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TRADITIONAL FISHERIES KNOWLEDGE AND SOCIAL APPROPRIATION OF MARINE RESOURCES IN BRAZIL

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Introduction

This paper examines the relationship between traditional fisheries knowledge and contemporary fisheries management in Brazil.

In recent years, researchers have emphasized the importance of the knowledge produced and orally transmitted by traditional fishermen and the potential role of traditional fishing and related environmental knowledge can play for the development and implementation of fisheries management in the modern world. (Ruddle 2000, Cordell 2000). As Ruddle (2000) points out, traditional knowledge continues to guide and sustain the management of many traditional, community-based fishing systems as well as governs fishing decisions and fishing strategies. Local knowledge systems is empirically-based and designed for practical purposes , for example to inform decision-making about where to dish daily and seasonally. Local environmental knowledge domains characteristically include much valuable information about fish behaviour, location, distribution and availability of species, taxonomies and habitat classifications. Over time, as this knowledge is transmitted to new generations of fishermen it helps communities maintain and constantly renew ties to to fishing grounds and access to a continuous suppl;y of marine aquatic resources, particularly in tropical countries where biological data are scarce or no-existent.

Spheres of local knowledge also include references to classification of aquatic species, fish behaviour, taxonomy, patterns of reproduction and migration, feeding interrelation among species, to physical and geographic characteristics of the aquatic habitat, climate (cloud formation, winds, storms, weather change), principles of navigation and functioning of diverse fishing techniques in a range of micro-environments. Traditional knowledge may also reflect peoples's association and connections with the spiritual world, for example, demarcation of sacred sites in the sea, creation myths and story places.

1. Areas and subjects of traditional knowledge

Various maritime anthropology and ethno-ichthiology studies illustrate the richness and resilience of artisanal fishing knowledge in Brazil. Glaucia Silva (1997) records the analytical categories of the fishers of Piratininga (Rio de Janeiro) and Begossi (1989) documents the species nomenclature and criteria for fish classification system fishermen use in Buzios Island, (Sao Paulo). Cunha and Maldonado (1989) have described how fishing knowledge operates among artisanal communities and the know how of fishermen in Paraná and along the Paraíba Coast. Diegues (1983, 2000) explains how traditional knowledge

functions in the rocky fishing grounds of Rio Grande do Norte and Espirito Santo states. Forman (1970), Cordell (1974) , Mourão (1967)and Marques,(2001) have made important contributions to the study of traditional knowledge in Brazil.

Thus*, traditional fishing knowledge* may be understood as a distinct cognitive realm: on the one hand consisting of a replicable, orally transmitted set of specialized skills and culturally shared practices and beliefs that have stood the test of time, enabling people to make a living from coastal and marine environments, working from small boats and relying on artisanal techniques; on the other hand traditional fishing knowledge exists in more encompassing symbolic and conceptual frameworks governing social relationships and spiritual connections to inland aquatic, coastal and offshore marine habitats.

It can also be defined as a cumulative body of knowledge and beliefs handed down through generations by cultural transmission about the relationship of living beings (including humans) with one another and their environment. (Berkes, 1993)

Some areas and subjects of traditional fishing knowledge are:

a) Fish taxonomies

In some Brazilian fishing communities, fish have a great importance in native classification, being the most meticulously classified in categories built upon multiple criteria. This deference to fish is made clear by the use of the "family" category that is meticulously applied to fish while receiving quite casual application in the case of other animals and especially plants. This special treatment given to fish should be seen within a set of conceptualizations that approximate them to man since both form the articulation between land and sea.

> " Native classification also employs typologies. According to these typologies the beings grouped in each class must present the greatest possible amount of characteristic features in order to be identified. Besides this rule, based mostly on shape and external appearance, there are also "situational incorporations" between classes so that labels attributed according to essences are articulated by a kind of "hierarchy" of complementary opposition, whose terms relate to each other in different ways, according to the referential context. This "hierarchical" understanding is very different from that of present biological taxonomy which establishes a subordination even between categories."(Silva,G 1997)

B) Habitats classification

In addition to species of fish, certain rocky fishing grounds are classified and designated by names of fishermen who discovered them.(Cascudo, 1954, Galvão, 1968, Diegues, 2.000). Some of these rocky habitats are very rich in fish species and kept secret by their "owners". These territories have no visible markers or borders, but are respected by other

fishermen. Local sea tenure systems are based on long established knowledge traditions containing retailed information on ecological features of the sea territory.

Cunha's (1997) highlights the relationship fishermen perceive between physical characteristics of the ocean and the social production of knowledge. According to Cunha, fishing knowledge is culturally produced and accumulated through professional practice and continually recreated according to the features of the maritime environment, which presents itself as cyclic, mobile, and unpredictable. In other words, the appropriation of the sea and its resources is expressed in the principle and practice of "knowing-how" marine territory is constructed and ritualized by means of tradition, apprenticeship, experience, and intuition. This know how is ontly attainable by those with experience and intuitiveness that comes from understanding what tradition is in specific cultural and work/production contexts sof fishing apprenticeships.

Several authors (Diegues, 2000, Cunha, 1997) emphasize the relationship between the combined land and sea space where fishermen live and do their work.

> " Fishermen understand nature as consisting of two vast worlds: sea and land. Distinctions between these two worlds are an important basis for classification since animals and plants are understood and organized according to the fact that they belong to one or the other domain. Those living on land are seen in a relationship of contiguity with fishermen and classified according to criteria human characteristics. Those living in the sea are linked to land by analogical relationships, this world being perceived as an imitation of land reinforced by the similarity of forms between the beings of these two "worlds".(Silva, G 1997).

C) Fish behaviour

Detailed feeding habits are described by fishermen (Marques , 2001) in Marituba lagoon at the mouth of São Francisco River in the state of Alagoas. Local fishermen describe fishing habits of many species and use their knowledge to select appropriate baits. Knowledge of feeding and reproductive behaviour are also used to organize fishing activities. As an example, during the first rains, when fish makes noise ("snores") this means they are ready to spawn; thus it is time to prepare fishing traps (covos).

Marques (1991) has studied the *caiçaras,* a brush park used in the coastal lagoon of Mundaú and Manguaba, in Alagoas from an ethnoichthyological point of view. He observes that fishermen distinguish fish which live in the caiçara more or less permanently such as the *mero (Epinephelus), carapeba (Eugerres brasilianus), camurim (Centropomus* spp), *caranha (Lutjanus cyanopterus)* from species which only temporary seek shelter in the brush-parks, such as the *salema (Archosargus* sp) and *vermelha* (*Lutjanus spp)*

The movements of fish and their migration patterns are also precisely known by many artisanal fishermen in Brazilian coast. A good example concerns the migration of mullets (Mugilidae) during the winter from Brazil's southern to the northern coasts. The first cold winds in May mark the beginning of the mullet migration. Numerous artisanal communities continue to rely heavily on this species for their livelihood. (Mussolini, 1945)

The ability to locate and keep track of fish aggregations is another realm of fish behaviour known in intricate detail by many small-scale fishermen in Brazil. Signs of spawning aggregation are identified by "ardentia", the scyntillation produced by shoals of certain pelagic fishes (such as sardines) during the nights without moon light. This indicates that fishermen should prepare to deploy their encircling nets.

Ruddle (2001) also mentions that knowledge of predictability of food fish in "prime spots is widespread in traditional fishing societies throughout the Tropics. Calendar devices and mental maps which enable fishermen to track fish behaviour according to lunar phases are among the most critical indicators of possible events in the marine ethnobiology of fishing.

2. Social and cultural characteristics of the knowledge

The knowledge systems described above tend to develop within tradicional societies or communities that: a) maintain strong economic and symbolic ties with the land and the sea through continuous observation of natural cycles; b) attachment to continual use and occupancy of a specific group territory which allow a community to reproduce itself through ongoing traditions of communal and family land and sea tenure; c) where subsistence activities continue to play a vital role in fishing, even in conjunction with and increasing focus on market production; d) individual/family ownership of means of production; e) limited accumulation of capital; f) crucial socio-economic relations that are structured along family, domestic, communal kinship lines; g) the use of relatively simple technology, with limited impact on the environment; h) positions of marginality from political power bases that tend to be concentrated in urban centers; i) oral traditions responsible for the production and transmission of knowledge, symbols, myths and rituals associated with artisanal fishing and sometimes with small scale agriculture; j) a certain degree of social/cultural identity based on fishing and other maritime activities.

Artisanal fishing knowledge should not be judged or seen as pre-logical or pre-scientific. Silva, G (1997) following Levi-Strauss (1978) points out that traditional production and ecological knowledge is based on long observation of recurrent natural phenomena which allows a fishermen to make decisions about the timing of fishing activities, selection of favorable fishing locations and the use of appropriate techniques for specific species . Without this fine-tuned knowledge it would be impossible for fishermen to earn livelihood within an ever changing and frequently dangerous marine environment

According to Silva, G (1997)

> " Traditional classification systems are, in some ways similar to the taxonomic concepts of the biological sciences; nevertheless, possibly the most important fact is that both are an answer to the very same "demand for order" mentioned by Lévi-Strauss (1978), which underlies all cultural configurations.

The construction of this body of complex and detailed concepts and symbols is based on a long term empirical observation and is applied to rather small marine areas used by local fisherman and seldom can be replicated elsewhere. It also guides their behaviour and fishing strategies and is essential for predicting situations where fishing can be successful. In this sense, traditional knowledge help local fishermen to produce their own mental maps that indicates to them where and how to fish.

As Ruddle points out (2000)

> "Resource use patterns are products not of their physical environment and its resources per se, but of their perceptions our culturally formed images of the environment and its resources. Thus, to properly understand human ecological relationships, an understanding of a society's local knowledge base, and the cognitive system that underlies it is crucial ." (p.282)

3. Transmission of local knowledge

The ability to identify productive zones of the sea and to find one's bearings in the midst of the immensity of the sea, out of sight of land, is part of what has been called "the cognitive skill set of fishermen" which seem to be the direct and accumulative result in may fishermen communities. This knowledge is not evenly distributed among artisanal fishermen but tends to be concentrated in the hands of boat captains and skippers.

According to Maldonado, 1997)

> "it is useful to consider the seamanship and territoriality among fishers in terms of practical adaptation to the marine environment. This culturally conditioned learning accounts for the development of systems of orientation in exploiting the marine environment. In other words, seamanship and the art of fishing are socially mediated. They appear and evolve in a marine space that shape the worldview and the organization of production of artisanal fishermen. (Maldonado, 1997)

There are various ways to transmit this knowledge set. In the case of the retrieval of submersed rocky fishing grounds in Galinhos (Rio Grande do Norte) described by Diegues (2000) the captain may show to his children or a selected crew member the geographical signs in the continent he is using (mountains, church towers) to trace his routing. In other cases, an apprentice must learn informally through observation and imitating what the captain does.. Instruction to acquire these aspects of fishing knowledge is rarely formal or consciously intentional.

4. Gender, division of labour and traditional knowledge

Traditional fishing knowledge is not evenly distributed among artisanal fishermen. Knowledge varies among communities and among their members Although old fishermen are generally considered to possess more knowledge than their younger counterparts, successful captains are not necessarily the oldest fishermen. Rather they tend to be people with natural leadership and captaincy qualities (mestrança), i. e the ability to command . In the Northeast knowledge is associated with captainship that requires competence and experience that bestows authority to orchestrate fishing operations, based on respect (respeito) gained from the crew members. Some captains are boat owners themselves but many of them work on other people's boats.

For the fishermen of Galinhos (Rio Grande do Norte), finding fishing spots is certainly not just a matter of luck. Captains must be competent to sail at nights guided by the stars in order to tocate the best and most productive fishing grounds, which they hold secret (Diegues, 2001).

Women too are skilled in locating and sustainably using shell fish beds to provide food for households when boats cannot go the sea due to bad weather . In some regions of Brazil some women go fishing with their families.

5. The traditional appropriation of the marine environment: space and sea territoriality

The concept of **t**raditional appropriation of sea resources incorporates material as well as non-material aspects that define the relationship between fishermen and the sea. Modern concepts and tools for managing fisheries usually emphasize economic, biological and administrative aspects of regulating fisheries. On the other hand, anthropological studies of fishing have been open to broader interpretations of what constitutes resource management in fisheries. In many cases, anthropologists have documented traditional territorial systems used to appropriate and manage sea space which have been found to have meaningful fisheries management functions and implications. Local tenure customs which control access to fishing grounds can have management impacts which are similar to the quota and limited entry provisions and restrictions employed in contemporary fisheries management frameworks.

Traditional appropriation of marine resources in some cases ends up having noticeable effects on fishing pressure and production by establishing normative procedures to control fishery access and activities within socially demarcated sea space. Such cultural practices are basically designed to allow fishing communities to intervene in nature and in the life cycles and processes of marine species. In recent years anthropologists have found this to be an enlightening way to understand and explain why tenure systems develop and how they work in many tropical coastal areas which in the past have been perceived by governments, fishery entrepreneurs and by regulatory agencies alike as open-access areas. The prevailing wisdom behind imposition of most recent fishery management regimes and legislation stems from what is turning out to be a naive and erroneous assumption about ownership status of inshore fisheries and coastal sea space, much of which has long been held and sustainably managed under pre-existing traditional tenure arrangements. The anthropological and social science literature is now replete with examples of local fishing traditions that intentionally or un-intentionally regulate access to resources and sea territory, create fishing rights and with corresponding social obligations and that regulate the use and distribution of fishing gears in order to reduce social conflicts and in certain cases to control fishing pressure itself. Also as Cordell (2000) points out, sea tenure traditions may include not only susbsistance strategies bu reflect basic cultural values, social identity and a sense of place.

An outcome of the traditional appropriation of the marine environment and its natural resources is the establishment of informal sea tenure systems, through which portions of the sea, including, for instance submerged rocky grounds are allocated to fishermen families. But, as Cordell (2000) points out sea tenure traditions include not only subsistence strategies but are also based on cultural values that are related to the construction and maintenance of a social identity and a sense of place.

Traditional appropriation of marine environment occurs within a broader framework of territoriality through which the artisanal fishermen of the Brazilian coast have marked areas of the sea that "belong" to them by virtue of their use.

An important element in the relation between traditional populations and nature is the notion of ‘territory’, which a particular society claims as its own, and grants to all or to a part of its members stable rights of access, control and use for all or part of the natural resources located there, that they desire or are capable of utilizing (Godelier, 1984). This territory furnishes, first of all, the nature of humans as a species, but also the means of subsistence, the means of production and the means of producing material aspects of social relations, such as kinship relations. (Godelier, 1984)

The marine/coastal *territory* depends not only on the type of physical environment exploited, but also on the *social relations* established among those who use it.. For many

traditional populations that exploit the marine environment, the sea has its *marks* of ownership, generally productive fishing spots, discovered and guarded carefully by artisanal fishermen. These marks can be physical and visible, as it occurs in the *caiçaras(brush parks)* constructed in the lagoon of Mundaú and Manguaba (in Alagoas, Brazil). They can also be invisible, as in is the case of submerged rocks where there is an abundance of fish stock. These fishing spots are marked and guarded**,** and kept secret through a system of navigation locally called *caminho e cabeço* by the fishermen of the Northeast. For members of traditional artisanal fishing communities the marine territory used is much larger than that of the land, and is more fluid. Despite this, it is conserved by a *lei do respeito* (law of respect) that governs the ethics of this community (Cordell, 1982).

Knowledge of the marine physical environment is extremely important for safe navigation, for the use of appropriate gears and for the identification of certain fish species. Among Brazilian artisanal fishermen the marine environment is not uniform but it is formed by different micro-habitats that includes mangrove, lagoons, estuaries, sand and rocky based grounds. Some fish species are known to use different micro-habitats for different purposes such as feeding, protection and reproduction.. In some cases, some micro-habitats must "rest" when some others are used for fishing (Marques, 2001).

Despite numerous advantageous uses noted here of artisanal sea tenure systems, this is not to say they present a panacea for overcoming all fisheries management problems; fishing may become highly competitive and arguably, as a work setting it seems to have an inherent tendency to generate conflict. The act of appropriating and controlling access to local sea space and resources by no means renders work environments or the natural environments- even those of small-scale fishing, free of conflict.

6. Symbolic aspects of the social appropriation of the sea

The social appropriation of the sea implies not only na extension of social relationships on land and the accumulation of local environmental knowledge. It also involves the formation and symbolic expression of links with the spiritual world. Conceptions and representations of the natural world and its resources differ greatly between the subsistence and market-oriented societies. Godelier (1984) argues that these two societies have different rationales, and each displays a system of social rules consciously elaborated to best attain a set of objectives. According to this anthropologist, each economic and social system creates a specific mode of exploitation of natural resources and use of the human labour force and, consequently, utilizes specific norms of good and bad use of natural resources.

According to Godelier (1984), at the heart of our material relationship with nature there is an underlying non-material bond that unites the three key functions of knowledge: to simultaneously represent, to organize and to legitimize our social relations and our the relations with nature. In order to understand the process of material production, it is essential to understand symbols and myths used by fishermen to represent the sea and its beings.

The production process involved in fisheries generates a range of symbolic elements through which fishermen act not only upon nature but in concert with super-natural forces that may favour a successful fish catch or punish those fishermen who are too ambitious.

Thus, together with defining a space for economic reproduction and projecting principles of social relations, marine territories can also be the locus of representations and of the mythological imagination of these traditional societies. The intimate relation of these people with their surroundings, and their greater dependency on the natural world when

compared with urban-industrial societies, result in the cycles of nature (the arrival of schools of fish and the abundance of crops) being associated with mythical and religious explanations.

For example, *Caiçara* communities along the Southwest coast of Brazil use both the Atlantic Forest resources as well as associated estuaries, mangroves and marine environment. They also do not have a fear of fishing in the estuaries and coastal lagoons**,** , but many fishermen have a dread of the *mar de fora* (open sea) and the *passagem da barra* (going beyond the mouth of the estuary),where storms might occur, sometimes resulting in loss of boats and human lives. (Mourão, 1971).

One of the most popular "orixás" (gods of the Afro-Brazilian pantheon) is Yemanjá, the goddess of the sea. She is also considered to be the Mother of the fish (Yeye: mother and Eja: fish, in Yoruba from Nigeria). The fishermen of Bahia, in particular those involved in the fishing of cavalla (pesca do xaréu), present their gifts to Yemanjá before their nets are launched from the shore. According to these fishermen, those who do not praise the goddess of the sea will have small catches, as Yemanjá protects the shoals. In the evening of February 2, coastal communities, in particular artisanal fishermen celebrate Yemanjá and throw in the sea the gifts she likes, such as soaps, bottles of perfume, and silver coins.

Another important aquatic goddess is Oxum, the spirit who protects the living beings of rivers and water sources. (Seljan, 1973)

The popular imagination of the people of the Brazilian coastal forests, rivers and lakes is inhabited by magical beings that castigate those who destroy the forests *(caipora/curupira, Mãe da Mata, Boitatá)***,** those who mistreat animals *(Anhangá),* those who abuse animals in the time of reproduction *(Tapiora)* and those who fish more than necessary (*Mãe d'Água*) (Câmara Cascudo, 1972). Thus, the inhabitants of the Várzea da Marituba in Alagoas have various legends, such as the *Mãe d'Água* (water mamma) which sinks the canoe of those fishermen that are very ambitious and catch an unnecessarily large amount of fish from the lagoon.

Mythological beings called "ataídes" threaten those fishermen who use the mangrove without care in Marajó Island. In the lake Arari, also in the same island, fishermen say that there is a spirit of a big ray (arraia grande) that protect other fishes from human predation when they become trapped in small ponds during the dry season and are an easy prey of fishermen. In order to fish in those ponds it is essential to ask permission from the "big ray" otherwise the fisherman may risk his life.(Fares, 2001)

The mythical world of "caboclo fishermen" of the Amazonian rivers and estuaries is filled with spiritual beings or *encantaria* of the forest or water, that can favour or harm him.

The worlds of forest and water are two separated domains: two extensions of the fishermen/*caboclo's* lives. There are supernatural entities (*caruanas*, *bichos do fundo* [animals of the depth], *mãe d'água* [water's mother]) capable of casting spells or haunting and and bewitching those who abuse or disrespect the rights and rules pertaining to the use of these environments. In this case, a belief that one should not harvest more than one needs is reinforced. Like the forest, aquatic areas along with their human inhabitants also have their protective spirits, with the power to harass those who engage in destructive resource use. There also exists the *cobra grande* (great snake), the *Tapiraiauara*, and the *onça d'água* (water leopard), which inhabit, respectively, the depths of lakes and the rivers (*igapós)*.

Fishermen understand they must avoid fishing in certain places and times for fear of meeting supernatural entities. It has been suggested that this fearfulness may act as a mechanism for limiting potentially damaging human-environment interactions, thus tending to prevent over-exploitation of resources. (Furtado, 1997)

An ongoing debate surrounds the natural resource conservation function of these mythological beings. In other words, are traditional fishermen aware of the ecological intentions of these cultural practices. Can such practices actually facilitate conservation or be viewed as "conservationist"?

Darrel Posey, (1992) uses the emic/ ethic approach to discuss the issue of intentionality related to traditional practices. According to him, in some conservationists' minds traditional practices that limit overexploitation of resources can be considered to enhance or support biological conservation, in the modern, scientific sense. Under these conditions, whose practices mediated by beliefs in mythological beings purposely choose to avoid overfishing may play na important role im modern fisheries management?

For Posey, this interpretation falls into the category of an etic approach that is developed by the resercher. On the other hand, in the mind of a traditional fishermen (the emic approach) the function of beliefs about the behaviour of mythical beings may turn out to be something quite different. Fear of being punished by super-natural beings may function, for instance, to discourage capital accumulation and social differentiation in societies organized along egalitarian lines. In this connection, an emic approach to explain these practices is unlikely to be deliberately "conservationist":, at least not in the sense this concept is defined in the Western science.

Inhabitants of many fishing communities in Brazil retain socio-cultural affinities with their Indian ancestors. Indian cosmologies usually do not make clear cut distinctions between animals and humans but see life as a continuum in which all beings are inter-related through a network of different sociabilities. (Descolla, 1997). Nature is not only inhabited by humans and the spirits of the ancestors but also by animals and their spirits. In this connection, the modern concepts of wilderness, biodiversity, pristine ecosystems are not able to explain the complex relationships between traditional communities and their environments. For example, in the worldview of these communities and cultures, the existing diversity of species is not only a natural phenomenon but also a cultural one resulting from a long term interaction between humans, habitats and non-human beings.

In the Brazilian context, several traditional groups are currently making efforts to incorporate the modern notion of "conservation" in their discourses in order to gain the support of ecologists in their struggle for cultural survival .

7. Examples of Sea Tenure and Traditional Management Schemes on the Brazilian Coast and rivers

In Brazil there are over 200 different Indian peoples, with their own language and cultures, some of them living and fishing in coastal areas (Guarani, Tremebe, Pataxó). There are also non-Indian traditional communities that have important influence from the Indian cultures in their way of living. There are the "praieiros" in the Northern coast, the "jangadeiros"(raft fishermen) in the Northeast, the "caiçaras" in the Southwest region, the Azorian descendents in the South, as well the "caboclo"fishermen along the rivers and lakes.

Traditional appropriation of marine/riverine resources and sea tenures have been touched in the preceding discussion of cultures and sea tenures. Salient aspects of a number of these traditional knowledge, tenure, resource and spatial management systems are described in

further detail below although it is important to point out that much more research and documentation is needed to begin to do justice to this topic.

▪ *Caiçara / pesqueiros (brush parks*)

This is a brush-park built with mangrove poles making a circle or a rectangle. Inside it the artisanal fishermen lay branches. It is similar to the *akadjás* described in Benin by Bourgoignie (1972) and by Kapestky (1981). The similarity between the Brazilian *caiçara* and the African *akadj*ás was first mentioned by Diegues (1983, 1988).

It is not yet known whether this technique was brought from West Africa by the African slaves or developed locally. *Caiçaras or pesqueiros* are known and used by many fishermen communities.(Diegues e Nogara, 1994) In Mundaú-Manguaba lagoons in the state of Alagoas they are in shallows where there are weak water currents. Fishermen have a profound knowledge of the fish species that are caught in the brush-parks..

Fishermen are also aware of natural processes within the *caiçara* as an artificial habitat they have created For instance, they recognize different stages of ecological succession. According to Marques (1991) they are equivalent of what is known in modern science: in the poles first settle the macroalgae (*cabelo*), then the perifiton (*limo*), the Terrinidae (*buzame*), *Mytella charruana* (*sururu*) and *the Crassostrea rizophorae* (*ostras*). Each stage is associated with a specific fauna. When the climax is reached fishermen net fishing the adult fish, leaving the juveniles for latter fishing.

In summary , " caiçaras are":

a) *a system of sea tenure*: Local fishermen informally own the space where the caiçara is settled.. Access to the newly created habitat and its resources is determined by the law of respect (*lei do respeito*). As the fishermen say: "We cannot forbid other fishermen to fish in the caiçaras, but they respect our place as we respect theirs".

b) *a unit of resources***:** the fishermen have an idea that the *caiçara* concentrates biomass.

c) *a fish aggregating device***:** fish species find a new habitat and a feeding place in the *caiçara*. Local fishermen say that "fish go to the *caiçara* to find safety. (Marques, 1991).

d) *a fisheries management technique*: local fishermen utilize these new habitats in a responsible way, using appropriate nets that catch only adult fish. In a broad sense the *caiçara* can be also considered an extensive aquaculture technique, as was noted by Kapetsky (1981).

The brush-parks of Alagoas State, however, are now suffering from the overall degradation of the Mundaú-Manguaba lagoons. Tons of wastes from sugar-cane alcohol production are being discharged into the lagoons. The urbanization of the state capital, Maceio, is also responsible for the overall degradation of the estuarine area and contributes to the disruption of the fishing communities. As local fishermen say: "Outsiders who are not local fishermen lack respect and take fish from our *caiçaras* in the night."

▪ The *calâo* Fishing of Southern Bahia

This type of fishing was thoroughly described by Cordell (1983). It is a type of shallow-water purse-seining in which an eight-man crew works in six- to ten-meter canoes. Purse seining is well adapted to the intricate tidal changes along Bahia's estuaries and creeks that wind back into the mangrove swamps.

Cordell (1983) also explains that the skippers (*mestres*) have consolidated control over premium waterspace, which has distinctive spatial limitations within the lunar/tidal

cycle, providing a territorial foundation for the marine tenure system. Names are given by the skippers who exercise exclusive rights and priorities over these tiny tidal fishing spaces. He has also observed that the skippers give names to the traditional casting spots (called *pesqueiros*) that are microenvironmental areas for fishing. They are subdivided for a particular fishing technique into *lanços* (casting sites) or minimal waterspace as determined by fort-nightly current changes, daily tide-level changes, light conditions during different phases of the moon, bottom conditions, etc.

Cordell (1983) also mentions that fishing rights and property exist as spatial points in the context of the lunar calendar.

Access to others can also be granted by the skipper in the context of godparenthood (*compadrio*), networks, rituals and obligations. When an outsider fisherman wants to fish in the estuary he usually takes along a crew member who has a local godfather (compadre) or friend. It is a precaution to ensure that his crew will receive good treatment if they have to go ashore and thus avoiding the threat of competition during net-casting operations.

In thee case of Mundau-Manguaba lagoons, the estuaries of southern Bahia are suffering from outside interference, mainly incursion of industrial fishing boats that do not have the respect and engage in "pirating" resources in the customary territories of traditional fishermen.

- The *Caminho e cabeço* (routing and rocky botton fishing)of the Northeast

Caminho e cabeço is a fishing system in which a fishing ground is discovered and pinpointed in the ocean through a complex method of mentally constructed reference points. Fishermen use no compass but still by crossing imaginary lines (caminho/routing), and refering to geographical landmarks such as the top of continental mountain range, they are able to retrieve small fishing grounds made of rocky bottoms (cabeços) several miles away from the shore. These fishing grounds become "owned" by the boat captain or skipper who discovers them. Other fishermen do not know where these grounds are located. Some boats might follow the lucky owner of a fishing ground but when the skipper becomes aware of this, he changes his route. After some years, some of these productive fishing grounds might be made public but keep the name of the skipper who discovered them. The secrecy of the cabeços are transferred from the father to his children or selected crew members..

This system was first described by Galvão (1968) in the state of Rio Grande do Norte. Later on, Forman (1970) analyzed the system in the state of Alagoas. According to Forman, the secrecy is the core of that type of fishing and it is a way of diminishing competition for scarce resources. The *segredo* (secrecy), based on traditional knowledge, is a sign of authority of skippers over the other fishermen. The more *cabeços (rocky grounds)* he discovers and keeps secret, the more fish he lands and the more respect he gets within his community. As a fishermen from Galinhos (Rio Grande do Norte) points out: "The sea has plenty of marks that nobody sees". The "caminho e cabeço demonstrates territoriality and functions also as a means of controlling the availability of scarce sea resources in the Northeast.

- *Cercos* and *Currais*

(Bamboo Fishing Trap)

These are fixed traps built in many estuaries and lagoons all along the Brazilian coast. They were first built by the Indians to catch migratory species such as mullet. They are made of local material such as bamboo poles. They have one entrance that allows only big fish to get in, as the small ones escape through the fence. The owner of the *cerco* rebuilds it

every two years when the bamboo poles decay, and when it is abandoned, another fisherman can build his own *cerco,* after having the approval of the previous owner of the previous trap.. No other fisherman will dare to take fish from somebody else's trap as long as the law of respect prevails. At present, however many intruders, mainly recreational fishermen, fish in the *cercos*.

▪ *Restricted Access to Fishing Grounds*

According to Brazilian law, fishing is open to all fishermen registered in fishermen's guilds (*Colonias*). However, in some places, local communities have reserved specific areas for the use of their fishermen. That is the case for example, of Mamanguá estuary near Rio de Janeiro, where traditional fishermen laid cement blocks in the bottom of the sea to damage large trawling nets. Artisanal fishermen use only small nets to catch shrimp and felt that their fishery was being damaged by industrial boats from companies. Today the area is used only by the traditional community as the trawler owners are afraid of entering into the restricted area and damaging their nets. (Diegues and Nogara, 1994).

▪ *Organized and Sequential Net Casting*

Artisanal fishermen are often accused of being disorganized, anarchic and not receptive to management. In fact, what happens is that fishermen organize themselves. That is illusrated in the " manjuba "fishery *(Anchaviella hubsi)* inside the estuary of Iguape-Cananéia in São Paulo coast. Due to the construction of a barrier in the Ribeira River, the migration of manjuba changed. As a result, fishing is primarily concentrated at the mouth of the river. Hundreds of canoes converge during the short fishing season in a narrow area. In order to ease confusion, fishermen have developed a system where after net casting each canoe returns to the end of the queue. Disputes are solved by fishermen themselves, and their organization probably works better than any other system proposed by fishery management authorities (Lima, 1979).

8. The relationship between traditional and scientific knowledge and the empowerment of local communities

In Brazil, traditional sea tenure and fisheries management have only recently begun to receive attention from scholars, scientists and fisheries managers. One reason why recognition of these traditional systems have been impeded is that vast areas of Brazil, notably Amazonia and the coastal zone have been treated by powerful industrial and urban élites essentially as "empty spaces" although they have long been inhabited by widely dispersed traditional communities . Traditional communities, particularly artisanal fishermen, Indians and the riverine populations have, for all intents and purposes remained "invisible" to the rest of society until recently. This "invisibility" has provided justifications and ideological underpinning for the claims of the élites to occupy, colonize and "develop" these areas where only enclaves of "uncivilized people" were supposed to reside.

This stereotypical view also extends to artisanal fishing communities. Yet, as some of these populations have started to react to encroachment by outsiders on their valuable beaches, traditional settlements and fishing habitats, we are witnessing increasing social resistance, not only to development pressures but to preservationist conservation initiatives as well. As a result, previously marginal fishing groups are becoming more socially "visible".

As in other parts of the world, Brazilian coastal waters are still considered common property with open access. With the advent of the modern fishery industry, particularly in the 1960s, "common property" and "free access" were viewed as precondion and pre-requisites for

building a "modern fishing industry" (Diegues, 1983). Highly subsidized trawler fleets invaded areas traditionally used by artisanal fishermen, ignoring and disrupting existing sea tenure. Serious conflicts arose in some parts of the coastal areas, particularly of the Northeast lobster fishery. Fishery managers simply paid no attention to the traditional fishing tenure . In many instances, financial incentives, formal regulations(such as limited-entry licensing and transferable quotas) imposed by management agencies have tended to favour the expansion of new mechanized, albeit inefficient fishing industries (and consolidating the power of tlites-in some regions essentially leading to the formation of a new class of "sea lords".

Moves to establish new systems of protected areas in coastal habitats are also altering and having detrimental impacts on the livelihoods of traditional fishermen. Many habitats targeted in protected areas strategies have long been used by artisanal fishing communities, whose own sophisticated resource management systems have been responsible for helping to conserve major stretches of the Brazilian coastline. Unfortunately, the first step in gazetting and establishing a national (marine) park, at least in the Brazilian context, ordinarily involves the expulsion or exclusion of local fishing populations from their ancestral land and territories. Estuaries, mangroves, lagoons and (nearshore)islands tend to be viewed as empty spaces , whereas they are actually encompassed and often elaborated subdivided and claimed by traditional fishing groups who use their own spatial "sea marks" to distinguish territories and use rights. As this paper has shown, in some cases, the spatial orientation and organization practices that still occur widely in Brazilian artisanal fishing have evolved over many generations. Recent studies (Cunha, 1989, 1992, Diegues, 1992, 1989) indicate the toll that ill-conceived conservation (including marine protected areas) schemes have taken on traditional fishing communities. While conservation interventions may appear to be benign, ostensibly constructed for the great good of nature and society as a whole, crusades to save marine environments, like uncontrolled land based "development", can be a pathway to increasing marginalization of local coastal populations.

Another common misconception underlying the lack of recognition of the value of traditional fisheries knowledge is that some government managers and some in the academic and conservation agencies as well continue to assume that "primitive societies" are unable to produce "scientific" and valuable knowledge. Government fisheries development agencies (as well as government environmental agencies) have been heavily influenced by certain natural scientists that take Western science and research on biodiversity priorities (in a strict sense) as the worlds's only basis for "sound marine management".

The question is: how much power, political will and capital do small-scale fishermen (and their advocates or representative organizations) have to persuade other stakeholders to listen to their voices and respect their traditions?

As Ruddle (2001) points out

> "Local knowledge can be understood as a system of power, and thus can provide a basis for the empowerment of communities to undertake community-based resource management. This is particularly important in tropical, multi-species fisheries and their environments, for which the scientific knowledge is still relatively poor"(Ruddle, 2001: 291)

To draw more attention to the problem of valuing and integrating traditional knowledge in marine management, govern agencies and representatives of the industrial/urban sector should consider the increasing body of evidence for legally recognizing traditional,

interconnected land and sea tenure systems. If measures could be found to accord formal legal status to these systems, this could help the escalating evictions of traditional coastal communities from their beach territories – a process on a micro-scale driven by over –arching, socially and environmentally destructive urbanization patterns in Brazil. It would be, at least a small victory for artisanal communities, if means could be found to keep their villages and fishing territories from being transformed into exclusive protect areas and resorts for wealthy tourists –or perhaps of even greater importance to guarantee fishermen a voice and a more of a choice in deciding their future.

More recently in Brazil, there is a welcome, growing interest in and awareness of the importance of understanding and protecting traditional marine resource management knowledge, both inside and outside the university. A literature review of this topic conducted by NUPAUB (Center for Wetlands Conservation of the University of São Paulo) in 1999 on the traditional knowledge of biodiversity discovered that out of papers selected for review, over 35% emphasized the importance of ethno-knowledge and over 25 % of the papers in this sample address or highlight traditional management practices of artisanal fishermen. Roughly 60 % of papers analysed were written between 1990 and 1999 by anthropologists and particularly by ethno-ichtyologists. It was also apparent from this study that a growing number of biologists have become interested in research on traditional knowledge systems of artisanal fishermen.

The NUPAUB study identified the following thematic areas where the knowledge of traditional fishermen could provide valuable inputs to the management of marine resources, habitats and ecosystems.

a) Stock assessment. As Ruddle (2001) points out the knowledge of fishermen can provide a useful basis for understanding local fish stocks and their population dynamics. Particularly important in this respect is indigenous knowledge concerning the timing, location and behaviour of spawning aggregations of reef and lagoo fishes.(2001:289)
b) Knowledge of micro-habitats and their related species that can be use to determine location of marine reserve areas, and extractive reserves as well as specific locations for closed seasons and protected spaces for fish species reproduction

c) Traditional management methods. As previously noted, artisanal fishermen have developed a variety of sea tenure regimes that ensure equitable access to resources and their sustainable use. Such management strategies include seasonal, spatial, gear and species restrictions as well as community-based ownership of resources

d)Fishing methods

Artisanal fishermen know a wide range of fishing gears and techniques that are relevant to projects of fisheries sustainable development. The experience of some fishermen communities in the use of the traditional fish aggregation devices can be of great importance in projects based on Fads.(fish attractive devices)

e)ethno - ichtyology

The knowledge of local fishermen on fish classification and taxonomies using local names are relevant for stock assessment and a valuable basis for biological studies.

9 New trends and local experiences on community management.

Two interwoven trends can be identified in terms of understanding what is happening in the spheres of traditional appropriation of marine resources. Some shoreline and inshore sea tenure and knowledge traditions are disappearing under the pressure of industrial fishing, urban expansion, tourism and aquiculture projects. The cumulative effects of these modernization processes and events are seriously jeopardizing and leading to the loss of coastal/marine territories which artisanal fishermen depend upon. On the positive side, some communities are actively reviving and participating in the incorporation of traditional knowledge in modern marine frameworks. Gradually, some communities are becoming familiar with scientific research and management approaches. Often these projects are developed by NGOs or academic research institutions with little government involvement.

While coastal zone planning and management led by the Brazilian government has basically remained a technocratic exercise, confined to mapping activities, without significant in situ impacts, in some areas, coastal communities are proceeding with their own versions of coastal managment. In Ceará, for instance, local communities have suffered from the invasion of their beaches by land speculators, tourism and from overfishing of lobster mainly by the industrial fleet and by divers coming from a neighbouring state. Assisted by local NGO and research institutions, various fishing communities have proposed a Coastal Forum, where shared problems are discussed by representatives from a range of stakeholder groups and interests. Within this Forum, a joint management plan for lobster fishing has been proposed. When IBAMA (N Brazil's national environmental agency) announced that no funds and boats were available for surveillance of lobster fishing, local fishermen equipped one of their boats to help ensure compliance with rules regulating that fishery. Fishermen who disobey the regulations are firstly reprimanded and later, if they fail to comply with the agreed rules, they are taken to a court.

In some beach areas where there are fishing neigbourhoods, the sale of o plot of land for tourists must be approved by the community council..

In some other coastal communities such as Pirajubaé in Santa Catarina, Mandira, in São Paulo and Arraial do Cabo, in Rio de Janeiro, Ponta do Corumbau-Bahia, extractivist marine reserves have being created to ensure continuing access to fisheries resources for the inhabitants and members of the reserve and to limit outsider's access to and use of local waters, particularly for purposes of sport fishing. Most of their initiatives have a strong resource conservation component, and as result, they frequently succeed, in attracting support from Government and NGOs.

Another innovative example of the power of local initiative in establishing protected areas, where local fishermen have been actively and meaningfully engaged from the outset, through project design, monitoring and implementation is the Mamirauá Reserve for Sustainable Development in Amazonas. Mamirauá covers 1.124.000 há and was created to protect a large part of the floodplain between the Japurá and Solimões rivers. In this huge are live 4.500 *vargeiros(inhabitants of floodplains)* dispersed in 50 small settlements, each with and average of 14 households. These communities gain their livelihood primarily from fishing, hunting and gathering of forest products.

Contrary to what is required by national parks legislation (expulsion of the population of the area), the project administrators decided to allow the *vargeiros* to remain in the territory where they have always lived. This is a region of great biological diversity, and when flooded, the water covers millions of hectares, making enforcement of legislation exclusively by government officials an impossible task. The administrative team belonging to a local non-governmental organization believed that only through community participation could the biodiversity and culture of the region be protected. Community-based-management ,

however, is different from the establishment and imposition of 'management plans' by scientists and bureaucrats. Community based system needs more time to develop, since their viability depends on continuous consultation and a constant dialogue with the local population, the inclusion of social scientists in the research teams and more flexibility in planning. The experience of this project demonstrates that once a decision is taken by the local population, it has a much greater chance of being followed. The advantage of this approach for conservation was in the consensus that was reached by the local population in terms of sustainable use of Amazonian lakes, which have high diversity and socio-economic values.

The communities in question decided to define different resource and territorial use categories for the lakes, including no-take zones to enhance reproduction of key species; subsistence lakes (limited for subsistence fishing; *lakes for commercial fishing* (for exclusive use of the community, where fish are to be sold); and *lakes that may be used by nearby urban centers* (where fishing is permitted to satisfy the needs of municipalities).The communities, in a democratic assembly, also decided on the types of sanctions to be applied to those community members who disobeyed restrictions.

Conclusions

In the face of and in spite of the host of threats to traditional fishing outlined in this paper, management and sea tenure practices till have an important role to play in contemporary fisheries and environmental management. Traditional structures, however, cannot be transposed mechanically into modern fishery management policies and frameworks. Natural resources management is fundamentally about regulating human behaviour vis-a-vis nature and the activities of resource-users;;managing resources in not about regulating nature per se. Most modern fishery managment centers on sustainable yield, economic efficiency and profitability considerations.

Traditional marine management has a far broader, more diverse set of objectives and functions, designed to maintain a certain way of live, local identity tied to a sense of place. Most of the regulatory measures proposed by the Brazilian Fisheries Management Authority (IBAMA) (quotas, licensing) are a mechanical transposition of those existing in Northern countries, where the ecological and social context is very different. IBAMA,s agenda, in fact aims to control fishing effort within the industrial fleet, maintaining or increasing economic profitability without taking into account the social, economic and cultural contribution of small-scale fisheries to the regional economy, particularly in terms of employment and environmental conservation.

The position taken in this paper advocates and illustrates the advantages of integrating traditional marine management knowledge and sea tenure into national fishery administration. There are encouraging signs this approach is already meeting with success in some areas and that a wider audience of fishery, conservation, environmental and public policy specialists are becoming more aware of the potential of traditional knowledge to improve marine management. Artisanal fishermen organizations are still weak, although important step forward was taken as strong social movements occurred since the beginning of the 1980's, particularly reacting against coastal pollution. These fishermen also have actively participated in providing inputs for the 1988 Constitution and succeeded in having the benefits of social security.

Changing public perception and attitudes in Brazil concerning the benefits of working to protect and strengthen artisanal fishing, local tenure systems and associated domains of environmental knowledge can to some extent be attributed to the fact that there may be

substantial costs to society in the long run in failing to take action on these issues and that some coastal communities have been able to convince other stakeholder and government authorities to respect local

There is also is a growing interests among biologists and social scientists in knowing better traditional management systems. In particular, ethno-scientists have also contributed in the last two decades to the research and dissemination of the traditional fisheries knowledge and many of them can be useful tools for the management of artisanal fisheries in Brazil

Extractive reserve concepts being put to the test in Brazil, have the potential to empower fishing communities in integrating scientific and traditional management methods and in exerting greater control over their marine resources. Brazilian experiences with the extractive reserve model and in implementing site-specific projects are worthy of much more studies. Working within this framework, hopefully, more fishing communities in Brazil may yet be able to accomplish something that has elude most other traditional fishing societies in modern era, namely to require that commercial and recreational fishermen and government agencies, knowledge and respect local resource management standards, values, territorial claims and use rights..

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