

Fishing spots and sea
tenure in Atlantic Forest
fishing communities
(Brazil)

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ABSTRACT

Recent work has dealt with the local management of aquatic resources as an alternative to Hardins' "tragedy of the commons". In communities with no formal management of the resources, informal ownership of fishing spots or conflict situations may be a basis for future local management. In this study, I analyze the use of aquatic resources by five fishing communities in the Atlantic Forest coast, southeast Brazil: Búzios Island, Puruba and Picinguaba, in São Paulo State, and Jaguanum and Itacuruçá Islands at Sepetiba Bay in Rio de Janeiro State. Field work was carried out at Búzios Island in 1986-7, at Sepetiba Bay in 1989-90 and at Puruba and Picinguaba since 1991. Procedures included interviews, sampling of fishing trips and other direct observations. Informal ownership of fishing spots, used for set gillnet fishing, is regulated by kin ties at Búzios Island. The artisanal fishers of Sepetiba Bay, especially from Jaguanum Island, have a situation of conflict with Bay "intruders", such as the shrimp and herring fishing trawlers. Finally, two coastal communities, Puruba and Picinguabá, have conflicts with fishing regulations from a State park (*Parque Estadual da Serra do Mar*), created in 1977.

INTRODUCTION

This is a study on five fishing communities located at the northern coast of São Paulo and southern Rio de Janeiro States, Brazil, including analysis of territorial fishing spots at Búzios Island, sea tenure and conflict at Sepetiba Bay and confront of state regulations and local communities at the coast of Ubatuba. All those communities, locally called *caíçaras*, have in common historical, cultural and economic patterns and their location next to the Atlantic Forest.

Territoriality generally serves the purpose of guaranteeing access to resources contested by other individuals but the specific form of territoriality may vary, depending on the nature of boundaries, defense of boundaries, forms of exclusion of outsiders, and types of resources which are defended (Morse, 1980). Ecological studies of human territoriality have focused on hunter-gatherers (Dyson-Hudson and Smith, 1978) and on maritime fishing communities, following Acheson's lead (1972, 1975), with studies on territoriality of fishing spots or sea tenure. Effects of territoriality often includes the reduction of competition for limited resources (McCay, 1978) and an increase in individual control over resources (Cass and Edney, 1978). For reviews of such studies, see Acheson (1981) and McCay and Acheson (1987).

Worldwide, resources are held under four kinds of regimes: open access (no property rights), private property, state property and communal property (local management) (Feeny et al., 1990). Since Hardin's (1968) proposition of the "tragedy of the commons", research in human ecology and anthropology has shown that for some fisheries the sea is considered as "common property" but for others, individuals or communities establish ownership of resources (Acheson, 1981), which is a rejection of the determinism of the "tragedy of the commons" (Berkes and Kislalioglu, 1991). Collective actions and local institutions are contrasts to Hardin's predictions (Berkes and Feeny, 1990; McGoodwin, 1990:92), although Hardin (1968) also predicted that the commons are justifiable under conditions of low population density. Examples of local management of resources have been documented for many areas, such as Canada, United States, India, Indonesia, South Pacific and Japan (Berkes and Feeny, 1990; Bailey and Zerner, 1992).

METHODS

Field research in the communities included interviews based on questionnaires, informal talks with fishermen and participation-observation on fishing trips. Fieldwork was conducted at Búzios Island for 14 months in 1986-7, at Sepetiba Bay for 6 months in 1989-1990 and at the coast of Ubatuba since 1991. Interviews included adults from Búzios Island (75), Gamboa at Itacuruçá Island (45) and Puruba at Ubatuba District (69). About 70% of adults were interviewed at Jaguanum Island (125) and Picinguaba (159). A total of 170 interviews were performed at

Sepetiba Bay and 228 at the coast of Ubatuba.

Fishing trips were sampled each month at major landing points for a period of 3-5 days each month. Data about the location of fishing spots, departure and arrival time, species composition and weight of the catch were recorded. At the communities of Puruba and Picinguaba two fishermen were trained to collect data on fishing trips, which have been gathered in 10 days per month. At Búzios Island, 906 fishing trips were sampled, at Sepetiba Bay 272 trips and at Ubatuba coast 302 trips (7 months).

Diversity indices were calculated for fishing spot uses at Búzios Island, based on the number of fishermen that visited a spot. The Simpson index, a measure of diversity widely known in ecological studies, was used (Magurran, 1988:39).

STUDY SITES AND COMMUNITIES

The communities studied are located in the States of São Paulo and Rio de Janeiro, southeast Brazil, and are close to remnants of the Atlantic Forest (Figure 1). Part of this coast includes Federal or State Parks, besides Biosphere Reserves according to the "Man and the Biosphere Programme" from UNESCO (Lino, 1992:15). Atlantic Forest remnants are top priority conservation areas ("hot spots") (Conservation International, 1992).

A typical coastal population, called *caiçaras* and descending especially from Indians and Portuguese live on relatively isolated areas of the southern Brazilian coast. The majority of people living in those communities are native, as confirmed in interviews: 75% of people living at Búzios were born there, 93% of Gamboa's residents are natives, as well as 80% from Jaguanum Island (or born in other sites of Sepetiba Bay). In the area of Ubatuba, 84% interviewees were born at their own communities or nearby.

Fishing and agriculture (especially manioc growing) are the main activities of the *caiçaras*. Plants are collected for food, medicine, handicraft, house and canoe construction (Begossi, 1989; Rossato *et al.*, 1993). Fishing technology in the northern coast of São Paulo State was influenced by Japanese, such as in the use of *cerco*, a circular fixed trap made with nets (Begossi, *in press*). Classical studies on the history, culture and economic relations of southern Brazilian coastal fishermen are in Schmidt (1947), Bernardes and Bernardes (1950), Willems (1952), França (1954) and Mussolini (1978).

Fish is a very important source of protein in those communities, representing 68% of meat consumed at Búzios Island (Porto do Meio), and 65% at Itacuruçá (Gamboa) and Jaguanum Islands (Calhaus) (Begossi and Richerson, 1992; 1993). At Puruba and Picinguaba (Ubatuba) fish is also the basic protein of meals.

Búzios Island is located at 23°47'S and 45°10'W, 24 Km off the coast of the State of São Paulo (Figure 1) and it has a community of 44 families. Despite the proximity of Búzios Island to the cities of São Paulo and Santos, it is a relatively isolated community. There is no regular transportation to the coast and no tourism (there are no beaches), with the minor exception of divers that visit the island.

The population of Búzios (220 individuals in 1986) is distributed among 8 small settlements in which Porto do Meio is the largest settlement, with 23 houses. Women from Búzios have an average 4 children and spend their time in house care and some agricultural activity (especially old women). Literacy level at Búzios is low (32% of adults). Fishing is the main source of cash and trips occur around the island, using especially paddled canoes but also motorized canoes and boats. Hook and line, including specific hooks for bluefish (*Pomatomus saltatrix*) and for squid (*Loligo sanpaulensis*), and set gillnets are used for fishing (Begossi and Richerson, 1991; Begossi, *in press*). Net fishing is the subject of this study at Búzios, because informal ownership of fishing spots, associated with kin ties, occurs just for set gillnets.

Itacuruçá and Jaguanum Islands are located at Sepetiba Bay at 22°57'-23°00'S and 43°54'-43°56'W, respectively (Figure 1). Itacuruçá Island is less than 1 Km and Jaguanum is 6.7 Km distant from the coast. Sepetiba Bay is a touristic site in the "Green coast" (*Costa Verde*), and is located about 60 Km south of the city of Rio de Janeiro. Hotels and restaurants are found in the coastal cities of Itacuruçá, Muriqui and Mangaratiba and in some islands of Sepetiba Bay. Fishing communities are found especially in the islands of Itacuruçá, Jaguanum, Martins and Marambaia (Begossi, 1991a). Data from the *Colônia de pescadores Z-16* (fishermen's association) indicated 886 registered fishermen, 396 living at Jaguanum or Itacuruçá islands.

The community of Gamboa, located next to a mangrove forest, is the last fishing community of Itacuruçá Island, where beaches include essentially tourist houses. Gamboa includes 26 families that obtain cash from fishing, tourism and agriculture (bananas, manioc). Literacy at Gamboa is above the level at Búzios, with about 74% literate adults. Women have an average 5 children and spend their time with house and child care. Fishermen from Gamboa use paddled and motorized canoes to fish with small encircling nets for sand drum (*Micropogonias furnieri*), kingfish (*Menticirrhus americanus*), mullets (*Mugil spp.*), weakfish (some Sciaenidae) and shrimp (*Penaeus schmitti*) (Begossi, 1992a).

Jaguanum Island includes about 76 families distributed in 9 small settlements. The largest settlement, with 24 families, is located at Calhaus Beach. Literacy level (81%) is slightly above the level at Gamboa and women have an average 4 children. Most women, like at Gamboa, spend their time in house care, but some

works as housekeepers and in restaurants or hotels. Fishermen from Jaguanum use encircling nets in canoes but especially set gillnets in boats. One type of fishing technique often used is called *caceia* (drift netting, McGoodwin, 1990:66).

Fishermen from Itacuruçá and Jaguanum islands complain about industrial fishing at Sepetiba Bay, represented by trawlers of shrimp (*arrastão*) and herring (*traineira*). Conflicts between small-scale and large-scale fishermen raise questions about territories for fishing, sea tenure and local regulations.

The communities of Puruba and Picinguaba (*Vila de Picinguaba*) are located in the district of Ubatuba, next to the Rio-Santos highway (*BR-101*), at Kms 24 and 7, respectively, and between 23°15'-23°30'S and 44°45'-45°00'W. Puruba includes about 14 families living next to the beach and 22 living on the other side of the highway. Picinguaba, located in a small bay, includes more than 70 families. Other 11 families are found in the other side of the highway, next to a communitary manioc mill (*Casa de Farinha* or *Sertão da Fazenda*) (Figures 1 and 2). In the last ten years tourism increased at Picinguaba and in 1991 there were about 104 tourist houses compared to 76 native houses (Vianna and Brito, 1992). Literacy level (67%) is above the level at Búzios Island but below the level at Sepetiba Bay and women, as in other communities, have in average 4-5 children and devote their time to some agricultural activity, tourism and house/children care. Most men (45%) are fishermen but there are some agriculturalists, too. Data by Vianna and Brito (1992) showed 40% of fishermen in 1991.

Fishing activities at Puruba are different from Picinguaba. Puruba is a very small community, located between the rivers Puruba and Guiririm (Figure 2). Fishing in this community occurs upstream and at sea, in the mouth of the rivers. Canoes, encircling nets, beach seine and hook and line are used. Picinguaba is a larger community and fishing is performed in boats, using often set gillnets or in canoes, when visiting the *cercos* (anchored trap), located close to the community. Like at Sepetiba Bay, the method of drift netting (*caceia*) is also employed at Picinguaba.

At Puruba and Picinguaba, besides small riverine fish, mostly catfishes, common marine fish are sand drum, mullets, cutlass fish (*Trichiurus lepturus*), and snook (*Centropomus undecimalis*). Picinguaba and part of Puruba are located in a State Park, the *Parque Estadual da Serra do Mar* which imposes local fishing regulations, inspected by Forest Police and supervised by State governmental institutions such as the Forest Institute (*Instituto Florestal*), which is part of the Environmental Secretary (*Secretaria do Meio Ambiente*) of São Paulo State.

TERRITORIES, CONFLICT AND STATE REGULATIONS

Búzios Island: informal ownership of spots and kinship

Fishermen at Búzios rely primarily on hook and line techniques although they also place gillnets at sea, usually from late afternoon to the next morning. Among 906 trips, gillnets were used in 120, lines in 785 and *cerco* in one trip. Cast net (*picaré*) was used in 43 trips, usually to get bait before a trip (Begossi, *in press*).

Territories at Búzios were observed for gillnets. Some fishermen often use the same spot to lay out a net and other fishermen should ask for permission to use those spots. Some kind of genealogical link connects all the fishermen whom we studied. Fishermen are grouped into families, *i.e.*, two men are in the same family if they are brothers or father/sons. This criterion follows the importance of biological kinship and of local customs, which distinguishes kin ties based on blood from those based on neighborhood and close kin from distant kin. There are four extended families included in the analysis: family I is composed of three brothers, family II includes only one fisherman, family III includes a father and two sons and family IV a distant relative (Figure 3). Close relatives or members of the same family share spots used for net fishing.

Features of Búzios' fishermen

Young fishermen tend to use more spots for net fishing than older fishermen (Spearman, $r = -0.73$, $df = 7$, $p < 0.05$) (Table 1). As fishing involves risk, it is possible that younger fishermen accept higher risk levels by trying new spots for net fishing than older fishermen. Or, it may be that older fishermen have more rights to the spots and therefore concentrate on preferred spots. Probably, older fishermen had more chance to mark their rights over a spot. This behavior resembles the one described by Acheson (1972; 1975; 1987:41) in which older and well established lobster fishermen may even infringe territorial rights.

Family II is represented by a cousin and brother-in-law of family I and a nephew and cousin of family III (Figure 3). This fisherman often shares the spots most used by family I and III, especially Araçaeira, the main spot used by family I (Figure 4). The most distant relative is a fisherman that uses the most distant and risky spot (high variance) (Table 2). Family IV has a low diversity index because a same spot is frequently used, although other fishermen enter the spot (Figure 4). Thus, kinship play an important role in the division of spots for net fishing at Búzios. Close relatives (brothers, father and sons) usually share spots for net fishing but as kin ties get weaker rights over the spots decrease. The flexibility of family II and the vulnerability of family IV is understood based on kin ties. Informal territories in lobster fisheries at Maine were owned by harbor's gangs (Acheson, 1987: 40) but at Búzios, a smaller and

isolated community, families or kin roles play a major role in economy and consequently in fishing strategies.

Ownership in net fishing was observed through data on fishing trips, because they have no formal status. In interviews, fishermen were asked if they hide good fishing spots and 21 fishermen (out of 28) told they would not hide a good spot but 3 said they would show it only to relatives. Thus, to hide a spot is not well accepted among fishermen from Búzios. Cordell (1985) observed that fishing spots in Bahia State, Brazil, were also not formally owned and fishermen do not have to be physically present to defend their territories. The concept of *respeito* (respect) is an informal rule which maintains the territories, which agree with the behavior found at Búzios. Búzios resembles other Brazilian fishing communities in terms of the importance of territoriality. Forman (1969) was the first in pointing out the mechanisms of secrecy of spots among Brazilian fishermen from the village of Coqueiral, at Alagoas State. Cordell (1974, 1985) studied sea tenure on coastal villages from Bahia State and observed sea tenure varying from claims on migratory species to long-term private claims covering spawning grounds, reefs and net fishing spots defined by the lunar tide cycle. Territories associated with fishing regulations were also reported in many other areas of the world, such as United States, Mexico, Iceland, Indonesia and Ghana (Berkes and Kislalioglu, 1991).

SePETIBA Bay: sea tenure and conflict

Sea tenure refers to the ways fishermen perceive, delimit, defend and own rights on fishing grounds (McGoodwin, 1990:108). Artisanal and industrial fishermen live in a relative state of conflict at Sepetiba Bay, because purse seines and ground trawling are used in the bay. As fishermen perceive the bay as a spawning and growing resort for species, they consider the industrial fishery causing a serious impact on resources and on the artisanal fishery (*Carta de Jaguanum* - Letter from Jaguanum, January 9, 1990 and Table 3).

The letter of Jaguanum was a political act of artisanal local fishers who are relatively well organized and often organize meetings, including a few legislators, to complain on the impact caused by industrial fishing in the bay. Those meetings are usually commented by the press (*Jornal do Brasil*, February 5, 1990 and *Tribuna de Angra*, January 12-18, 1990). Industrial fishing boats include trawlers of shrimp and herring. Fishermen would like a law to forbid industrial fishing in the bay enforced by governmental authorities. However, they feel very impotent, because the industrial fishery include influential boat owners living at Rio de Janeiro or other cities.

Direct conflict already occurred among artisanal and industrial fishermen of Sepetiba Bay. Fishermen like to tell those conflicts with details in very informal talks. A 68 years old fisherman from Catita Beach (Jaguanum Island) described, a

direct conflict among Sepetiba Bay fishermen and trawlers which occurred 12 years ago. Conflicts among small-scale and large-scale fisheries have been reported in other Brazilian areas and in other areas of the world, such as Thailand, Malaysia, Indonesia, Philippines, India, Yemen, Turkey, Mexico, Suriname, Sierra Leone and Ivory coast (Berkes and Kislalioglu, 1991). Interests of small-scale and large-scale fisheries are different, because the high mobility and technology of the second and different economic relations, as many industrial fisheries have a wage system instead of a share system (Diegues, 1983:71).

The impact industrial fishery has on artisanal fishing at Sepetiba Bay is felt also in fishing technology. An interview carried out with 57 fishermen from Jaguanum Island (Fernandez and Begossi, 1991), showed that fixed fishing technologies, such as set gillnets and drifting longlines were abandoned by local fishermen because of damage by trawler boats. Bailey (1987, in McGoodwin 1990:18) stressed that trawlers frequently destroy passive small-scale gear due to their active mode of operation. The impact of trawlers on fish resources were stressed in interviews, especially the impact upon young fish. The "invasion" of the bay by trawlers, according to fishermen, is more recent from herring boats than from shrimp (Table 3). Bernardes and Bernardes (1950) mentioned the first trawlers at the southern Brazilian coast around 1930.

Advantages of local management are mentioned in the literature because of its effectiveness, as local fishers have usually a deep knowledge on resources, and of equity, because local fishers are motivated to protect resources from overexploitation (Bailey and Zerner, 1992). Sepetiba Bay fishers are mobilized to defend resources that they depend upon, which is different from trawlers, which can fish in other sites if resources were exhausted. Naturally, the support from the local authorities is a fundamental condition for any local management to succeed. As stressed by Bailey and Zerner (1992), in the absence of governmental support, coastal communities lack the ability to manage fishing grounds and to defend their interests against powerful intruders. There are promising examples combining government resource management and community-based management, such as given by the *James Bay and Northern Quebec Agreement*, 1975, of the Cree Indians and the Inuit, in Canada (Berkes and Feeny, 1990).

Puruba and Picinguaba: State regulations and local communities

Puruba and Picinguaba are part of the State Park of Serra do Mar, which imposes local fishing regulations. Local communities complain they are not allowed to fish in the rivers, even with hook and lines (Figure 2).

Fishing laws and practical regulations in Brazil are essentially confused¹ and there is a conflict among State and Federal Institutions about who should inspect a specific fishing

activity or site. For example, there are at least 3 different institutions that may deal with fishing activities: supervisors of National or State Parks, the *Capitania dos Portos* (under the Ministry of the Navy) and the National Environmental Institute, the *IBAMA (Intituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)*.

Fishermen from the community of Puruba are usually part-time fishermen that fish in small canoes in the rivers Puruba and Quiririm (Figure 2), with hook and line and encircling nets, and at Puruba Beach with beach seines. Fishing with beach seines is a male communal activity performed at night, to catch snook, and the catch is shared among families. About ten years ago, a tubular trap with baskets attached, for mullets, was used in the Quiririm river, but its use was forbidden by local authorities. As shown in informal talks, it is not clear for communities what are the fishing regulations because Brazilian legislation allows local communities to fish, at least with hook and line for subsistence.

At Picinguaba, there are at least four different types of fishing. The first three are concerned with maritime fishing, and include fishermen that fish at the *cerco* using canoes, fishermen that work for the industrial fishery of Santos or Rio de Janeiro and fishermen that own small boats and use gillnets. Fishing grounds for gillnets are often located in close islands, such as Couves, Comprida, Rapada and Vitória (Figures 1 and 2). It is not clear if there are territories for fishing, considering the other fishermen from close communities, such as *Camburi*, *Praia da Almada*, *Ubatumirim*, and Ubatuba city.

The fourth kind of fishing, at the rivers next to Picinguaba (*Rio da Fazenda* and *Rio Picinguaba*) (Figure 2) should be performed with hook and line for subsistence but this is not allowed by local authorities. As the *Vila de Picinguaba* is located next to the Forest Institute lodgings, the Forest Police has an easy access to Picinguaba and also enforces fishing restrictions. Obviously, it is a kind of attitude that eliminates partially an important source of food for the local population. Vianna and Brito (1992) stress that state conservation policies are *in between* legislation and traditional communities. Besides, there are no differentiations for fishing by tourists, recreational fishers and local population. Actually, there is a lack of management in the area where restrictions are imposed for local population without any resource management. Local management should include scientifically sound proposals (Begossi, 1991b) and the participation of the local community.

In general, fishery management is assumed to be a government responsibility, but the effective capacity of the government to deal with environmental questions is limited (Bailey and Zerner, 1992). Often, there are conflicts between state and fishermen's regulations and territories, such as at Lake Titicaca, Peru (Levieil and Orlove, 1990; Orlove, 1991) and in tropical

countries, administrative and technical capacities from governmental agencies are relatively weak (Bailey, Pollnac and Malvestuto, 1990). In Brazil, besides conflicts among environmental governmental agencies (States/Federal), there is a sharp technical weakness in those agencies. Co-management of government and local populations are viable (Feeny et al., 1990), and local communities, such as these described in this study, show some organization or even a motivation to manage their fisheries, which is of extreme value for resource management.

CONCLUSIONS

The five communities studied, besides some minor differences in literacy, fishing strategies and agricultural activities have a common core: they are small-scale fishers, living in low population densities with a kin basis, next to the Atlantic Forest, and depending on fish as their main protein source. The efficacy of coastal management depends on factors such as low density and simple technology (Bailey and Zerner, 1992) because traditional communities may be driven by market incentives and economic imperatives. Even in more isolated communities, such as Búzios Island, fishermen catches are market-oriented and fishermen aims include also to be buyers². Small communities and rudimentary technologies may explain resource exploitation without having to be conservative (McGoodwin, 1990:60,112) and signs of respect to animals or food taboos are not necessarily signs of conservation (Acheson and McCay, 1987:14; Begossi, 1992a; Begossi and Braga, 1992).

The secrecy of spots observed at Búzios in net fishing may be explained by kinship ties. Fishermen share spots readily within extended families. Family II, with some ties to both I and III, has intermediate access to fishing spots of others, and some success in protecting his own spot. Family IV, with only distant ties to other fishermen, is able neither to visit the spots of others nor to exclude outsiders from his own spot.

Territorial use rights, may be seen as a key attribute for managing resources and for others, traditional knowledge may be a key factor (Berkes and Kislalioglu, 1991). According to such authors, a third framework, the "common property framework" is more comprehensive, because there may be successful communal property systems in the absence of territories and traditional knowledge. Known cases of local management refer usually to access to fishing space (McCay, 1981) and the importance of territoriality is that it can be the basis for restrictive common property institutions (McCay and Acheson:11).

There are intrinsic factors in fishery resources that make them difficult to manage: the renewability of fish stocks (an excessive effort may collapse the fishery), uncertainty of scientific data (fish is usually a non-visible and fugitive resource) and the lack of property rights or restriction to access

the fish stocks (Bailey and Jentoft, 1990). Therefore, traditional knowledge and use rights may be important to manage fisheries. Territories may be communal or not, but imply in restrictions to access the fishery.

In the case of Búzios Island, informal ownership of spots may regulate access within the community. At Sepetiba Bay, the area defended by the small-scale fishers is the Bay, which should be a territory communally managed, with the support of the local government. At the communities of Ubatuba, governmental institutions should help local fishers in regulating the entrance of recreational fishers, instead of prohibiting subsistence fishing in the area. According to Berkes and Feeny (1990), the value of local populations in management has been widely recognized and development planners should help local communities to set goals and implement them.

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Table 1. Fishermen attributes and utilization of spots for net fishing. Brothers: A, B and C; father-sons: E, F and G. The Simpson index is based on the number of spots fishermen used for net fishing.

Fishermen	Number of nets*	Number of trips	Simpson index	Age
A	2	9	4.24	28
B	5	29	1.94	31
C	4	6	3.77	20
D	4	32	5.12	22
E	2	4	1.92	40
F	2	15	3.66	22
G	2	6	3.00	24
H	7	18	1.56	36

Table 2. Secretion of spots: comparisons among spot feature and family attributes. Family I includes brothers A, B, and C, family II is fisherman D, family III includes father-sons E, F, and G and family IV is fishermen H (Table 1). * in Kg/Hf (average time in hours in which the net was in the sea). ** average time of round trip. *** sample used in calculations.

Spot name	Family	Yield *	Variance	Time of trips (**)	Mean age	Number of trips (***)
Araçaeira	I	0.2	0.11	12	26	36
Laje	III	0.2	0.10	52	29	16
Saco do Saquinho	IV	0.4	0.56	72	36	22

Table 3. Results from interviews with fishermen from Jaguanum Island about the industrial fishery at Sepetiba Bay and its impact on artisanal technology (Fernandez and Begossi, 1991).

Question	Answer	Percent Interviews	
TRAWLERS			
Time trawlers* are in the bay	herring: < 5 years	82	57
	shrimp: > 10 years	75	56
Benefits of trawlers	none	100	57
Prejudices of trawlers:			
shrimp trawler	- kill young fish	68	57
	- kill young shrimp	33	
	- destroy nets	23	
herring trawler	- kill all fish	21	
	- kill spawning fish	19	
	- destroy nets	12	
FISHING TECHNOLOGY			
Do you use set gillnets ?	- no	36	56
Why did you stop using it ?	- shrimp trawler	45	22**
	- herring trawler	18	
Did you ever have problems with your nets ?	yes	69	52
What problems ?	- shrimp trawler destruction	67	42
	- herring trawler destruction	2	
	- stolen	12	

* trawlers are from harbors of Angra dos Reis, Sepetiba and Rio de Janeiro. ** includes just fishermen that stopped using nets.

Longlines were still used by just 4 interviewees, but 31 used it in the past (60%). Among 35 fishermen, 17% considered trawlers the reason to stop using longlines, 14% low catch and 26% a dangerous technique. Among 22 interviewees, 41% said their longlines were destructed by trawlers and 36% were carried out by fish.

FIGURE LEGENDS

Figure 1. Map of the coast of the States of Rio de Janeiro and São Paulo, in southeast Brazil, including Búzios Island, the islands of Itacuruçá and Jaguanum at Sepetiba Bay and the coastal communities of Puruba and Picinguaba, at Ubatuba district.

Figure 2. Location of Puruba and Picinguaba and fishing areas used by fishermen.

Figure 3. Genealogy of fishermen from Búzios Island, including family I (fishermen A, B, and C), family II (fishermen D), family III (fishermen E, F, G) and family IV (fishermen H). Age are from November 1986. Fishermen of this figure are just the ones involved in net fishing.

Figure 4. Fishing spots used to place gillnets at Búzios Island by families I (brothers), II (close relative of families I and III), family III (father and sons) and family IV (distant relative).

NOTES:

1. Brazilian fishing legislation includes the decree number 221 of February 28, 1967 with Article 35, which states that it is forbidden to fish in "any area forbidden by authorities". Law number 6,631 of April 19, 1979, modifies article 35 of decree 221, including paragraph 2 that allows exceptions for "artisanal fishermen that uses hook and line or pole and line" (*source: Legislação de conservação da natureza, CESP, São Paulo, 1983:160, 345 and V. J. Ventura, Legislação Federal sobre o Meio Ambiente, Ed. Vana Ltda., 1992:47,169*).

2. Buyers at Búzios Island are usually middle-aged fishermen that own a motorized canoe used to transport fish for sale and supplies to and from the coast (Ilhabela and São Sebastião).

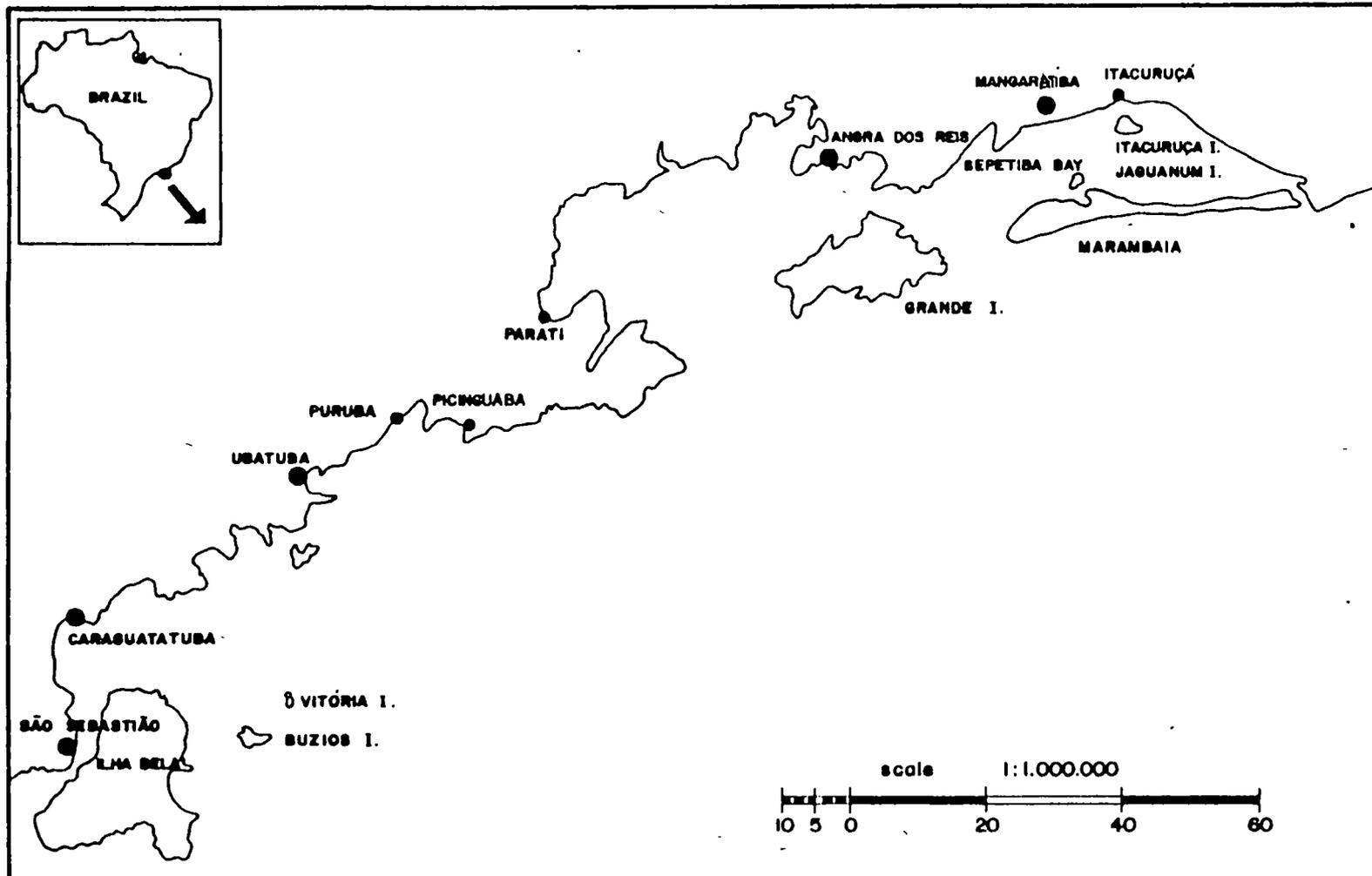


FIGURE 1

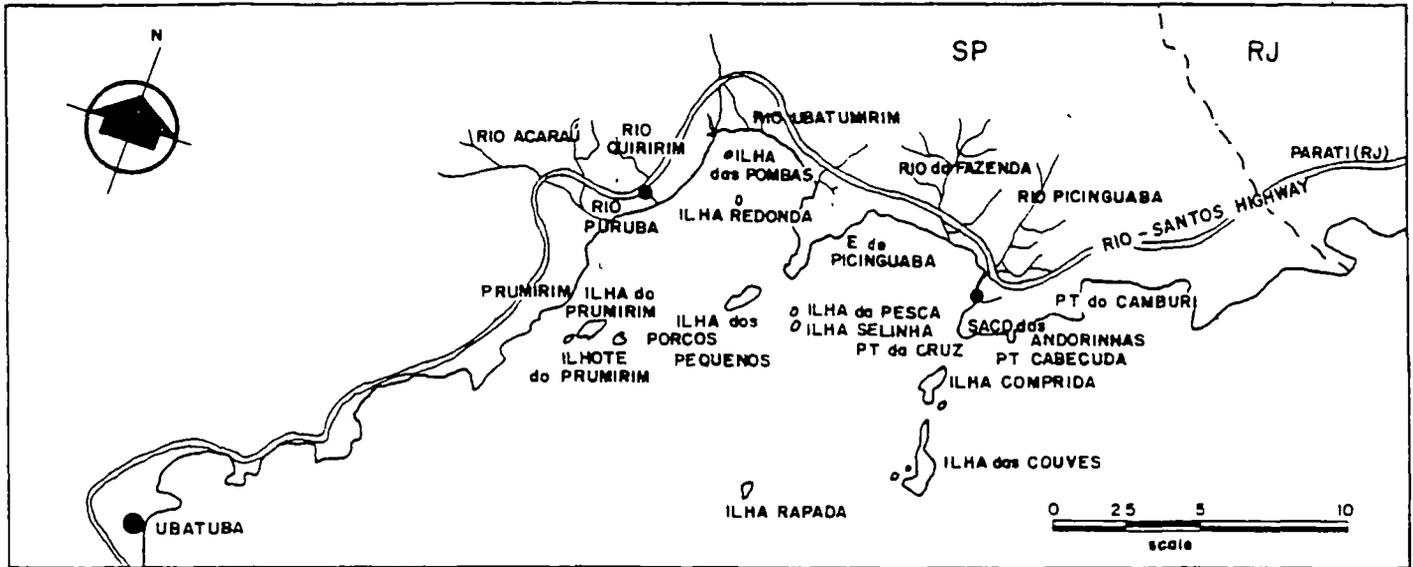
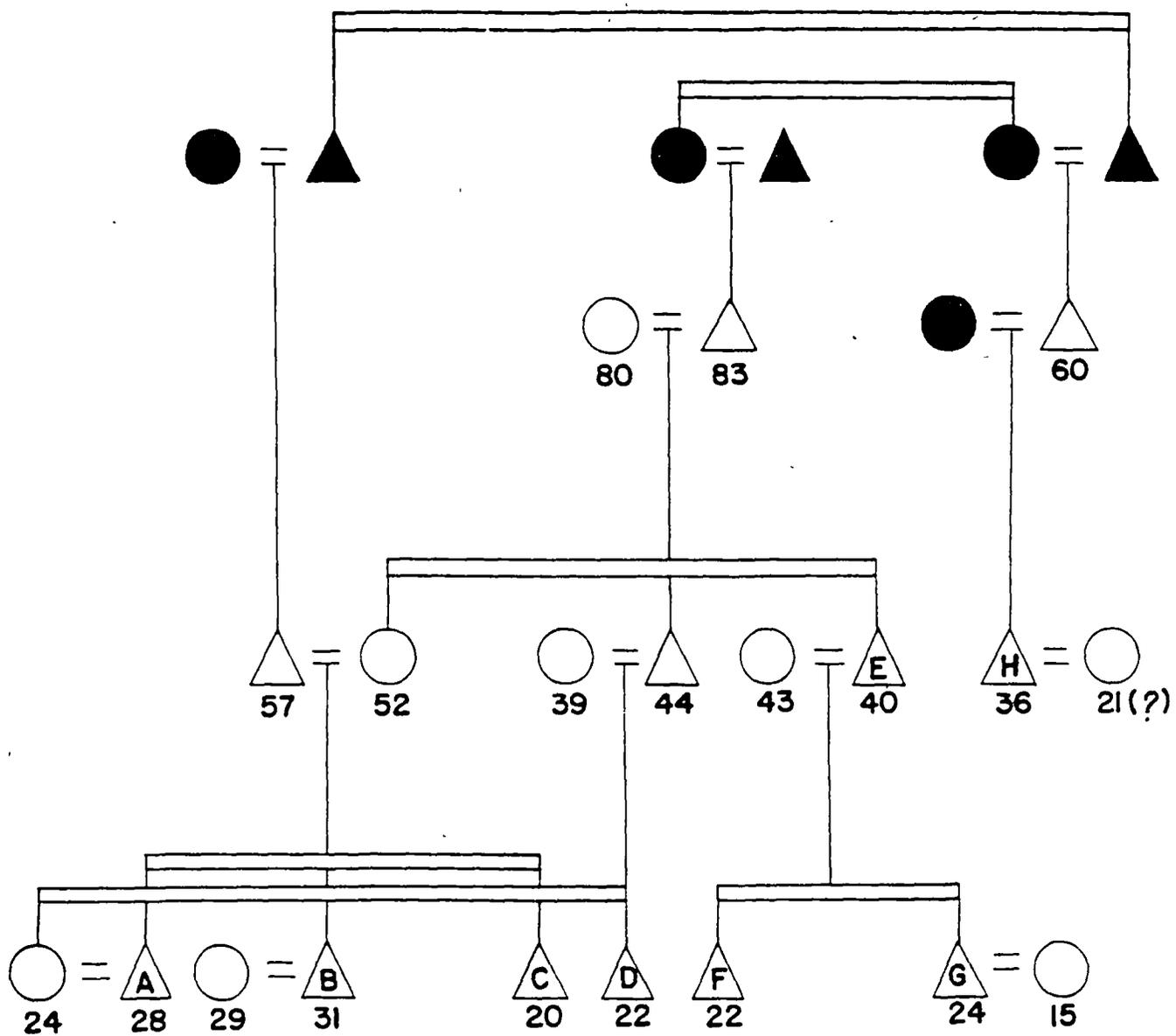


Figure 2



- ——— DEAD FEMALE
- △ ——— LIVING MALE
- ——— LIVING FEMALE
- ▲ ——— DEAD MALE
- = △ ——— MARRIAGE
- ▬ ——— SIBLINGS

Figure 3

FISHING GROUNDS

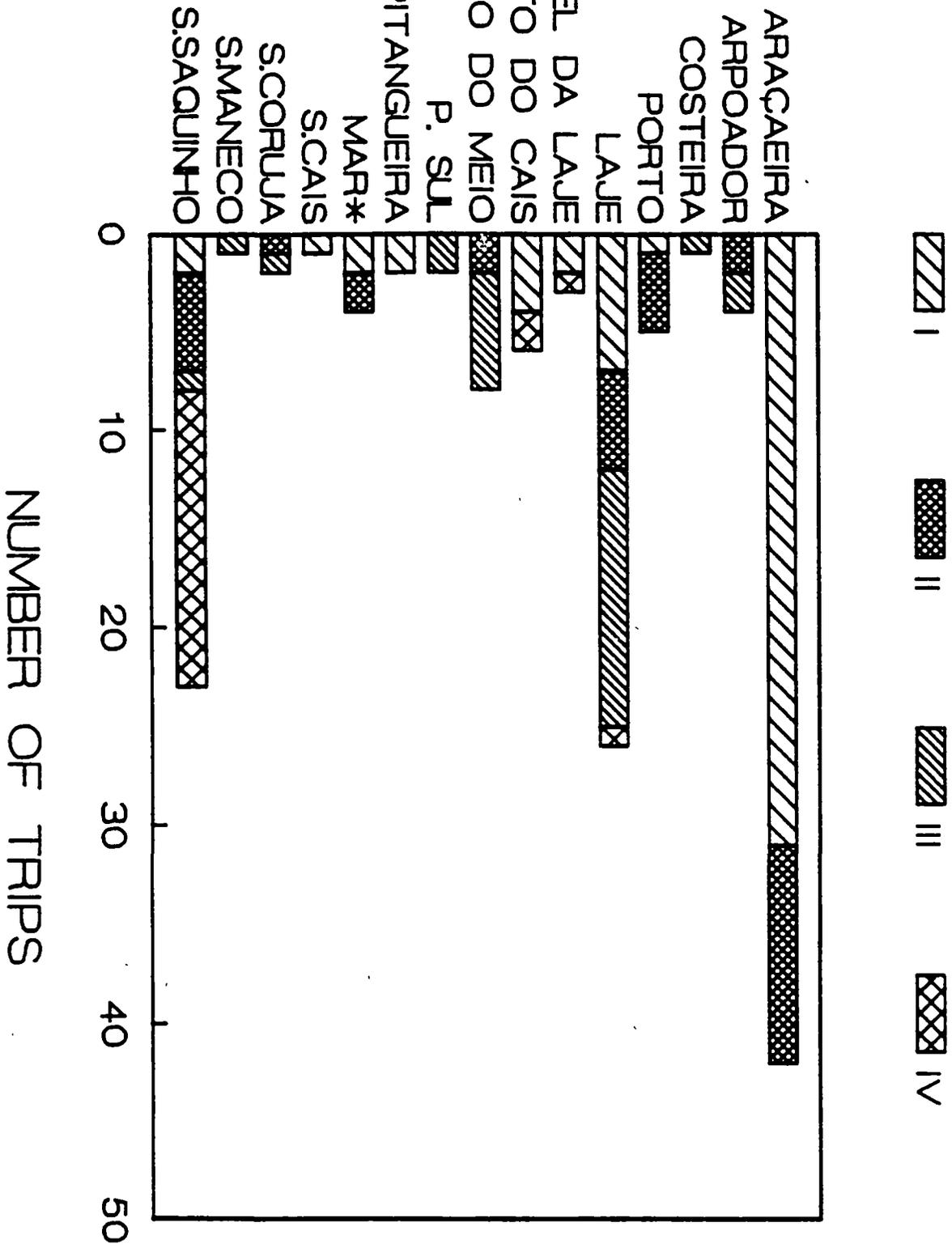


Figure 4