



Biota Neotropica

ISSN: 1676-0611

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Instituto Virtual da Biodiversidade

Brasil

Ramires, Milena; Rotundo, Matheus Marcos; Begossi, Alpina
The use of fish in Ilhabela (São Paulo/Brazil): preferences, food taboos and medicinal indications
Biota Neotropica, vol. 12, núm. 1, enero-marzo, 2012, pp. 1-9
Instituto Virtual da Biodiversidade
Campinas, Brasil

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Biota Neotrop. 2012, 12(1): 000-000.

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<http://www.biotaneotropica.org.br/v12n1/pt/abstract?article+bn00212012012>

Received/ Recebido em 02/04/2011 -

Revised/ Versão reformulada recebida em 27/09/2011 - Accepted/ Publicado em 02/01/2012

ISSN 1676-0603 (on-line)

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The use of fish in Ilhabela (São Paulo/Brazil): preferences, food taboos and medicinal indications

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RAMIRES, M., ROTUNDO, M.M. & BEGOSSI, A. **The use of fish in Ilhabela (São Paulo/Brazil): preferences, food taboos and medicinal indications.** Biota Neotrop. 12(1): <http://www.biotaneotropica.org.br/v12n1/en/abstract?article+bn00212012012>

Abstract: This study was conducted in three communities of artisanal fishermen from Ilhabela, located on the northern coast of São Paulo, Brazil. The objective was to analyze the preferences, taboos and medicinal indications of fish and thus representing one of the interactions of fishermen with fish stocks. Data collection was conducted through interviews with the aid of semi-structured questionnaires. We interviewed 25 families, 29 residents in three communities studied during our fieldwork for data collection. Five interviews were done in Jabaquara Beach, 6 in Fome Beach and 14 Serraria Beach. During the interviews, 18 species were cited as preferred for consumption, 11 species considered to be taboo (food prohibited), 5 species were cited as avoided as food, and 4 species indicated in case of illness. The families of fishermen prefer to consume finfish and do not consume puffer fish, the latter probably due to its toxic characteristic. Fish such as little tunny, largehead hairtail, shark, serra mackerel and king mackerel are avoided by unhealthy people and in cases of wounds, inflammation, pregnancy and postpartum. Other fish, such as sea chubs, silver porgy, bluefish and grouper are reported as medicinal in these situations. Aspects related to fish consumption are part of the knowledge of fishermen and their families and provide a wealth of information that combined to biological information is useful for the conservation of fishery resources. Data such as those presented in this study, regarding the use of aquatic animals for treatment of diseases, could serve as a basis for future studies on substances that contain active elements in curing diseases.

Keywords: use of resources, artisanal fishermen, biodiversity, ethnoecology, human ecology.

RAMIRES, M., ROTUNDO, M.M. & BEGOSSI, A. **O uso de peixes em Ilhabela (São Paulo, Brasil): preferências, tabus alimentares e indicações medicinais.** Biota Neotrop. 12(1): <http://www.biotaneotropica.org.br/v12n1/pt/abstract?article+bn00212012012>

Resumo: Este trabalho foi realizado em três comunidades de pescadores artesanais de Ilhabela, localizadas no litoral norte do Estado de São Paulo, Brasil. O objetivo foi analisar as preferências, os tabus e as indicações medicinais dos peixes e, desta forma, representar as interações dos pescadores com os recursos pesqueiros, visando entender os aspectos biológicos e culturais envolvidos. A coleta dos dados foi realizada através de entrevistas com o auxílio de questionários semi-estruturados. Foram entrevistadas 25 famílias, das 29 residentes nas três comunidades estudadas durante a coleta de dados, sendo que 5 delas foram realizadas na Praia do Jabaquara, 6 na Praia da Fome e 14 na Praia da Serraria. Foram citadas 18 consideradas preferidas para o consumo, 11 espécies consideradas como tabus, 5 espécies evitadas e 4 indicadas no caso de doenças. As famílias de pescadores preferem consumir peixes de escama e não consomem o baiacu, este último provavelmente devido a sua característica tóxica. Peixes como bonito, espada, cação, sororoca e cavala são evitados em casos como feridas, inflamações, gravidez e pós parto e outros como pirajica, marimba, anchova e garoupa são indicados como peixes medicinais nestas situações. Aspectos relativos ao consumo de pescado fazem parte do corpo de conhecimento dos pescadores e suas famílias e constituem um acervo rico de informações que somadas as informações biológicas são úteis para a conservação dos recursos pesqueiros. Dados como os apresentados nesse estudo, com relação ao uso de animais aquáticos para tratamento de doenças, podem servir de base para estudos futuros sobre substâncias que contenham elementos ativos na cura de doenças.

Palavras-chave: uso de recursos, pescadores artesanais, biodiversidade, etnoecologia, ecologia humana.

Introduction

Fish consumption as food is of great importance once fish is a protein source of high biological value, containing all essential amino acids, exhibiting highly digestibility and having low cholesterol due to the presence of 70% unsaturated fatty acids from the omega 3 series in their composition (Leitão 1984). However, among products of animal origin, fish is more susceptible to deterioration processes. Some factors contributing to this trend include the conditions of hygiene, transportation and storage, the pH near neutrality, high amount of water in tissues, high nutrient content, amount of unsaturated lipids, presence of little conjunctive tissue, action of autolytic enzymes present in tissues and the high metabolic microbiota activity (Leitão 1984, Fraser & Sumar 1998, Soares et al. 1998, Mousse 2000). Thus, the fish quality is an important factor that influences consumption by human populations. Moreover, preferences, dislikes and bans in consumption of certain foods are also strongly related to environmental and sociocultural factors and are discussed in ecological studies, since interactions between human populations and consumption of natural resources may explain aspects of behavior and habits in human populations (Colding & Folke 1997, Hanazaki & Begossi 2000, 2006, Pezzuti 2004).

Food choice may represent some association between dietary habits, environment and cultural patterns (traditions, customs, rituals, beliefs and taboos), and they have importance in the economy and social relationships, factors able to prevent the consumption of food existing in abundance in a given territory by the human population inhabiting it. From the ecological point of view, preferences or aversions can be explained, among other factors, by resource availability and species location in the food chain (Trigo et al. 1989, Begossi et al. 2004, Begossi & Hanazaki 2006).

There is a multitude of reasons to explain why different communities avoid the use of species and habitats. Conceptually, food taboos represent ecological-social rules in the form of prohibitions that regulate human behavior in relation to food, which may be considered informal local institutions (norms of behavior, conventions or self-imposed conduct codes by social groups) (Colding & Folke 2000a), which define and limit the use of resources and ecosystems among human populations. For some authors, these may have the ability to protect species and habitats and be used in the management and nature conservation (Colding & Folke 1997, Pezzuti 2004). Other authors (Begossi et al. 2004) presented a review on food taboos in aquatic environments and show that the ecology of fish species is of fundamental importance to determine the diet of human populations.

Among fishermen populations, the practice of avoiding consumption of certain fish species in specific situations, as in cases of illness, pregnancy or postpartum is common (Begossi 1998, Madi & Begossi 1997). Taboos related to fish consumption were verified by Begossi (1992) in Búzios Island (SP). Begossi & Braga (1992) studied why some fish are preferred and others rejected by fishermen from the Tocantins River. Hanazaki et al. (1996) described some taboos related to fish in a community from Ubatuba (SP). Madi & Begossi (1997) identified the taboos about fish among the inhabitants of Piracicaba River (SP). Begossi & Seixas (2001) recorded the food taboos of fishermen from two communities of Ilha Grande (RJ). Begossi & Hanazaki (2006) analyzed the preferences and food taboos in relation to items of animal protein in three communities from southeastern coast of Brazil. McDonald (1977) studied 11 human groups from South America and indicated that general taboos applied to an entire community can play an important role in biodiversity conservation.

In ancient times and even today, many animals, their parts and products have been used as medicine to treat various diseases and constituted part of the inventory of medicinal substances used

by several cultures (Lev 2006, Mahawar & Jarolli 2007). Several species used for medicinal purposes are protected by taboos, which supports the ecological explanation that in localized cases, some specific taboos increase the availability of animals with high zootherapy value (Pezzuti 2004). According to the “drugstore hypothesis” (Begossi 1989, 1992, Begossi & Braga 1992), nature is the “drugstore” of isolated populations, where plants and animals are used for medicinal purposes, thus, it is expected that the most fish species used for medicinal consume would also be the most avoided as food, therefore being preserved from other uses due to its medicinal value (Begossi & Braga 1992).

Zootherapy implications may be related to ecological, cultural, historical, sociological, economic and health aspects (Alves & Rosa 2005, Lev 2006, Ferreira et al. 2009). These aspects reveal peculiarities in the use of resources, since medicinal animals are important natural resources connecting people to the environment and its direct use enriches the local knowledge related to them (Alves & Rosa 2005). This relationship between medical use and local knowledge has been registered for several authors in different parts of world. Mahawar & Jarolli (2006) demonstrated in the work with residents of villages around the Ranthambhore National Park in India, that many animals are used in full, or only body parts and their byproducts (milk, blood, etc..) in the treatment of different diseases including tuberculosis, asthma, paralysis, earache, constipation, snakebite, jaundice, and others. In case of fishermen from the Amazon and Atlantic Forest, it is common the use of animals' body fat, like lizard, or fish such as rays and eel, among others, in the treatment of diseases (Begossi 1992, Begossi & Braga 1992). Costa Neto & Marques (2000) reported the use of molluscs, crustaceans, echinoderms, fish, reptiles and cetaceans in folk medicine of traditional fishermen from Siribinha beach (BA) and found a high prevalence of fish on other aquatic animals prescribed as natural medicines. Begossi et al. (2004) found in fishing communities from Amazon and Atlantic Forest that fish food taboos or prohibitions in cases of diseases are associated with the consumption of carnivorous fish, especially piscivores. Alves & Alves (2011) performed a review of the literature and they revealed that at least 584 animal species have been in traditional medicine in Latin America, 110 of them being species of fish.

The understanding of food preferences, food taboos and medicinal use of resources, as well as the analysis of diversity, availability of natural resources and intensity of resources extraction, may provide important information for the development of management plans (Colding & Folke 2000b, Seixas & Begossi 2001). For example, threatened species represent important medicinal resources in Latin America and according Alves & Alves (2011) is necessary integrate local knowledge into strategies to conserve and manage animal resources and also include ecological, cultural and pharmacology aspects in new studies of medicinal fauna. This study aimed to examine the preferences, dislikes and prohibitions (taboos) in relation to fish species consumption and the existence of medical indications of fish as well as their justifications.

Methodology

This research was conducted in three communities of artisanal fishermen from Ilhabela, North Coast of São Paulo, Brazil: beaches of Jabaquara, Fome and Serraria, which have history of fishing tradition and still develop fishing activity as an important income source. During the data collection performed in the communities interviews were carried out with 5 families in Jabaquara Beach, 8 in Fome Beach and 16 in Serraria Beach. All families were informed about the study and invited to participate, and of these, 25 families

agreed to participate in being interviewed: 5 in Jabaquara Beach, 6 Fome Beach and 14 in Serraria Beach, resulting in an adequate sampling effort, since it approximately 80% of the resident families. Data collection was conducted through interviews with structured questions about the fish species preferred for consumption, the most consumed, avoided and prohibited species and those consumed in case of illness. Data analysis was performed by responses summation of families interviewed and calculation of its frequency as a function of the total families interviewed.

Fish was identified from samples taken by fishermen on landing points or on fish stores (markets) in the fisheries of the communities studied. A pre-identification, based on popular names was performed in the communities with the help of fishermen. The identification was made through the taxonomic keys of Figueiredo (1978), Figueiredo & Menezes (1980, 1985), Figueiredo & Menezes (1980, 2000) and Menezes et al. (2003). The specimens were deposited in the fish collection of the Santa Cecília University and correspondence of names (English/Portuguese) was performed by consulting the FishBase (Froese & Pauly 2011) and Carpenter (2002).

Results and Discussion

The bluefish, *Pomatomus saltatrix* (Linnaeus, 1766) is the favorite fish, cited by 76% of these families. Other fish species such as: grouper, *Epinephelus* spp. Bloch & Schneider, 1801; Largehead hairtail, *Trichiurus lepturus* Linnaeus, 1758; blue runner, *Caranx crysos* (Mitchill, 1815) and sea chub, *Kyphosus* spp. Lacepède, 1801 are also among the favorites and were cited by 32, 28, 24 and 20% interviewed, respectively (Figure 1). Usually, fish preferred by fishermen are also preferred by consumers and they show higher market value and better opportunities for sale. Favorite species like bluefish, grouper

and Largehead hairtail are, for example, white flesh fish with mild flavor, few spines and therefore are preferred both for consumption by fishermen themselves, as consumers searching for buying these species. In such cases, fishermen prefer to sell than consume certain fish species (e.g. grouper), due to the high value that they can charge the market. However, in certain seasons like summer, when some fish species are more abundant, they can be marketed and consumed as much due to the high fish availability, which favors its use for commercial purposes and also for survival.

Fishermen's preferences in Ilhabela and shown in this study are finfish such as: bluefish (*Pomatomus saltatrix*), grouper (*Epinephelus* spp.), blue runner (*Caranx crysos*) sea chubs (*Kyphosus* spp.) and lebranche mullet, *Mugil liza* Valenciennes, 1836. This preference pattern was also identified in the literature (Hanazaki 2002, Begossi & Richerson 1992, Begossi & Hanazaki 2000, Begossi & Hanazaki 2006, Begossi & Seixas 2001, Begossi & Braga 1992). In Ponta da Almada, north coast of São Paulo, the lebranche mullet (*Mugil liza*) was the favorite species and also the most consumed (Hanazaki et al. 1996), whereas in this study it was indicated as favorite by 12% of respondents (Figure 1), however it was not cited as one of the most consumed. However, preferences of fishermen associated with the quality of fish are generally related to properties such as: flavor, color, type of preparation, quantity of spines, among others (Table 1).

Regarding the fish taste, biochemical differences and in texture of muscle tissues should be taken into consideration since they are responsible for wide variety of flavors found among fish species. The lipid content in tissues is the main factor (0.6 to 36% in muscle). In general, fish with higher fat content are more flavorful (Ogawa 1999). Furthermore, the biochemical composition of muscles vary according to species and between specimens, which may suffer influences

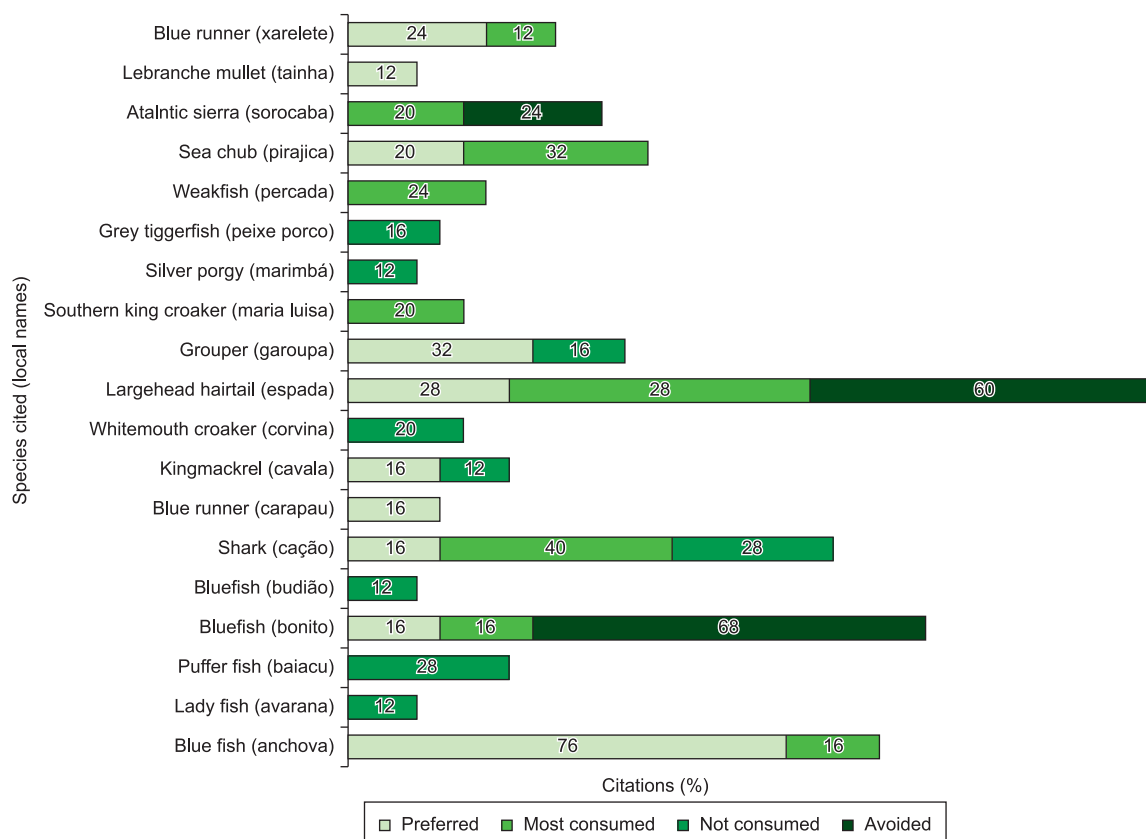


Figure 1. Preferences and consumption of fish in Ilhabela (n = 25, >10% de citations).

Table 1. Reasons cited for food preferences of Ilhabela's fishermen (n = 25).

Features observed	Cited species (local names)	Justifications*
Flavor	Bluefish (anchova), little tunny (bonito), shark (cação), blue runner (carapau), king mackerel (cavala), largehead hairtail (espada), grouper (garoupa), silver porgy (marimbá), bigeye (olho de cão), sea chub (pirajica), black margate (salgo), sardine (sardinha), lebranche mullet (tainha), snapper (vermelho), blue runner (xarelete)	"Good taste", "good flesh", "tastier flesh", "tastiest"
Color	Bluefish (anchova), grouper (garoupa), mullet (tainha), crevalle jack (xaréu)	"White flesh", "clean flesh"
Preparation	Bluefish (anchova), shark (cação), blue runner (carapau), king mackerel (cavala), largehead hairtail (espada), grouper (garoupa), weakfish (pescada), sea chub (pirajica), black margate (salgo), Atlantic sierra (sororoca), blue runner (xarelete), crevalle jack (xaréu)	"Good for cleaning, good for frying", "good for making stew, good for roasting, for Calderada and for mush"
Spines	Bluefish (Anchova), little tunny (bonito), shark (cação), blue runner (carapau), king mackerel (cavala), largehead hairtail (espada), grouper (garoupa), weakfish (pescada), Atlantic sierra (sororoca), blue runner (xarelete)	"Has no spines", "few spines"
Texture	Bluefish (anchova), grouper (garoupa)	"Soft flesh", "more fleshy"

*Cited by more than one respondent.

related to capture location, temperature, depth, habitat, age, sex, breeding period, nutritional status, type and volume of food, among others, making each specimen has a particular taste (Ogawa 1999).

Regarding color, morphological and biochemical differences are observed between two types of muscles, ordinary (white) and blood (red), being morphologically characterized as: ordinary muscle presenting large muscle fibers, large proportion of myofibril/sarcoplasm, a few external and internal membranes and scattered distribution of blood vessels; blood muscle characterized by being composed of small muscle fibers, a small proportion of myofibril/sarcoplasm, many external and internal membranes and compact distribution of blood vessels. Biochemically the red muscle has a higher proportion of sarcoplasmic protein, high glycogen and stroma content, higher lipids, taurine (sulfonic amino acid), iron, extractive nitrogen (mainly histidine) compared to the ordinary muscle (Dyer 1945, Stansky 1962).

The trophic level of certain fish is another factor that may influence food preferences of fishermen. The most often cited fish in this study (bluefish, grouper, sword, blue runner) have carnivorous habits (Carvalho Filho 1999, Buckel et al. 1999, Lucena et al. 2000, Figueiredo & Menezes 1980, 2000, Macpherson et al. 2002, Sanches 2006, Martins & Haimovici 1997, Szpilman 2000) and this pattern was also observed by Silva (2006) in the fishing community Bonete, also located in Ilhabela.

In this study, species cited as the most consumed include: Largehead hairtail (*Trichiurus lepturus*), shark (Carcharhinidae Jordan & Evermann, 1896), sea chubs (*Kyphosus* spp.), weakfish (*Cynoscion* spp. Gill, 1861) and Atlantic sierra (*Scomberomorus brasiliensis* Collette, Russo & Zavala-Camin, 1978), respectively quoted by 52, 40, 32, 24 and 20% of fishermen. Favorite fish are not necessarily the most consumed, the anchovy, preferred by 76% of fishermen, was cited as the most consumed by only 16% of them (Figure 1). By being a fish enjoyed by its white flesh and a small amount of spines, it has good sale value, and then fishermen prefer to sell than consume it. In addition, the bluefish (*Pomatomus saltatrix*) is a pelagic fish and with seasonal occurrence. According to Carvalho Filho (1999), this species has abundance cycles, sometimes scarce for years, others emerging in large quantities. Therefore, it is consumed in just a few months of the year and in times of great abundance.

The relationship between consumption and preference for shark (Carcharhinidae) is a case that can be discussed based on the preference observed in some studies (Begossi & Braga 1992, Begossi & Richerson 1992, Hanazaki 2002, Begossi & Hanazaki 2000, Hanazaki & Begossi 2006, Begossi & Seixas 2001). These are species listed as favorite by 16% of respondents, but consumed by 40% of them. The preference recorded in the literature for other fish cited in this work is by finfish. However, the shark is a much consumed "leather" fish (modified scales on dermal denticles) since it no spines, it is easy to prepare, tastes good (Table 1) and moreover, according to fishermen, it is abundant in the region.

Several other fish are not consumed by fishermen in the communities studied (Figure 1). Puffer fish (Tetraodontidae), according to 28% of fishermen has bad taste, since it fish with many thorns, which eats dirt and is poisonous, requiring special care in cleaning and preparation. In Búzios Island (SP), puffer fish is also a target of aversions because it is considered poisonous (Begossi 1992).

According to Oliveira (1998), the puffer fish acquire their neurotoxic toxicity through the food chain or symbiotic bacteria found in the digestive tract and skin. Toxins are often found in the liver, intestine, gonads and skin, with tetrodotoxin (TTX) and saxitoxin (STX) the main toxins found in puffer fish (Halstead 1988, Williamson et al. 1996, Rotundo 2007). The puffer fish's flesh is considered one of the greatest delicacies of the world, being its preparers highly trained for cleaning and preparing it (Halstead 1988, Williamson et al. 1996, Oliveira 1998, Haddad Junior 2008).

For other species, the most mentioned reason (84%) was "dislike", related to the fish flavor. In 44% of interviews the justification presented was related to the quantity of fish spines and 20% of respondents justified their hatred due to the "bad smell" (Table 2).

Begossi (1992) found that in the island of Búzios (SP) sergeant major, *Abudefduf saxatilis* (Linnaeus, 1758), the ray (Rajidae) and moray, *Gymnothorax* spp. Bloch, 1795 are targets of hatred due to their bad odor. In the communities studied in Ilhabela, fish avoided for this reason are the whitemouth croaker, *Micropogonias furnieri* (Desmarest, 1823) and grouper (*Epinephelus* spp.). According to Seixas & Begossi (2001), food taboos can be observed in local communities through the prohibition of animals or because they are considered loaded, or because they have "strong" flesh or cause indigestion. According to Pezzuti (2004), both among riverine from

Amazon as among those from Atlantic Forest, fish subjected to food restrictions are considered “reimosos” and caícaras also use the term “brave” and “loaded” which include a series of supposed attributes such as strong and fat flesh capable of causing inflammation in people with injuries or sick. These aversions have been also mentioned in literature for other fishing communities (Table 3).

In the communities studied in Ilhabela bans observed were for fish that are avoided in certain periods. The most commonly cited were little tunny, *Euthynnus* spp. Lütken 1883, largehead hairtail (*Trichiurus lepturus*), shark (Carcharhinidae), atlantic sierra (*Scomberomorus brasiliensis*), king mackerel (*Scomberomorus cavalla*) (Table 4). The terms “loaded”, “reimoso” and “bloody” means that the fish flesh is very strong, with much blood and that is what triggers these diseases and therefore should be avoided or prohibit for consumption.

The term “brave” is given to fish that have many teeth, very strong flesh and bite a lot triggering the problems mentioned above. The term “disease” appears in this context as a physiological state which one should give special attention to food and not just as pathology itself. Cases such as pregnancy, postpartum and cesarean, for example, are counted as periods in which one should also take extra care in relation to consumption of certain fish; therefore, these periods are included in the category “disease” in this work.

Understanding the concepts of “health” and “disease” in local populations is important, especially when the goal is to analyze the diagnoses and treatments carried out by traditional medicine (World... 2002). In several populations the causes of diseases are attributed to natural factors, socio-cultural and supernatural (Hilgert & Gil 2007, Reyes-García 2010). Thus the concept of health is not taken only as a state of absence of disease. Some periods are considered at risk or imbalance of the body, such as pregnancy (Meyer-Rochow 2009), menstrual cycle (Herndon et al. 2009), childbirth and puerperium (Vandebroek et al. 2008) that also deserve attention.

Among the Quechua, for example, in rural communities of Bolivia, childbirth and postpartum period are considered a health condition that requires medical care. Vandebroek et al. (2008) revealed patterns in the treatment of health conditions nesta community based on plant use data from traditional healers and patient data from a primary health care (PHC) service, and to demonstrate similarities and differences between the type of illnesses treated with traditional and biomedical health care, respectively. Meyer-Rochow (2009) found that many taboos affect pregnant women and are largely related to the fields of mind and “psyche”. It cites as an example, the taboos related to fish among the Trobriand Islanders or watermelon between Onabasulu, to protect the health of the pregnant woman and her offspring. Reasons for not eating refers mostly to the fact that by

consuming these fish, people already affected by diseases will take a longer time to heal, or as some fishermen said, “leaves no cure”. In other cases, like the stingray for example, consumption is what triggers the disease, or as fishermen said: “burst the wound”.

Little tunny is a species much reported in the literature as target of aversions and prohibitions (Table 3) and, moreover, it was quoted in this work by 68% of respondents as a fish avoided in certain cases such as: guard, after surgery, wounds, allergies and infections (Table 4). Begossi et al. (2004), for example, found that in eight of the twelve local communities studied in the Atlantic Forest, bonito is largely forbidden, cited by 35% of fishermen interviewed and, according to Pezzuti (2004), fish of the family Scombridae, as little tunny, serra mackerel and king mackerel, which typically have very small scales or even absent, are classified as flat fish and therefore are also subject to taboo. Studies in different countries prove that fish of the family Scombridae, particularly tuna, little tunny, Atlantic sierra and Atlantic chub mackerel, are those with higher levels of free histidine and, consequently, the most frequent vehicles of histamine poisoning (Scombrototoxin). However, fish belonging to the family Clupeidae and crustaceans, may also exhibit relatively high levels of free histidine (Huss 1993, Soares et al. 2005).

In the communities studied in Ilhabela, most of the taboos mentioned by fishermen occur in certain periods, ie when individuals are affected by some diseases or pregnancy and postpartum, being thus characterized as segmental taboos according to Colding & Folke (2000a,b). Such aspect has also been shown in other studies, e.g., Trigo et al. (1989), who studied the food taboos of mothers living in Marabá (PA) with children under five years and found that fish food taboos are related to the leather species (very abundant in the region) and these are, in their most, banned in human physiological states such as pregnancy and lactation.

On the other hand, several studies conducted among fishermen populations from the Brazilian coast have reported the fish use for medicinal purposes (Begossi 1992, Begossi et al. 2006, Costa Neto 2000, Costa Neto & Marques 2000, Marques 2001, Begossi & Seixas 2001, Silva et al. 2004). In Ilhabela, some fish are also indicated in case of illness. The sea chubs (*Kyphosus* spp.), the silver porgy (*Diplodus argenteus*), bluefish (*Pomatomus saltatrix*) and grouper (*Epinephelus* spp.) were species recommended for use in cases of illness (Table 5).

The main indications include: wounds, pregnancy and guard (postpartum). In these situations, the consumption of some fish is highly recommended rather than others and thus, justifications for indications are opposite to those for prohibition. These are now indicated because they are “meek” (do not attack) and have “white

Table 2. Reasons cited for food taboos of Ilhabela’s fishermen (n = 25).

Features observed	Cited species (local names)	Justifications*
Flavor	Catfih (bagre), puffer fish (baiacu), parrotfish (budião), snake eels (camburu), whitemouth croaker (corvina), grouper (garoupa), silver porgy (marimba), grey triggerfish (peixe porco)	“Dislike”, “bad taste”, “strange taste”, “never liked”
Smell	Whitemouth croaker (Corvina), grouper (garoupa)	“Bad smell” (strange, strong, weird)
Spines	Baiacu de espinho (porcupine fish), budião (parrotfish), marimbá (silver porgy), avarana (ladyfish)	“A lot of spine”, “many spines”
food habit	Catfih (Bagre), puffer fish (baiacu), grey triggerfish (peixe porco)	“It eats dirt (silt, mud, sea foam)”
Poison (toxin)	Puffer fish (Baiacu)	“It is poison”
Other	Puffer fish (Baiacu), snake eels (camburu), whitemouth croaker (corvina), grey triggerfish (peixe porco)	“I have never eaten”

*Cited by more than one respondent.

Table 3. Aversion patterns identified in the literature on marine and riverine communities.

Aversion patterns	Popular names cited (local names)	Local	References
"leather" or "flat" fish	Catfihes (bagres), little tunny (bonito)	São Paulo coast	Hanazaki 2002
	Moray (Moréia), ray (raia), little tunny (bonito)	Ilha de Búzios, SP	Begossi & Richerson 1992
	Ray (Arraia), catfih (bagre)	Conde, BA	Costa Neto 2000
	Catfihes (bagres)	Pedrinhas and São Paulo Bagre, SP	Hanazaki & Begossi 2006
	Largehead hairtail (Espada)	Ilha Grande	Seixas & Begossi 2001
Reimosos or loaded	barred sorubim (Surubim), flatwhiskered catfish (barbado), Amazon catfish (jaú), red tailed catfish (pirarara)	Rio Tocantins	Begossi & Braga 1992
	Little tunny (Bonito)	Amazon and Atlantic Forest	Begossi et al. 2004
	Ray (arraia), whitemouth croaker (corvina)	São Paulo coast	Hanazaki 2002
	Catfih (Bagre), little tunny (bonito), largehead hairtail (espada), shark (cação)	Ponta do Almada, SP	Hanazaki & Begossi 2000
	Caranha (snapper), barbel (cumbá), Atlantic sierra (sororoca), lebranche mullet (tainha), snakefish (traíra do mar), ray (arraia), catfihes (bagre), Atipa (caboje), spinner shark (cação gaia preta), tarpon (cangurupim)	Conde, BA	Costa Neto 2000
Aggressive behavior, "brave"	Yellow mandi (Mandi)	Rio Piracicaba, SP	Madi & Begossi 1997
	Ray (Raia), little tunny (bonito), shark (cação)	Ilha de Búzios, SP	Begossi 1992
	Little tunny (Bonito), crevalle jack (xaréu), white mullet (parati), bluefish (anchova)	Ilha Grande	Seixas & Begossi 2001
	Ray (raia), shark (cação)	Ponta do Almada, SP	Hanazaki & Begossi 2000
	Snake eels (Camburu), ray (raia)	Ilha de Búzios	Begossi 1992
Fish-like snakes	Mussun (muçum), snake eel (caramuru), goldspotted eel (mututuca), lamprey (lampreia), Moray (moréia)	Conde, BA	Costa Neto 2000
	Moray (Moréia)	Ilha Grande	Seixas & Begossi 2001
	Snake eels (Camburu)	Ilha de Búzios, SP	Begossi 1992
	Tarpon (Cangurupim)	Conde, BA	Costa Neto 2000
	Little puffer fish (Baiacu mirim), catfih (bagre urutu)	Conde, BA	Costa Neto 2000
Morphology (Fish looks ugly)	Puffer fish (Baiacu)	Ilha Grande	Seixas & Begossi 2001
	Puffer fish (Baiacu)	Ilha de Búzios, SP	Begossi 1992
	Atipa (Caborja)	Rio Piracicaba, SP	Madi & Begossi 1997
	Ripsaw catfish (Cuiú cuiú)	Rio Tocantins	Begossi & Braga 1992
	Snake eels (Camburu), ray (raia)	Ilha de Búzios, SP	Begossi 1992
Odor (bad smell)	Atipa (Caborja), yellow mandi (mandi)	Rio Piracicaba, SP	Madi & Begossi 1997
	Whitemouth croaker (Corvina)	Ilha Grande	Seixas & Begossi 2001
	Sergeant major (Tinhuna), ray (raia), snake eels (camburu)	Ilha de Búzios, SP	Begossi 1992
Flavor	Atipa (Caborja) e yellow mandi (mandi)	Rio Piracicaba, SP	Madi & Begossi 1997
	Whitemouth croaker (Corvina)	Ilha Grande	Seixas & Begossi 2001
Piscivorous fish	Barred sorubim (Surubim), flatwhiskered catfish (barbada), red tailed catfish (pirarara), little tunny (bonito), shark (cação), largehead hairtail (espada), crevalle jack (xaréu)	Amazon and Atlantic Forest	Begossi et al. 2004

meat" with "little blood", therefore, they are good in the recovery of people affected by the cases indicated.

Such statements may be related to the fish classification according to the amount of lipids, being known as thin or fat. Those with red meat, especially migratory species, have high myoglobin and lipid

contents; while those with white meat, non-migratory, show the lipid content below 1% (Visentainer et al. 2000).

These species were also recorded as recommended among fishermen from the Atlantic Forest in the works of Begossi et al. (2004, 2006). The indications were for cases of illness, puerperium

Table 4. Fish avoided by fishermen. n = 25 (>10% of citations).

Fish (local) and scientific names	N	%	Disease	Justification
Little tunny (Bonito) <i>Euthynnus alletteratus</i> (Rafinesque, 1810)	17	68	Wound, Itch, Allergy, Bruise, Postoperative, Liver problem, Guard, postpartum, Blood infection,	Brave fish very strong flesh, loaded, strong It has a lot of blood (much bloody) Dark flesh Reimoso
Largehead hairtail (Espada) <i>Trichiurus lepturus</i> Linnaeus, 1758	15	60	Wound, Itch, Allergy, Bruise, Infection, Caesarean, Guard, Blackfly Inflammation	Brave fish, tooth Much blood Loaded, strong
Shark (Cação) Carcharhinidae Jordan & Evermann, 1896	7	28	Infection, Wound, Guard, Operation, Caesarean, Injury	Leather Fish Reimoso Loaded, strong Brave Fish, big tooth Much bloody
Atlantic sierra (Sororoca) <i>Scomberomorus brasiliensis</i> Collette, Russo & Zavala-Camin, 1978	6	24	Wound, Itch, Allergy, Infection, Bruise, Guard, Blackfly Inflammation	Brave fish, it has teeth, bites a lot Loaded
King mackerel (Cavala) <i>Scomberomorus cavalla</i> (Cuvier, 1829)	3	12	Wound, Court, Guard, Operation	Much blood Strong fat Loaded

Table 5. Fish eaten by fishermen in case of diseases. n = 25 (>10% of citations).

Fish (local) and scientific names	N	%	Indication	Justification
Sea chub (Pirajica) <i>Kyphosus sectatrix</i> (Linnaeus, 1758)	5	20	Wound Pregnancy Guard	It is good Meek fish, it does not attacks White flesh Little blood
Silver porgy (Marimba) <i>Diplodus argenteus</i> (Valenciennes, 1830)	4	16	Pregnancy Wound Guard	It is good Meek fish, it does not attacks White flesh Little blood
Bluefish (Anchova) <i>Pomatomus saltatrix</i> (Linnaeus, 1766)	3	12	Wound Pregnancy Guard	Meek fish, it does not attacks White flesh Little blood
Grouper (Garoupa) <i>Epinephelus</i> spp. Bloch 1793	3	12	Wound Pregnancy Guard	Meek fish, it does not attacks White flesh Little blood

and menstruation. According to the fishermen in Ilha Grande, studied by Seixas & Begossi (2001), grouper, silver porgy and sea chubs are also considered “meek” fish and indicated for overall diseases and women with newborn children (postpartum).

The role of food taboos is an issue that needs further study if the objective is to know whether they only occur in localized contexts or can be generalized occurring in various regions. According to Colding & Folke (2000a), the use of some species can be avoided because the species is embedded in myths, or because it represents religious symbols. Species may be prohibited due to their behavioral patterns (e.g., fish are “brave”), morphological features (such as “flat” fish), belief that they are toxic, their eating habits or failure to adapt within a given cultural classification scheme.

Although some taboos can reduce the predatory pressure of some resources, or according to the “drugstore hypothesis” where

expected that the most fish species used for medicinal consume would also being preserved from other uses due to its medicinal value (Begossi & Braga 1992), there is no evidence that this behavior results in resource conservation. It is still need a more integrated approach of information to verify if taboos can conserve species in a given community (Begossi et al. 2004, Colding & Folke 2000b, Pezzuti 2004), such as taboos and medicinal uses noted in fishing communities from Ilhabela. However, food prohibitions as taboos cited in this study, direct fishing for certain species, exerting pressure on some fish species and relieving fishing on other species. The market pressure through the fish prices also directs the fishery, and in fact there is a number of deciding factors that determine what will be achieved through fishing activities and this result is what influence or not the conservation of fish species.

Conclusions

The understanding of what to eat and why eating expressed in knowledge of fishermen can be analyzed through the association with fish biological aspects, once they are related to factors such as meat quality (blood presence), anatomy (number of spines), presence of toxins, dermal composition (finfish or fish flat), among others. Relationship between nutritional quality and food taboos must not have a significant effect among communities in Ilhabela, since access to other sources of animal protein are no longer a problem that results in nutrients deprivation, since other families obtain other food through purchase.

This work raised elements of local knowledge related to the fish consumption that can foster discussion about the use, conservation and fisheries management, providing biological and ethnobiological information based on socio-cultural local knowledge indicators of environmental resource use and fishing activity in these communities. Besides these aspects, information on the medicinal use of fish can provide the basis for chemical substances are included in the treatment of diseases, as for the overall human metabolism.

Acknowledgements

We thank FAPESP for support through the PhD scholarship of M. Ramires (process: 04/02183-6) and by grants for research

(Biota 01/05263-2). We thank CNPq for the scholarship of research productivity of A. Begossi. We thank Phelipe Sens Coelho, trainee of the LAPEBio/ UNISANTA for helping in the taxonomic activities.

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Received 02/04/2011

Revised 27/09/2011

Accepted 02/01/2012