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Stream: Fisheries

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THE EXPERIENCE OF COMMUNITY-BASED MANAGEMENT OF MIDDLE AMAZONIAN FISHERIES

ABSTRACT

Amazonian fisheries have the characteristics of a typical tropical artisanal fishery. More than 200 species are captured utilizing a diversity of gear types. One in five residents can be characterized as engaging primarily in fishing activities. The consumption of fish in floodplain communities is on the order of 400 g/person/day. Despite the importance of fishing in the regional economy, there are no official statistics on actual production. Due to the rapide demographic increase, the improvement of fishery technology and the absence of government supervision, pressure on aquatic resources have been increased in the last decades. While some authors suggested that fish yield could be increased significantly, public opinion is that principal fish stocks have been already strongly reduced or even overexploited. Various users groups (communities, ranchers and outside commercial fishers) have been involved in serious conflicts over access to fish and other aquatic resources. The types of conflict vary from burning gear to physical violence and even armed confrontations. In response to this competition for local resources, floodplain communities of the Middle Amazon are developing and implementing new forms of management of fish resources, based on traditional knowledge and collective agreements, with the aim of preserving the productivity of their fisheries. Local people claim the ownership of lakes near their communities based on the same notions of territoriality employed by other traditional populations for hunting and extractive activities. However, Brazilian legislation determines that all water resources and their fauna are public domain and does not guarantee regulation of access to these 'common goods'. In this context, in the early nineties various initiatives for resolving the problem have been proposed for the region. The basic idea of the necessity to construct a locally negotiated and

locally based consensus on access to natural, mainly aquatic resources, has been developed by the different projects according to specific local conditions. As part of this effort, the fishery department of the Brazilian Institute of Environment and Renewable Natural Resources-IBAMA implemented Project IARA. One major objective of this project was to create a data base to give scientific support to the adoption of efficient management measures. After collecting landing data for the Santarém market and length-frequency data for the most important fish species it was possible to apply some single-species stock assessment methods to assess the status and main features of the fisheries. These approaches permit us to conclude that large species with a high market value are being exploited intensively, and in some cases are already overexploited. On the other hand, smaller, opportunistic species seem to be more affected by environmental factors than by fishing effort. Simultaneously, research has been conducted by social scientists to investigate traditional management measures, aiming to understand the holistic approach taken by fishers. "Fishing accords" and "lake reserves" are intended to regulate the use of fishing grounds, particularly lakes, implement zoning systems, seasonal closures and/or gear restrictions, primarily in floodplain lakes. The problematic aspects of these management measures is that floodplain communities are dividing among themselves the right to use the resource, excluding outside fishers, frequently from nearby urban centers. Officially, federal law regulates fishing activity on the basis of measures such as prohibition of fishing during spawning migrations, limits on mesh sizes and minimum sizes. This great variety of direct measures should be enforced through inspection at landing points or in local markets. Landing places in the Amazon, however, are very numerous, so effective control is not possible! With regards to the community-based management one relevant question is how to evaluate the success of the measures. A comparison of fishing productivity in two lakes near the city of Santarém, one with a community-based management regime and the other without, demonstrated that the managed lake was approximately twice as productive as the unmanaged lake. Nevertheless, community based management also has problems, and frequently causes new conflicts both between community members and between the community and outsiders. Until recently, fisheries management in the Middle Amazon has been conducted by the government in the conventional centralized manner. However, as a consequence of the growing support for participatory approaches, the official concept of fishery management in the Amazon is changing, and fishing accords are now considered as potentially "legalizable". We propose a new management model in which fishers, scientists and fisheries administrators jointly manage the resource.

INTRODUCTION

The development of the Amazon over the last thirty years has been characterized by a high rate of demographic growth and the acceleration of extractive activities, especially logging, fishing, and hunting, combined with deforestation for farming and ranching. However, traditional extractivism and farming on the floodplain are in crisis, threatening the economic base of the Middle Amazonian floodplain population (McGrath et al. 1993). These changes have caused floodplain smallholders to become increasingly dependent on fishing for both cash income and to supply basic subsistence needs (Furtado 1988).

Amazonian fisheries have the characteristics of a typical tropical artisanal fishery in the initial stages of development. A great variety of species are captured utilizing a diversity of gear

types, ranging from the bow and arrow to purse seines. While the total catch may not be significant when compared to Brazil's industrial marine fisheries, Amazonian fisheries do involve a large number of people and play an important role in the local diet and regional economy (Isaac & Barthem 1995). Fish is still the major source of animal protein for the floodplain population, with fish consumption in the range of 300 to 500g/person/day (Cerdeira et al. 1997; Batista et al., in press).

The lack of scientific information on amazonian fisheries and the uncontrolled increase in fishing effort are due to the vacuum in regional fisheries management policies. It is only in the last four to five years that research projects have begun to systematically generate data on effort, catch and the biology of fish stocks, as well as on economic and social aspects of conflicts within the fishery. This kind of information provides a basis for the formulation of new management strategies. At the same time, enforcement of existing fisheries regulations has been minimal, based on scientifically unsupported assumptions, and consisting mostly of sporadic, isolated efforts by regional government agencies. Largely as a result of this management vacuum, floodplain communities have taken the initiative to protect their rights to local fisheries, taking control of local lakes and imposing rules to control local fishing activity. Largely as a consequence of these changes, the growing scientific base, and expanding grassroots movement in support of community based management, government fisheries policies is beginning to change from the technocentric approach which has characterized Brazilian fisheries policy to a more decentralized and participatory approach to fisheries management.

This paper examines the development of this integrated, multidisciplinary approach to fishery management in the Middle Amazon, as a result of the work of government agencies, floodplain communities, fishers unions, non governmental organizations and scientific research institutions.

RESULTS

History of the social movement of fishers in the State of Pará

While there are similarities between the community lake management movement and other organized grassroots movements in the Amazon, such as that of rubber tappers and "sem terra" (the landless), the diversity of types of fishers, including both itinerant and sedentary commercial fishers and various degrees of subsistence fishers, and the consequent diversity of interests among fishers as a class, has complicated efforts to organize fishers around a common set of objectives. In fact, to a large extent the community lake management movement represents one side of a basic conflict between two major groups of fishers, larger scale itinerant commercial fishers, and smaller-scale sedentary, commercial and subsistence fishers.

Institutionally, fishers are organized in so called "fishers colonies" (Colônias de Pescadores). Since colonial times the government has made sporadic attempts to control this professional category. The first "colonies" were founded in 1919 by the military with the primary objective of organizing fishers to contribute to a coastal defense system, rather than to defend their own economic and social interests. Like Brazilian unions, Colonias have jurisdictions which correspond to municipal boundaries. However, to a greater degree than other rural unions, they

have traditionally been closely controlled by federal government agencies and Colonia leadership has, until fairly recently, been appointed by municipal politicians or federal government officials (Campos, 1993).

In the early 1980's a broadly based pro-democracy movement developed in opposition to the military dictatorship, largely through the support of organisations linked to the catholic church (Schoenenberg, 1994). The best known in rural Amazonia, the CPT (Pastoral Land Commission) has been the starting point for almost every progressive political and social movement existing today. In the case of middle Amazonian fishers, two other church-related organisations, the CPP (Pastoral Fishers Commission) and especially FASE (Federação de Órgãos para Assistência Social e Educacional), played critical roles in developing local leadership and organising fishers to take over municipal Colonias. By 1985, a national movement had been formed, called "the Fishers Constitution", which successfully fought for constitutional guarantees on the right to organise and the political autonomy of fishers' unions (Campos, 1993).

Since the transition to a more democratic system, fishers unions have become more representative. Although the political loyalties of local leaders still has some influence on the choice of candidates, community representation has gained considerable space. On the other hand, formal participation and representation of fishers in their respective unions remains quite low: in the State of Pará, approximately 1,2 million people depend on fishing, of which about 200.000 are active fishers (Ruffino, in press). However, only 20 to 30% of this number are formally registered as union members. At the same time, Colonia membership is not restricted to professional or even active fishers, so that participation of professional fishers in the Colônia is even lower than this figure would suggest. This situation is comparable to that for organizations representing other rural amazonian populations such as peasants, and rubber tappers.

Recently, an increase in the availability of government social benefits, such as 3-month unemployment benefits during the closed season, retirement and health benefits, combined with the eligibility requirement of Colônia membership, have stimulated additional registration. These are essentially changes in bureaucratic functions, however, of little to the relevance of management of the fishery itself. In this regard, the development of community-based, management oriented institutions, a result of the broad collaboration between formal and informal institutions at the local level, is of more direct importance. Here, the developing regional fisheries councils (Conselhos Regionais de Pesca), inter-community councils responsible for managing individual floodplain lake systems, is the basic element of the emerging participatory management model for regional fisheries.

Description of the Fisheries

Fishing activity in the Middle Amazon can be characterized according to fishing capacity, target species and fishing technology (Isaac et al. 1996). The main commercial fishery has greater productivity and fishing capacity, using large, drifting, and fixed gill nets and longlines. This fishery concentrates primarily on stocks of migratory catfish (*Brachyplatystoma flavicans*, *B. filamentosum*, *B. vaillantii*, *Pseudoplatystoma fasciatus*, *P. tigrinus*, etc) in the main river channels during the dry season (September-October). During the offseason, these fishers shift to

floodplain lakes where they concentrate on the small catfish 'mapara', *Hypopthalmus* spp. This commercial catch is sold to freezing plants and destined principally for consumption in other states.

A less professionalized and smaller-scale fishery is practiced by floodplain residents of the region. They catch mainly sedentary species such as the tucunaré-*Cichla* spp., pirarucu-*Arapaima gigas*, and pescada-*Pagioscion* spp, or those species which use lakes as trophic habitat during a part of their lifecycle, such as the characin tambaqui-*Colossoma macroponum*. Using smaller scale and less efficient gear, they exploit the lakes and local channels of the floodplain near their homes. Most of the fish derived from this lake fishery is either consumed by the household or sold in regional markets for local consumption.

Total landings for the four principal towns of the Middle Amazon (Santarém, Alenquer, Óbidos and Monte Alegre; Figure 1) vary from 4.000 to 6.000 tons per year, obtained from a 500 km stretch of the river and its marginal floodplain. Fish prices in the region averaged US\$ 1/kg, resulting in a total regional income for fishers of about USD 4.000.000 to USD 6.000.000/year. These estimates do not include the subsistence portion of the total catch, which as noted above is significant.

Conventional single-stock assessment of some commercially important fish species has been undertaken in recent years, most using length-based methods and growth and mortality parameters. Results indicate that large, slow growing species such as the tambaqui, *Colossoma macroponum* (Isaac & Ruffino, 1996), the surubim, *Pseudoplatystoma tigrinum*, *Pseudoplatystoma fasciatum*, (Isaac & Ruffino, 1997), dourada, *Brachyplatystoma flavicans* (Isaac et al. 1998), piramutaba, *Brachyplatystoma vaillantii* (Barthem 1990, Barthem & Petrere Jr. 1995), and probably the pirarucu, *Arapaima gigas* (Neves, 1995; Isaac et al. 1998) are overexploited. On the other hand, for species with more opportunistic ("r") life strategies, such as the pescada, (*Plagioscion* spp), it seems that environmental factors, such as the velocity and intensity of floods, explain the success or failure of recruitment, and consequently the total catch, better than the intensity of fishing effort (Annibal 1982; Merona, 1993). Many authors argue that other impacts of human activity such as the construction of hydroelectric dams, deforestation of the margins of rivers and lakes, and pollution by heavy metals have a more devastating effect than fishing activity itself, which in general can still be considered fairly moderate when one takes into account the great diversity of Amazonian fishes (Goulding 1983; Bayley & Petrere 1989; Pfeiffer et al. 1990; Leite 1993; Ribeiro et al. 1995).

Fisheries Regulations

Considering the enormous distances between fishing grounds and urban centers, the communication difficulties, the lack of sufficient staff to enforce regulations and the complexity of the fishery systems, a relevant question is: How to put the knowledge gained by stock assessment to use in practical and efficient regulatory strategies?

Brazilian legislation regulates fishing activity in the Amazon basin on the basis of conventional instruments such as the prohibition of fishing during reproductive migrations, limits on mesh size, minimum sizes, and the prohibition of especially noxious gear such as explosives and

poisons, (Isaac et al. 1993, Isaac & Barthem 1995).

Based on the results of recent biological studies (Ruffino & Isaac 1995; Isaac & Ruffino 1997) and the application of a yield per recruit model (Isaac et al. 1998), the legislation regulating fisheries has begun to be simplified and systematized, correcting inconsistencies and eliminating unnecessary measures. Presently, legislation regulating the minimum size of capture exists for only four species: *Arapaima gigas*, *Pseudoplatystoma tigrinus*, *P. fasciatus* and *Colossoma macroponum*. In addition, fishing for certain species of characins is prohibited during the period of upstream reproductive migration, December through February. There are also restrictions on the number of vessels and the mesh size used in the trawl fishery of piramutaba (*Brachyplatystoma vaillantii*) in the estuary of Amazon river. Despite these regulations, enforcement remains a difficult task and consequently most of these norms are not respected.

Management of the Fisheries

Fisheries management in the Middle Amazon has been highly ineffective, not just because of the way management policy has been implemented, but because of conceptual problems with the whole approach to fisheries management. The federal government has been responsible for all aspects of management formation and implementation, including the definition of policy goals, the institution of decrees to conserve fish populations, the monitoring of stocks, and the control and enforcement of the measures to achieve policy objectives. In this technocratic model, it is obvious that the government agencies have neither sufficient personnel, nor resources, to successfully accomplish these tasks, particularly to enforce compliance and insure management control of Amazonian fisheries.

Due to the resulting decline in fishing productivity and the absence of government regulatory authority, fishing conflicts have proliferated. These conflicts include gear burning, personal violence and even armed confrontations. Most of the conflicts occur in the lakes. In most cases local fishers, who live around lake margins, confront outside fishers, who typically utilize larger-scale gear. To defend their fishing grounds, which they consider community property, many floodplain communities have begun to develop and implement management systems to reduce or control fishing pressure.

Rules regulating fishing activity are usually defined in regional meetings involving representatives of communities which share the same lake system, and usually take place without the participation of the state. In some cases, municipal fishers unions have taken an active role in support of these community management initiatives. In others cases, where Colônias are dominated by itinerant commercial fishers, Colônias have tended to oppose community lake management initiatives, which they rightly see as a threat to their interests.

A variety of different measures can be employed in the accords. Frequently, the lake system is divided into zones based on the kind of use permitted (no fishing, subsistence, or commercial fishing). Local fishers may also restrict access to the lakes to surrounding communities, prohibiting access to those from other areas. In other cases, specific gear types, such as gillnets, are prohibited, either permanently or seasonally. Another measure concentrates on storage capacity and may involve restrictions on use of ice or limitations on the size of ice

boxes.

Enforcement of community rules is undertaken by local residents, and varies considerably in effectiveness. Due both to the imposition of rules, and frequently to the lack of community organizational experience in dealing with conflictive situations, fishing accords, which were created to reduce conflicts, may actually lead to higher levels of conflicts between floodplain communities and outside fishers. In these cases, the intervention of local governmental authorities is often thought to both legitimize accords and mediate conflicts.

Institutional support

Until recently, lake fishing accords were regarded with distrust by government management agencies, because they represent a questioning of government authority. Nevertheless, as a consequence of the increased frequency of fishing conflicts, on the one hand, and the efforts of intervention-oriented research and development projects working in the region, on the other, the federal environmental agency responsible for fisheries management (IBAMA), has come to realize that a participatory approach to fisheries management may be the most effective way to manage Amazonian fisheries. The first step in this direction was the implementation by IBAMA of the River Basin Management Program (Fischer et al. 1992). This proposal specified that regional policies should use the basin as the basic management unit and not federal units such as states. One result of this program has been the organization of a variety of regional institutions to assume responsibility for policy formulation and implementations for each basin. As of 1996 these regional environmental agencies have obtained increasing independence to formulate fishing regulations.

Recognition of community based management initiatives by IBAMA fisheries managers has followed a parallel course. An internal document was circulated by IBAMA in 1997, which considers fishing accords as potentially "legalizable", and defines criteria for their integration into the existing formal regulatory framework. This approach prohibits the establishment of accords which exclude outsiders, but promotes the adoption of measures which must be respected by both local and outside fishers, such as gear and seasonal restrictions, or even upper limits in the capacity of fishing boats. At the same time, considerable effort is being made to make communities aware of the fact that fishing accords must comply with existing legislation, conserving the resource, but without excluding some or privileging others. This new approach is based on the supposition that sustainability is possible if the resource is managed as a common property resource, involving all local fishers and not as a resource for exclusive use.

In the last few months various communities have organized meetings and created Regional Fishing Councils with the objective of formulating rules for local lake fisheries. In May 1998 a meeting of the First Municipal Fisheries Forum was held in the middle Amazonian town of Monte Alegre. Virtually, all the key stakeholding groups, including fishers, unions, communities, and representatives of municipal, state and federal government were represented. Together these groups defined rules to manage the fisheries of lake Monte Alegre, a great complex of floodplain lakes covering more than 50,000 ha (Figure 1), with a population of approximately 8,000 inhabitants, approximately 20 % of whom are fishers. Proposed regulations include measures for fishing as well as other aspects of the lake environment. With regard to lake fisheries, the

proposal includes a closed season, gear regulations, zoning of use and the prohibition of boats of with a storage capacity exceeding five tons. To preserve habitat, it is proposed that buffalo be removed from lands surrounding the lake and lake margins be reforested with fruits and other native tree species.

In addition, user group participation should not be limited to choice of regulatory mechanisms but, equally important, involve participation in enforcement. Towards this end, community enforcement agents are being trained in basic concepts of ecology and fisheries legislation that they can perform their functions as monitors of the regulations which are to be implemented.

DISCUSSION

It is evident that the implantation of measures to regulate Amazonian fisheries, is a difficult task. However, there is consensus around the idea that any management policy can only be successful, even if created and implemented by the government, if it has the active participation of those who use the resource. The lack of user-group participation in the process of planning and monitoring management, traditionally undertaken by the state, has been a major factor in the lack of compliance with existing regulations. Community management initiatives are to a large extent a response to their lack of participation in the formal process. Through these fishing accords civil society is developing an alternative to the conventional management model and at the same time, regulating fishing activity so as to address community management objectives.

Despite considerable promise, the management regimes proposed by floodplain communities still face some critical issues of both a practical and conceptual nature.

With regard to the practical issues, the first question is whether restrictions of gear, area, season, etc. are sufficient to efficiently manage the resource. Is it necessary to restrict the effort, by limiting use rights to a restricted number of fisher? If yes, what should the "rest" of fishers do?

This leads to another important question: how to evaluate the success of such lake management systems? How to predict the effects of regulatory measures on both the natural and the social environment? A comparison of fishing productivity in two lake systems near the city of Santarém, one with a system of community management and the other without it, demonstrated that the managed lake was approximately twice as productive as the unmanaged lake for all gear types used in common (McGrath et al. 1994). However, total catch per fisher in the managed lake was almost half that in the unmanaged lake. Much additional information is needed before the value of this kind of trade-off can be satisfactorily assessed. New methodologies using multivariate statistic are being applied in the analysis of artesanal fisheries elsewhere in the world, with the aim of obtaining indicators of the success of accords (Preikshot & Pauly, 1998). We are trying to develop similar indicators for Middle Amazon lake fisheries.

A third question is the monitoring and evaluation of community management systems. Collection of community level data for monitoring lake fisheries is also virtually nonexistent. This is another traditional responsibility of the federal government in which community participation is

urgently needed to insure user group involvement in all stages of the process of management.

A fourth question is the efficacy of the lake reserve model for the management of fish stocks, though little studied, since many commercially important species have complex migratory cycles, and use a variety of environments over the course of their lives; some of which would be protected by lake reserves and others not. It seems evident that it will be necessary to manage migratory species on a macro-regional perspective, and that community management will be most effective at a smaller geographic scale. Other kinds of policy and technical measures will be needed to adequately protect large, migratory species.

A final issue is the capacity of communities to enforce management rules. Enforcement is typically easiest when infractions involve outside fishers, and far more complicated for controlling members of the community itself. This problem is exacerbated when community rules do not achieve maximum support among the community members, due to lack of unity and consensus. Despite these concerns, community-based management seems to be a promising direction in the search for more effective management strategies for Middle Amazon fisheries.

At the conceptual level a number of other questions must be evaluated. The conventional, centralized model for Brazilian fisheries management was based on three assumptions: i) water resources are public domain and should be accessible for any citizen; ii) user groups are not capable of managing the resource without the supervision and control of the State, and; iii) the maximum sustainable yield of each resource can be estimated through scientific methods.

These assumptions are, however, problematic. First, because the government is not able to effectively regulate regional fisheries and the system is transformed in an "open access" de facto, which means, in this case, without control. Second, most government agencies assume that fishers are unable to control pressure and protect the resource from excessive exploitation (McGoodwin, 1990). However, the characteristics of the fisher communities of the Middle Amazon várzea, with strong social control and low numbers of inhabitants, could facilitate the development of enhanced community management, because mutual monitoring, which is one of the basic conditions for the success of the initiatives (Pinkerton, 1994), would be fairly easy. In this way a combined system, with shared responsibilities and clear limits on the use of resources should be a better option for the region.

The third issue is the inherent complexity of aquatic fisheries. Fisheries science and the classic methods for estimating optimal or sustainable yield are marked by uncertainty. This is a consequence of the variability of natural and social phenomena. The sources of uncertainty are not always predictable and in many cases constitute "surprises" in models (Hillborn & Walters 1992). Sophisticated and data intensive methods have been developed to improve predictions and consequently management (Funk, 1998), but these are mainly for well developed temperate fisheries systems. Unfortunately, the management of Amazonian fisheries cannot wait for the development of such complex models, especially when one considers the long time series of data needed.

Another conceptual question is that conventional fishery management strategies concentrate on the fish stock and its capacity to recover from catch removal, and rely on

characteristic mortality and growth rates to calibrate measures. However, the preservation of floodplain habitat is an important factor in the maintenance of fish abundance. Freshwater fishes are extremely sensitive to habitat modification (Welcomme, 1985). This is especially so for Amazonian floodplain fisheries in which the long slow rise and fall of water levels have enabled many species to adapt to take advantage of conditions during each phase of the cycle. The floodplains provide food for fish growth, habitats for reproduction and refuges to protect against predators (Junk 1983a & b, Goulding 1983; Bayley & Petrere 1989, Petrere 1989). On the Amazon floodplain, the principal cause of environmental transformations is associated with powerful economic interests (ranchers and loggers), which are generally unconcerned with the interests of local population. In the development of a new management perspective, the environment, the fish and the fishers should be considered as a unit, whose integration constitutes a fundamental element for the maintenance of the resource.

CONCLUSION

In conclusion, practical necessity is imposing a system of resource evaluation which involves the combination of theoretical and empirical models, conventional and alternative, and the development of multidisciplinary approaches. Towards this end, we are working to develop such a multidisciplinary approach which takes into account both the results of the application of classic stock assessment methods, as well as, a more socially-oriented approach derived from the experience and perceptions of fishing communities and grassroots fisheries organizations. Work now concentrates on different aspects of this approach as implanting measures for monitoring the process, as well as on strengthening grassroots fisheries organizations so that they will be prepared to assume increasing responsibility in the process of developing a co-management regime. Thus, in spite of the fact that communities are not yet permitted to impose sanctions on infractors, the recognition of fishing accords signifies an important landmark in the history of Brazilian fisheries management. It denotes an important trend away from the dominant technocrat paradigm towards a cooperative management model in which government managers and users groups cooperate in developing management strategies for amazon fisheries at local and regional levels.

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Figure 1 - Map of the Middle Amazon

Figure 2 - New Management Model



