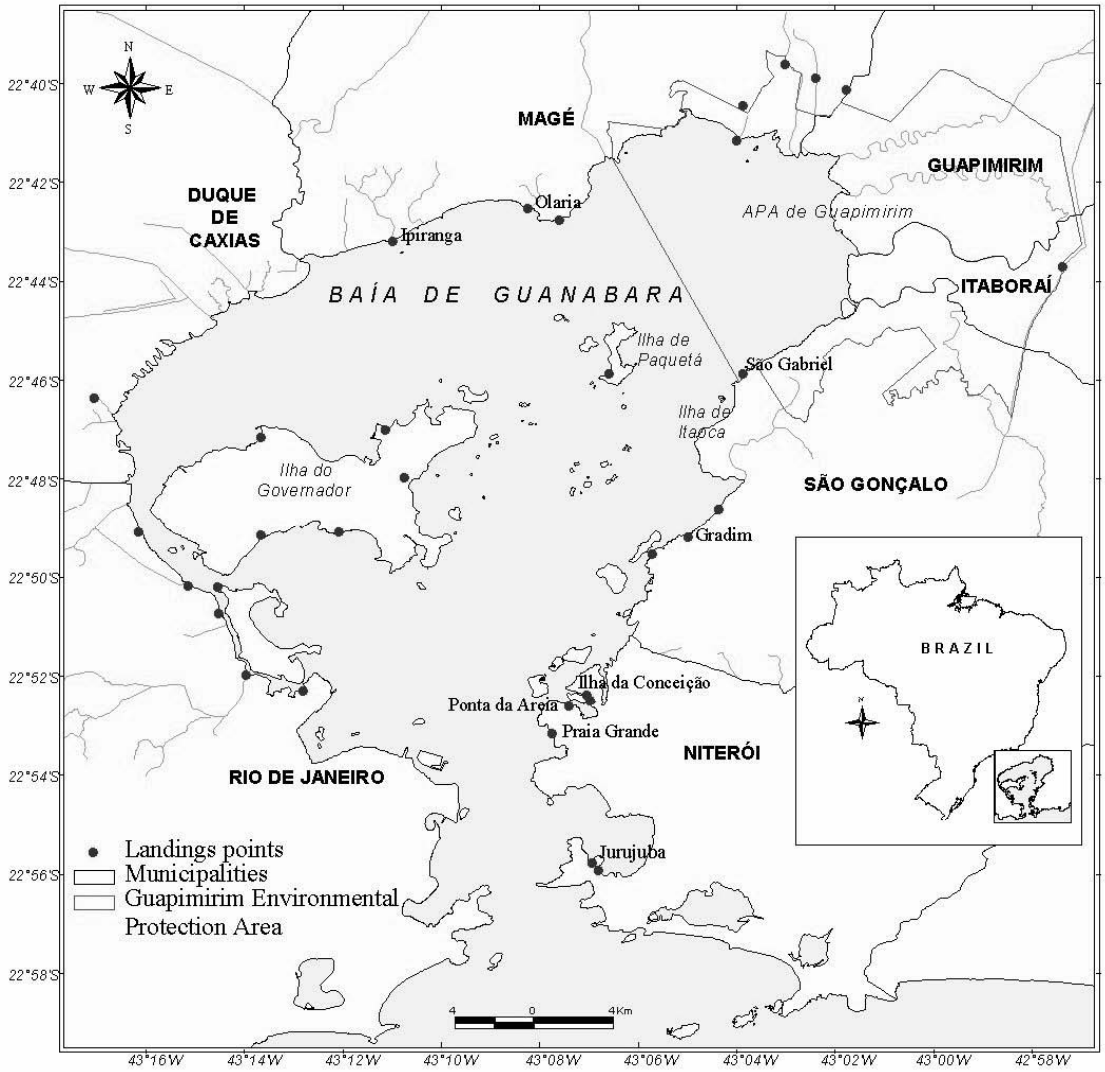

Figure 1 - Guanabara Bay - Main fish landing points, municipalities and the Environmental Protection Area of Guapimirim (APA)

Table 1 - Boats in operation in the Guanabara Bay, by gear type - April 2001 to March 2002[1]

Gear	Nº of boats	%
Otter trawl	84	5.99
Gillnet	864	61.63
"Digger" "escavadeira"[2]	23	1.64
Long line	45	3.21
"Lace" "laço"[3]	69	4.92
Hand line	101	7.20
Surface pots "puçá"[4]	80	5.71
Purse seine	109	7.77
Others[5]	27	1.93
Total	**1,402**	**100**

1 - Not including the boats giving support to the fish traps ("currais").
2 - Gear to extract mussels from hard substrate
3 - Gear to catch crabs, also called "redinha (little net)"
4 - Traps to catch swimming crabs
5 - Harpoon, poles, hooks and castnets.

The percentage of the fleet using diesel engines for propulsion is about 70%. Percentages of the fleet according to the system for fish preservation varies from 56% using isothermic boxes, 25% using ice and 19% without refrigeration. Availability of refrigeration depends on the type of fishing, being predominant in the case of gears that allow big catches (purse seines) and practically non-existent in other artisanal fisheries.

During the survey we counted 511 traps in activity, owned by 106 different fishermen, 38% located in front of Magé and Guapimirim, mostly inside the "environmental protected area"; and 33% between the northern part of Governador island and the continent. The number of traps per owner varied from 1.3 to 17, with an average of 5. The average monthly number of traps in activity during the period of study was 360.

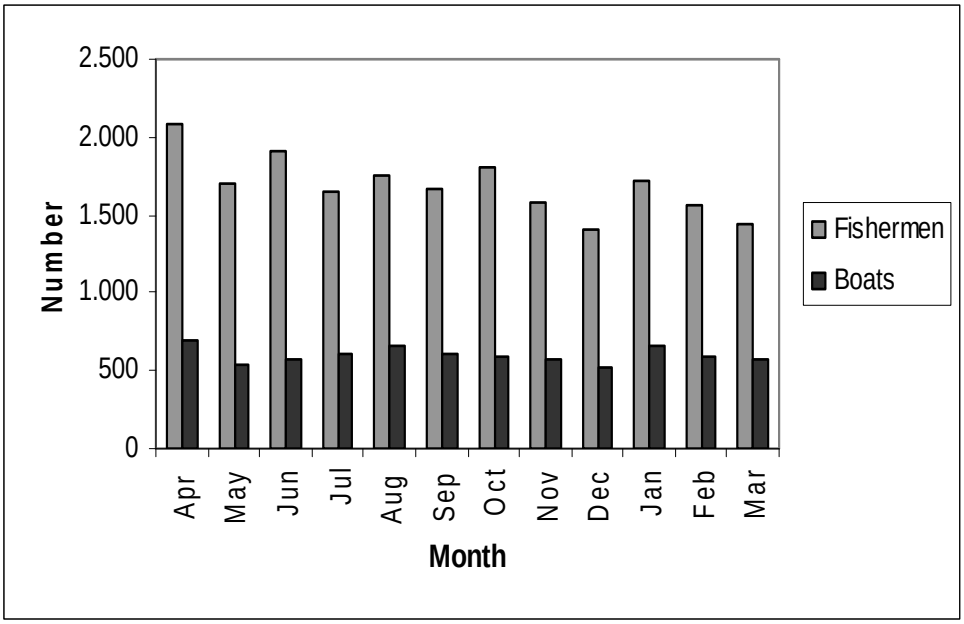

Figure 2 - Fishermen and boats in activity by month in Guanabara Bay, between April 2001 and March 2002. Fishermen numbers also include those operating without boats.

Not all fishermen operated with boats. Swimming crabs and fish fisheries in shallow waters (mainly with scoop nets and castnets), and, especially crab harvesting in the mangroves could be carried without boats. The survey detected 142 fishermen operating directly from shoreline, 81% dedicated to the crab fishery.

The total number of fishermen operating in the bay was inferred from the mean crew number observed for each type of gear and for the number of boats landing in the same period, resulting 3,651 fishermen effectively operating in the bay. Also, for a few places it was not possible to register the number of boats. For those localities around 40 fishermen were identified by interview. Therefore we got at a contingent of 3,700 fishermen potentially operating in the bay.

Nevertheless, this figure did not correspond to the effective monthly number of fishermen in activity in the bay. Fig. 2 shows the numbers of boats and fishermen operating in the bay in a monthly basis. The average number of operating boats was 598, varying from 517 to 690. For the fishermen, the mean number was 1,689, varying from 1,400 to 2,100.

We identified 220 crab collectors during the survey, 105 operating with boats to reach the mangrove areas and 115 without boats. The average number of collectors in activity was 51 for the former and 46 for the latter, averaging 97 fishermen per month. An independent survey (Consórcio Baía Azul, 2001), based on interviews, carried out in the localities near the mangrove areas registered a number of 289 fishermen engaged in crab harvesting.

Other specialized fisheries in the bay comprised the catch of swimming crab and mussel. For the swimming crab fishery, we identified 82 fishermen operating with boats and 26 operating directly from the shoreline. Monthly average number, however, was smaller correponding to 49 fishermen. Mussel harvesting is carried out by fishermen associated to a Cooperative, which was responsible for the meat processing and selling activities. We counted 41 fishermen in activity with monthly average number of 20.

Landings and values

Table 2 shows total landings and prices paid directly to fishermen for the main commercial group of species between April 2001 and March 2002. Atlantic anchoveta (*Cetengraulis edentulus*) was the dominant species in the bay fisheries (12,427 t, 69% ot total landings) mainly directed for reduction to meal and oil. Also Brazilian menhaden is directed for reduction but in rather less amounts (260 t). During the survey period, we registered 50 purse seiners in activity, however, with different degrees of exclusiveness to the fishery.

Table 2 - Landings and values for the main commercial groups of species, in Guanabara Bay, between April 2001 and March 2002 (kg)

Commercial Species	Landing (kg)	%	Value (US$)	%
Shrimps	87,917	0.48	435,867	9.96
Crab	99,058	0.55	138,189	3.16
Swimming crab	160,594	0.89	90,219	2.06
Mussel	532,399	2.94	31,279	0.71
Atl. anchoveta and Braz. menhaden	12,687,486	69.95	1,050,934	24.02
Croaker	1,390,796	7.67	882,354	20.17
Mullets	1,269,404	6.99	672,048	15.36
Brazilian sardinella	675,456	3.72	319,502	7.30
Catfish	316,745	1.75	94,113	2.15
Largehead hairtail	237,354	1.31	79,137	1.81
Blue runner	95,337	0.53	50,886	1.16
King weakfish	90,758	0.50	110,087	2.52
Bluefish	69,336	0.38	60,741	1.39
Common snook	61,523	0.34	161,276	3.69
Other fishes[1]	364,465	2.01	198,723	4.54
Total	**18,138,629**	**100**	**4,375,356**	**100**

1 - The category of "other fishes" includes at least 24 different commercial groups and also the unsorted bycatch derived from trawling

Among the fishes, the more important groups were the whitemouth croaker (*Micropogonias furnieri*); the liza (*Mugil liza*) and the white mullet (*Mugil curema*); and the Brazilian sardinella (*Sardinella brasiliensis*). Also important in terms of quantity were the catfish of the genera *Arius*, *Bagre* and *Genidens*; and the largehead hairtail (*Trichiurus lepturus*).

Shrimps included at least three species (*Farfantepeneus brasiliensis*; *F. paulensis*; and *Litopenaeus schmitti*). The "swimming crab" corresponded to different genera (*Callinectes* and others). The dominant crab was the "caranguejo - uçá" (*Ucides cordatus*). The mussel found in the bay was *Perna perna*, commonly found attached to any type of hard substrate in the intertidal zone.

Fig. 3 shows monthly variation of total landings when compared to those of Atlantic anchoveta and Brazilian menhaden (*Brevoortia* spp.). Due to their overwhelming amount the latter is responsible for the oscillations along the year. When disregarding these two species, variations are lessened, with an average monthly production of 285 t to 482 t.

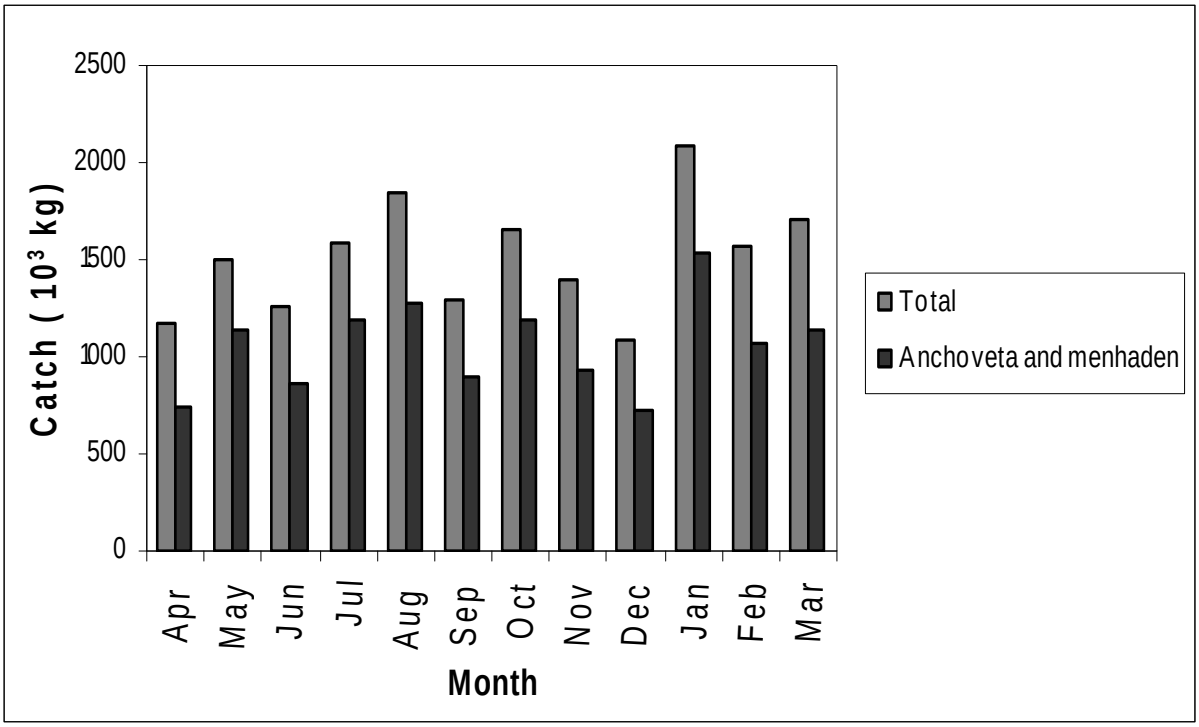

Figure 3 - Monthly variation of total landings when compared to those of Atlantic anchoveta and Brazilian menhaden (*Cetengraulis edentulus* and *Brevoortia* spp.) in Guanabara Bay, between April 2001 and March 2002.

Despite its low unit value, the Atlantic anchoveta landings, due to its large bulk, provided the greatest value in the bay (US$ 1 million), followed by croaker landings (US$ 870 thousand; mullets (US$ 600 thousand); shrimps (US$ 430 thousand); and sardinella (US$ 320 thousand). The average unit price per kg of fish (shellfish included) in the bay was US$ 0.25. This figure, however, was strongly influenced by the unit price for the anchoveta (US$ 0.08/kg). When considering only fish directed to fresh market the average unit price increased to US$ 0.60/kg (6,352 t and a total value of US$ 3.7 million).

Fig. 4 presents the percentage composition of fish groups derived from fisheries with gillnets, handlines and fish traps, not including those directed for reduction to meal and oil. Croaker and mullets corresponded to 54% of total catch.

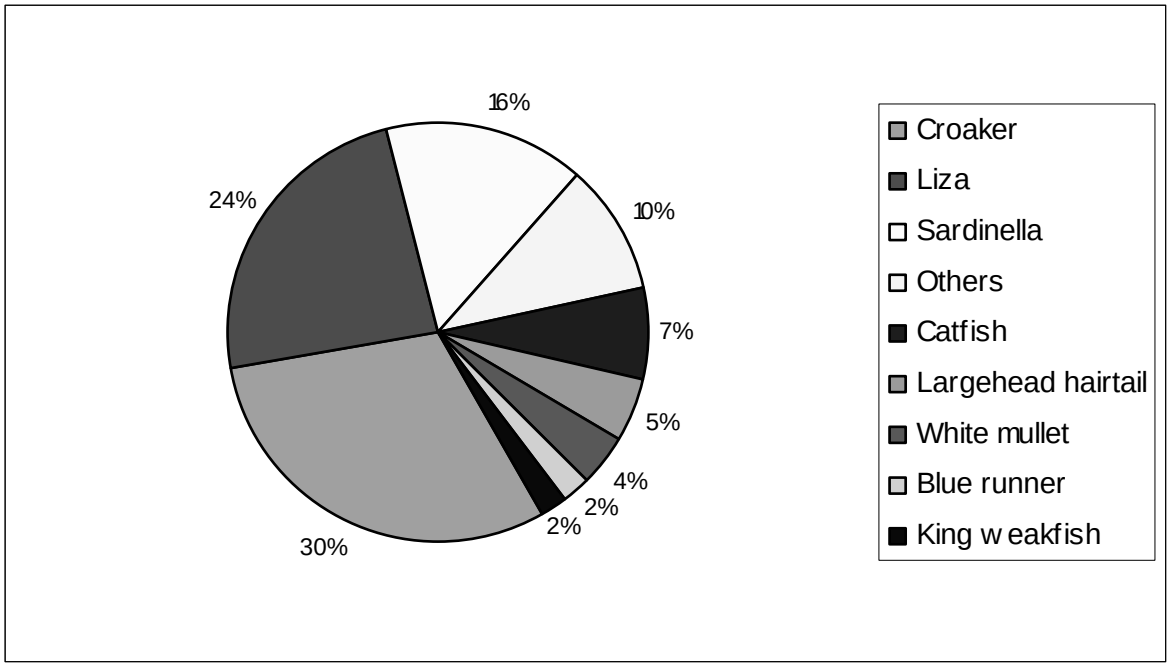

Figure 4 - Percentage distribution of the main commercial species captured in Guanabara Bay, between April 2001 and March 2002, excluding anchoveta, menhaden, mussels, shrimps and crabs.

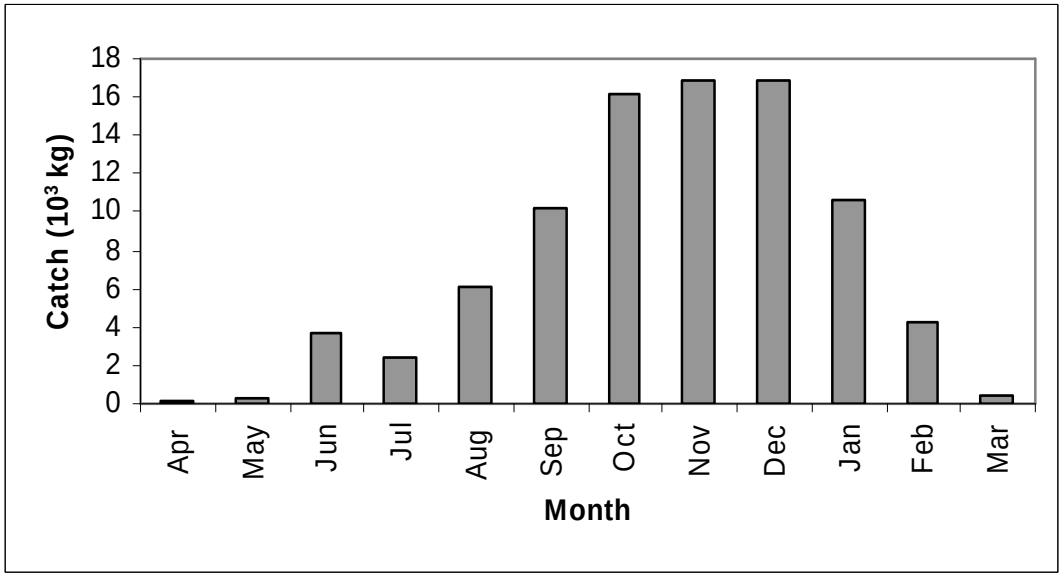

Figure 5 - Landings of shrimps in Guanabara Bay, between April 2001 and March 2002. Annual closed season from March 1st to May 31th.

The shrimp catch is shown in Fig. 5. Production was marked by a strong seasonality, with peaks in October, November and December. The fishery was carried out by trawling and also by drift nets. A small part of the catch was used as bait, and the

shrimps kept alive were sold by unit at better prices.

Crabs and mussels did not show marked seasonalities. The main bulk of the crab catch (95%) was derived from the mangroves of the "Environmental Protection Area" of Guapimirim and adjacent regions and to a lesser degree from the less preserved mangroves of Duque de Caxias, in the northwest section of the bay. Mussels were concentrated in the southernmost areas of the bay and also in the islands immediately outside the bay entrance.

Table 3 shows the landings by municipality and by fish processing industries in the bay, in addition to the corresponding values paid to fishermen. Data were corrected for those localities and months where records were not available, based on landings in places with complete data and similar patterns of fleets, gears and catch composition. Total figures in the last line of the table, therefore, corresponded to more precise estimates of the actual production of the bay.

Table 3 - Total landings from inside the bay and values paid to fishermen in industries and municipalities of Guanabara Bay, between April 2001 and March 2002 (kg)

Municipalities	Landing (kg)	%	Value (US$)	%
Industries (2 in São Gonçalo and 1 in Niterói)	12,551,029	65.92	1,298,238	27.16
Niterói	3,501,249	18.39	1,559,702	32.63
Magé	1,418,372	7.45	857,525	17.94
São Gonçalo	904,048	4.75	620,440	12.98
Rio de Janeiro	536,014	2.82	340,812	7.13
Duque de Caxias	78,352	0.41	45,410	0.95
Itaboraí	50,464	0.27	57,838	1.21
Total	**19,039,528**	**100**	**4,779,964**	**100**

The correction for landings increased the estimated total production from 18,139 t to 19,000 t. The geographic distribution was uneven, being highly concentrated (66%) in the two industries in São Gonçalo, and one in Niterói, reflecting the importance of the anchoveta for total production for the bay. The municipality of Niterói followed in importance also due to the purse seiners catches, with a percentage around 18%. Magé, and Gradim, in São Gonçalo, were the main landing points for the artisanal fleet (gillnet and handline), corresponding to 4% and 3.7% of the total catch, respectively. Olaria and its neighboring areas, in Magé, concentrated the majority of the landings derived from the fish traps.

Total value not corrected for the fish caught in the bay amounted to US$ 4.4 million (Table 2). The total estimated value of US$ 4.8 million was based on corrected catch for each locality not covered by the survey. The added value was calculated as a product of the monthly estimated production in each locality times the average unit value of the catch. For this we used the average price of the dominant fish in local catch composition.

Fig. 6 shows the percentages of landings and values for each main municipality around the bay when excluding the industries. This exclusion allowed a more precise view of the importance of the artisanal activity.

The percentage value for Niterói was slightly less than that obtained for the production in weight. The reduction was due to the lower unit prices paid for fish derived from purse seiners. This reduction was in part neutralized by the shrimp landings, during the shrimp season in Ponta da Areia (Niterói), which corresponded to about 32% of the total shrimp landings for the bay. The difference in value for Itaboraí, when compared to Duque de Caxias, was related to the dominance of crabs in the former place, while in the second landings included mullets, croaker and catfish with lower unit prices.

Two wholesale markets centralized the auctions where the fish from the bay was offered - CEASA (the main wholesale market for fresh fish in Rio de Janeiro) and São Pedro fish market, in Niterói. The decision of the fishermen to follow the catch through the commercialization process, despite assuring better prices, also implied in getting adequate means of transportation, paying commissions and extra costs, which increased with the catch volume and the distance to the markets.

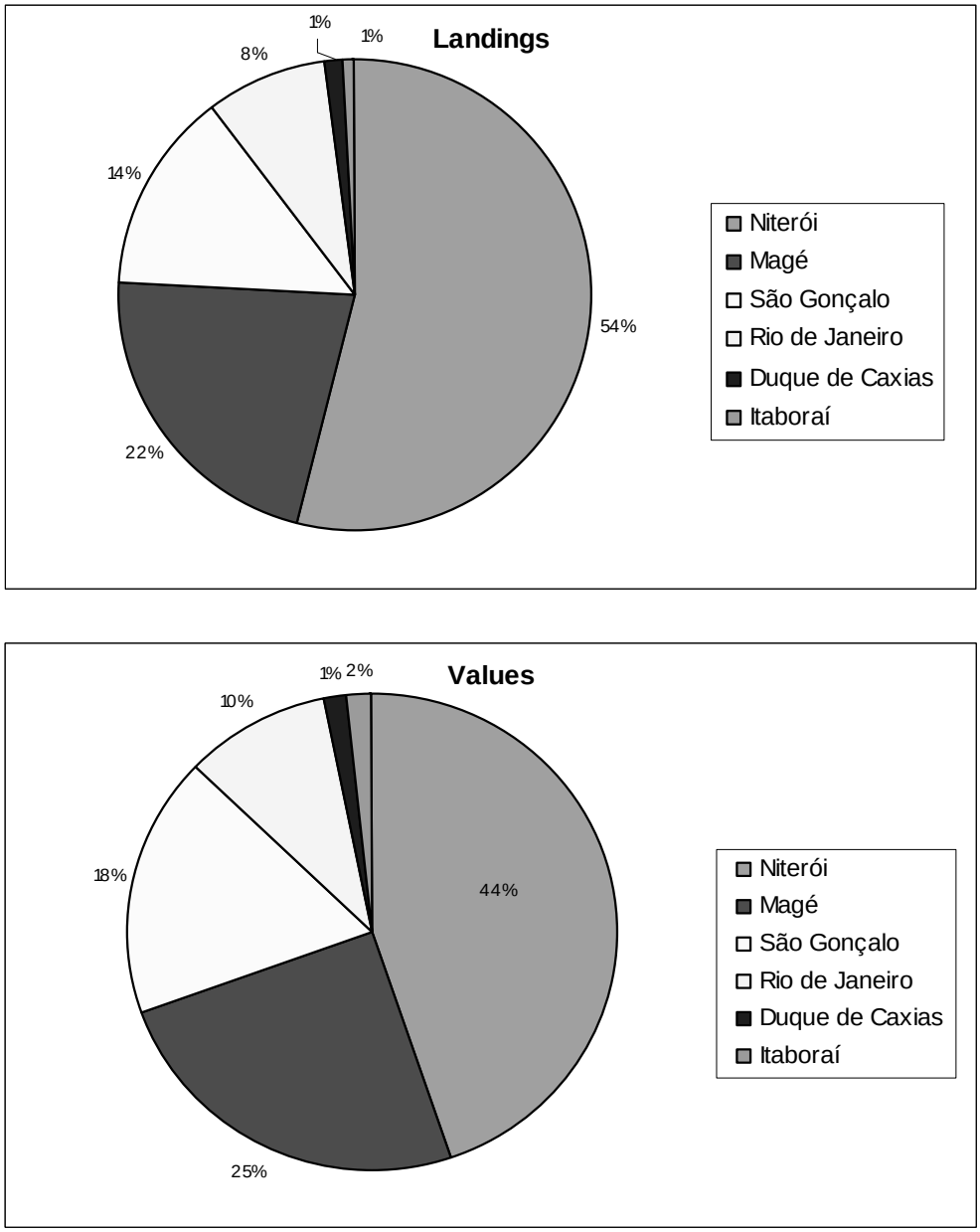

Figure 6 - Landings and values for the municipalities of Guanabara Bay, between April 2001 and March 2002. Landings in the industries were excluded.

That seemed to be the main reason why, practically, the whole catch of important localities such as São Gabriel, Olaria, Ipiranga and Gradim was sold to middlemen at the moment of the landings.

Crabs were sold alive directly by fishermen in street markets or offered on the roads nearby. They were sold in "ropes" with 9 to 12 individuals. Prices varied according the crab sizes. The swimming crab was processed by women who extracted and packed the meat in a very rudimentary way, with an average income of US$ 0.50 per kg of meat processed. They were locally known as "descarnadeiras" (almost 50 are located in Itaoca island). The product was sold directly to restaurants or fish markets.

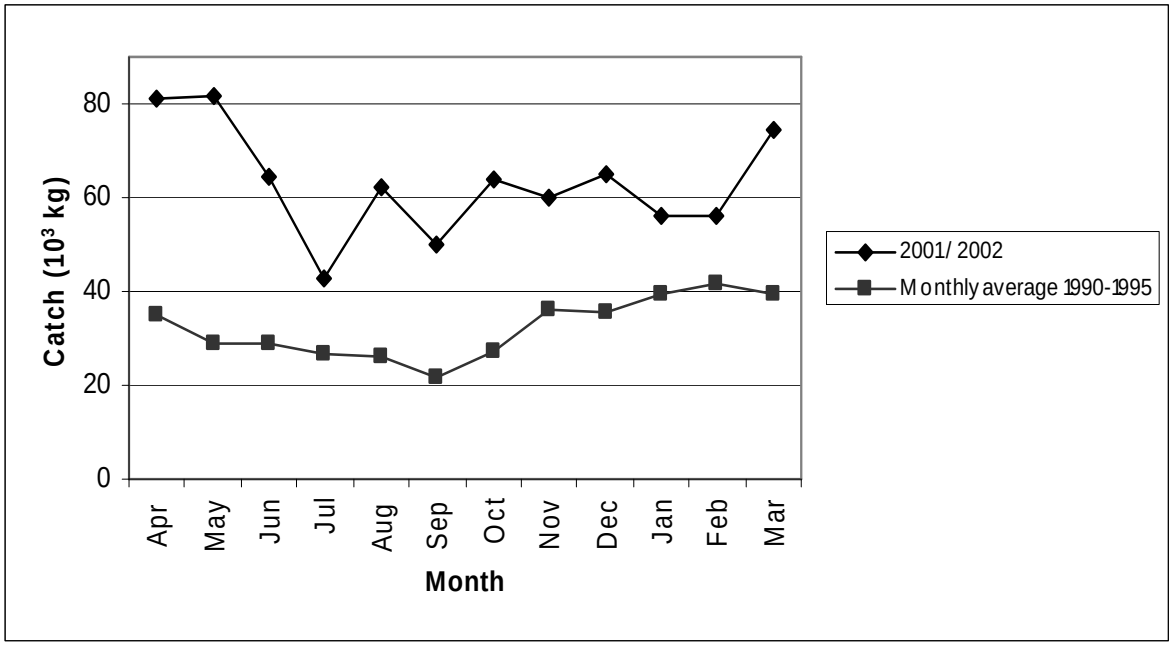

Figure 7 - Landings in the locality of Olaria, between April 2001 and March 2002; and monthly averages for the period 1990-1995 (IBAMA)

Past landing data were not available for the bay, with exception of those carried out at Olaria, between 1990 and 1995, registered by IBAMA (Fig. 7). Annual landing figures varied from 143 t in 1995 to 524 t in 1991; all of them lower than the registered in the present study (757 t). IBAMA data were probably underestimated (L.H.A. Moreira, IBAMA-RJ, pers. comm. 2002).

DISCUSSION

Numbers registered for total fishermen and boats and those effectively in operation in a monthly basis were quite different. The percentage of both fishermen and boats in activity varied from 42 to 49% of total surveyed numbers. The proximity to urban centers and their different opportunities of income probably determines part-time involvement in fishing activities.

Monthly data in Fig. 7 showed similarities with recent figures. Monthly averages were less variable, but the trend seemed to be compatible with the recent series. We considered that at least for the locality of Olaria, marked changes in the monthly pattern of catches have not been observed so far. The usual life time of a fish trap varied from 11 to 12 months (Esteves, 1995), which determined variations in the number of traps in activity in a given period.

The high number of landing points was a remarkable characteristic of the bay fisheries. In general, a landing point should favor the approximation and unloading of the boats, the fish discharge, as well as facilitated the fish selling process, providing at least a scale and other necessary items such as ice and fuel. In the specific case of Guanabara bay, where fishing was still carried out by a great number of boats with paddles, without refrigeration systems or using only isothermic boxes for the maintenance of the fish, the issue of inputs tended to be less important. On the contrary, the proximity of the landing point to the fishermen's place of living and boat keeping was important, given the reduced catch per boat and the consequent easy destination of the fish caught.

In spite of this, we observed some points of landing concentration in the bay. For example, purse seiners unloaded at Conceição island, Jurujuba, Praia Grande, and Ponta da Areia. Landings derived from more artisanal fishing gear (gillnets, fish traps, handlines) had also remarkable destination points. Olaria, in Magé, and Gradim, in São Gonçalo, concentrated around 42% of

landings, when excluding the localities commonly used for discharge by purse seiners.

The different fleets seemed to keep a high degree of "adherence" in relation to their landing points, probably as a result of the relationships with the middlemen. Despite the diversity of fish species occurrying in the bay, only few reached expressive densities compatible with commercial fisheries. Among the small pelagic group, Atlantic anchoveta and Brazilian sardine are the dominant species, and among demersal fish, croakers, mullets and catfishes comprise the main part of the catches, determining a low average unit value for the whole fish yield.

At least six different "fishing systems" coexist in the bay - the purse seining for small pelagics mainly directed for reduction; the artisanal fisheries carried out by fish traps, gillnets and lines aiming at croakers, catfish, mullets and other fish; the shrimp fishery by means of trawling and also drift nets, with a clear production peak between September and January; the crab harvesting in mangroves; the swimming crab fishery, directed to artisanal meat extraction and packing by fishermen women; and, finally, the mussel harvesting, along the rocky shores.

Shrimp is an exception, among the rather cheap fish caught in the bay, reaching relatively high prices (average of US$ 5/kg). Historical data for the shrimp production in the bay (E. Lima, FEEMA-RJ, pers. comm. 2001) indicate extremely variable landings - 209 t, in 1964; 24 t, in 1972, with an average catch of 87 t. Total catch observed during this study (88 t) seems, therefore, compatible with historical data.

Mussel harvest is organized by a fishermen Association and apparently follows a "natural management plan", shifting among areas in such a way as to avoid their depletion.

Crab harvesting consists in a very specific activity carried out in mangroves of the bay and characterized by direct selling by the fishermen themselves. The crab total estimated for the bay was around 99 t per year, corresponding to 550,000 individuals. This corresponds to an yield of 12 kg per year and mangrove hectare, in a total area of around 8,300 ha of mangroves. This figure seems acceptable if compared with that of the Parnaiba river delta in north of Brazil, where much more preserved mangroves provide yields around 20 to 30 kg/ha/year (Ivo et al., 2000; Jablonski et al., 2002).

The legislation enforced to the crab collecting in Brazil prohibits the use of any type of gear or trap. The idea for that is to stimulate the use of the simple and ancient techniques of crab collection by hand. Nevertheless this enforcement does not match the real practices in course in the bay where the fishermen since a long time left the traditional way of harvesting in favor of the more efficient "laço" or "redinha" (literally "little net").

Fisheries legislation also defines a kind of implicit zoning for Guanabara bay, in such a way that shallow waters are "reserved" for artisanal fisheries. Bottom trawling is prohibited in areas less than 5 meters deep and also inside the Guapamirim APA. Fish traps are regulated by IBAMA and should be completely removed by their owners when not in operation. The lack of control, however, leads to a more complex situation where abandoned semi-destructed traps are common even in the APA area and eventually double-rig and pair-trawlers operate in shallow waters.

Considering a linear distribution of revenues in the bay, the monthly average income per fishermen would be about US$ 230 (for the sake of comparison the legal minimum salary in Brazil is around US$ 100/month). This is not a real picture for the bay as certainly the different fisheries (shrimps, crabs, mussels and fish) will determine differente revenues. Moreover, in order to to get the net income, one should consider the costs for oil, ice, bait and gears, which will vary for each fishery. Also, the income distribution among the fishermen will depend on the ownership of the boat and gears.

Uncontroled domestic sewage, industrial pollution and solid waste discharges are the main cause of environmental degradation in Guanabara bay. Destruction and pollution of mangroves areas are also important factors limiting productivity of crab stocks. These factors probably contributed to limit the number and density of commercial species in the bay and could also be considered a source of "conflicts" affecting the fishery and income of local communities.

CONCLUSIONS

According to IBAMA data, total landings in Rio de Janeiro State varied around an yearly average of 60 to 70 thousand metric tons. This total included all artisanal and industrial catch landed in

the several harbours of the State. As far as Guanabara bay was concerned, the total included basicaly the Atlantic anchoveta and Brazilian menhaden. The bay contribution around 25% of the total State catch seemed to be unrealistic and indicated that the landings for at least part of the other localities of the State were underestimated.

Despite the intense pollution, habitat degradation and the reduced number of species available in commercial quantities, Guanabara bay supported a rather important fishery. Conflicts resulting from illegal trawling activities in shallow waters were also common. However, since the oil spill in January 2000, complaints of fishermen associations, concerning decreased fish abundance and fishery income, were mainly directed to presumed oil pollution late effects.

In such a way suitable catch and effort data are crucial to evaluate losses and to establish financial compensations in case of environmental accidents. The claim of fishermen representative organizations, in the specifc case of oil spill (US$ 250 million), corresponded to more or less 50 years of fish production in the bay.

The maintenance of an efficient system to gather fish statistics is essential to any initiative of improving the fish sector and quantifying eventual losses in case of environmental accidents. A data collection network can be established in a participative way with the main fishermen local associations at that places where landings are normally concentrated. The relatively stabilized fisheries in the bay suggest that reasonable inferences can be made, without having, necessarily a thorough coverage of all the landing points.

An improvement of the fishermen income can be achieved with greater success with investments directed to docking, unloading and fish processing and selling conditions, at the already existing landing points, than trying to centralize the discharges in bigger facilities. It is important to find solutions to contain the sediment deposition, that turns to impair some sites as landing points or places to boats docking. Also important is to contain the effluents, residues and solid waste that have been cronically degrading habitats and the water quality in the bay.

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RESUMO

A despeito da magnitude da poluição de origem doméstica e industrial, a produção de pescado registrado em diferentes pontos de desembarque na Baía de Guanabara, entre abril de 2001 e março de 2002, foi ligeiramente superior a 19.000 t, correspondendo em valor a US$ 4.8 milhões. Quando se considera apenas o pescado direcionado para o mercado fresco, a captura total alcançou cerca de 6.300 t e um valor de US$ 3,7 milhões. Somente algumas poucas espécies alcançam densidades expressivas compatíveis com as pescarias comerciais. Entre os pequenos pelágicos, a sardinha boca-torta e a sardinha verdadeira são as espécies dominantes, enquanto para as demersais, a corvina, a tainha e os bagres perfazem a maior parte das capturas. As pescarias para o caranguejo, nos manguezais, e a coleta de mexilhões nos costões rochosos da entrada da baía e ilhas adjacentes são, também, importantes. A ausência de estatísticas pesqueiras prévias ao vazamento de 1,3 milhão de litros de óleo, em janeiro de 2000, levou à reivindicação de indenizações, por parte das organizações representativas dos pescadores, de valores correspondentes a cerca de 50 anos de produção de pescado na baía. Um sistema de coleta de dados pode ser estabelecido de forma participativa com

as associações de pescadores locais. As pescarias relativamente estáveis na baía sugerem que inferências razoáveis podem ser obtidas sem que, necessariamente, se tenha uma cobertura completa de todos os pontos de desembarque.

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