

REPORT

Case analyses on experiences of formalization of informal sectors

Development of a formal co-management system for floodplain fisheries in the Lower Amazon Region of Brazil

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Center for International Forestry Research
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Report

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Reports

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Executive summary

Introduction

A major trend in the global trade in tropical forest products is the implementation of importation policies to promote the sustainable management of natural resources in the countries of origin. In many cases, efforts to ensure sustainable origins involve requirements that small-scale rural producers and managers cannot meet. These agro-extractivist groups are often only partially integrated into the formal economy. Many lack the basic documents required to engage the government bureaucracy, and most production, local processing and marketing take place through informal channels that are outside government regulatory frameworks. This is especially true of small-scale extractive activities such as artisanal fisheries in developing countries.

This paper examines the process of formalization of artisanal fisheries in the Brazilian Amazon. This case study is organized into two sections. The first section traces the evolution of fisheries policies and institutions at the federal level with a focus on the development of policies and institutional arrangement the co-management of Amazon artisanal fisheries and provision of government social services and benefits. The second presents the findings of three case studies. The first case study examines development of policies and institutions for management of artisanal fisheries in the state of Pará. The second case study examines the parallel processes of formalization in the neighboring state of Amazonas. The third case study examines development of a regulatory framework for the community-based management of the pirarucu, *Arapaima gigas*, a major commercial fish species. The last chapter summarizes the main findings and presents the main recommendations of this case study.

Background: Development of federal policies and institutional arrangements for artisanal fisheries

The development of a modern government fisheries sector began in the mid-1960s when the Superintendency for Development of Fisheries (SUDEPE) was created and the first comprehensive legislation for the fisheries sector, known as the Fisheries Code, was implemented (Código da Pesca 1967). However, this case study focuses on changes beginning in the early 1990s when the two parallel processes of policy development were initiated, one involving development of co-management policies and institutional arrangements for Amazon artisanal fisheries and the other provision of government services and benefits for artisanal fishers. While these processes were completely independent, they address two key aspects of the formalization of Amazon fisheries.

Co-management system for floodplain fisheries

The construction of a formal fisheries co-management policy was in response to the proliferation of fisheries conflicts in the 1980s and the growing number of informal community agreements to define rules for access to and use of local lake fisheries. In the early 1990s the Instituto Brasileiro de Meio Ambiente e Recursos Renováveis (IBAMA) with support of the GTZ¹ implemented the Iara

1 Renamed GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Project in Santarém, Pará, to develop co-management policies and institutions for floodplain fisheries. Around the same time World Wildlife Fund initiated funding of a community-based fisheries co-management project with similar objectives, one of several major floodplain community management initiatives that began in the same period. Over the next 10–12 years a policy and institutional framework for co-management of floodplain fisheries was developed.

In the first half of the decade IBAMA (Instituto Brasileiro de Meio Ambiente e Recursos Renováveis) and collaborating institutions worked out a basis for legal recognition of community fishing agreements. A draft document was circulated in 1997 that defined criteria and procedures for the formal recognition of community fishing agreements. At the same time, institutional arrangements for co-management were also defined. Regional Fisheries Management Councils were created that were composed of elected representatives of all the communities surrounding a given floodplain lake system. These Councils were responsible for drafting community fishing agreements in collaboration with participating communities and submitting the proposed agreement to IBAMA for evaluation, and, if approved, transformation into an administrative decree (Portaria and later Instrução Normativa). The Councils were responsible for implementing and monitoring the agreement and collaborating with IBAMA to enforce it. In addition, IBAMA passed legislation creating the position of Volunteer Environmental Agent (VEA), and instituted a program to train members of communities with formal fishing agreements as VEAs. These VEAs were responsible for educating community members and other fishers regarding fishing regulations and organizing the community to conduct regular patrols to monitor local fishing activity. VEAs were given the authority to cite individuals who broke fishing rules but could not make arrests or confiscate equipment.

By 2001 the major components of a municipal level co-management system had been created covering the seven major lake systems of the Santarém floodplain, roughly 2600km². This municipal level co-management system included 180 communities of the floodplain and adjacent uplands, roughly 40 000 people. Several studies were undertaken in the early 2000s to evaluate the performance of the co-management system. A study by Almeida *et al.* (2004) compared fishing productivity in nine pairs of lakes, one managed and one unmanaged per pair. This study found that managed lake fisheries were 60% more productive, even though community-fishing practices were very similar. This study showed that for a large group of species, lake management can be very effective, and this conclusion has been confirmed by management experiments elsewhere along the Amazon.

Institutional structure and performance were more problematic. The criteria adopted by IBAMA for formalization of community fishing agreements had significant flaws. They prohibited communities from excluding outsiders and charging any kind of user fee. This means that while community members participate in lake management activities, including meetings, patrols and other activities, other people who do not participate in management activities but comply with the rules have the same right to fish in the lake. Furthermore, communities cannot charge user fees, which could compensate for management costs. Finally, government participation and leadership in monitoring and enforcing agreements was minimal. In effect, the co-management system shifted a large proportion of the cost of managing local fisheries to communities.

Integration of artisanal fishers into formal structure for government services and benefits

The second major process of formalization involved the implementation of government programs that provided strong incentives for fishers and their families to obtain the required government

documentation to make them eligible for government social benefits and transfer payments. The first consisted of a variety of programs providing payments to poor families of which the best known was the *Bolsa Escola*, a program that provided small cash payments to families for each child on condition that the child regularly attended school. Under the Labor Party, these programs were combined into one program, *Bolsa Família*, and greatly expanded to eventually reach a significant proportion of the rural and urban poor throughout Brazil. The second was the *Seguro Defeso* Program that provides unemployment payments to registered fishers for the 4 months of the closed season for commercial fishing. This program began in the early 1990s with the objective of encouraging commercial fishers to comply with the closed spawning season regulation. The requirements for qualifying for the program were greatly eased in 2003 and the number of fishers increased considerably. This program provided a strong incentive for artisanal fishers to register as professional fishers and become integrated into the formal institutional structure for fisheries administration.

After the election of the Workers' Party candidate, Luiz Inácio da Silva to the presidency, the institutional structure of fisheries administration underwent major structural changes. Key changes included the creation of an independent federal Secretary and later Ministry of Fisheries and Aquaculture (MPA) with a development orientation in contrast to the conservationist orientation of IBAMA. After some negotiation between IBAMA and the Ministry of Fisheries and Aquaculture, responsibility for fisheries management and state-level environmental licensing responsibilities was transferred to state secretaries of the environment. These changes caused considerable turmoil within the fisheries sector and disrupted the development of federal policies and institutional arrangements for co-management of artisanal fisheries. What progress has been made has been achieved by individual states.

Case study 1: Evolution of co-management policies and institutions in the state of Pará

In Pará the evolution of co-management is taking two distinct pathways. A state-wide process begun in 2002 by the Secretary of Science, Technology and Environment (SECTAM) and later continued under the Secretary of Fisheries and Aquaculture (SEPAq) and the state Secretary of Environment (SEMA) has concentrated on replicating IBAMA's federal co-management policy framework at the state level. Comprehensive law for fisheries and aquaculture was passed in 2005 and revised in 2006. This law provides for the co-management of community level fisheries and is based on the federal co-management policies developed by IBAMA. The major institutional change was the creation of a state SEPAq in 2006. However, little progress has been made thus far in implementing state-level policies for co-management of artisanal fisheries. A second process is underway in the Lower Amazon region of western Pará, where the original co-management system developed in collaboration with IBAMA has been integrated into the formal settlement policy adopted by the National Institute for Colonization and Agrarian Reform (INCRA) for the regularization of floodplain settlement and land tenure. This has resulted in a new settlement-based model distinct from the "collective agreements" model of IBAMA and the reserve-based model developed by the state of Amazonas.

In 2006 INCRA created some 41 Agro-extractive Settlement Projects (*Projeto de Assentamento Agro-extrativista*, PAE). The newly created PAEs included communities of the pre-existing Regional Fisheries Council Districts in the municipality of Santarém and clusters of floodplain communities throughout the *várzea* portions of the other seven Lower Amazon municipalities. *Instituto de Pesquisa Ambiental da Amazônia* (IPAM) worked with INCRA and the PAE communities to prepare

Utilization Plans that incorporate pre-existing fisheries, cattle grazing and other resource management agreements and to prepare settlement development plans based on the sustainable management of *várzea* resources. The PAE co-management system resolves the two structural problems of the co-management system developed under IBAMA. PAEs have exclusive rights to settlement fisheries and the right to charge user fees for fishing in PAE lakes. The problem of government support for monitoring and enforcement of PAE fishing management agreements continues to be a problem, however. Furthermore, despite the rhetoric, there is little evidence that the state government considers the modernization of artisanal fisheries to be a priority. This is surprising given the fact that the state's fisheries are one of the most important in the country and that it has the largest number of artisanal fishers.

Case study 2: Formalization of fisheries co-management in the state of Amazonas

The development of fisheries co-management in Amazonas was part of the same region-wide processes that led to the development of fisheries co-management policies in the state of Pará. However, there were important differences in how co-management policies have developed in each region, which can be attributed in large part to the broader conservation/sustainable development strategies adopted by each state. Pará has never adopted an overarching strategy of sustainable development while the previous two term governor made green development the centerpiece of an ambitious state-wide program of sustainable development based on the creation of a huge network of sustainable development reserves. Thus, while fisheries co-management in Amazonas has essentially the same origins as those of Pará, it has been largely incorporated into a reserve-based policy and institutional framework for environmental management and sustainable development.

The state of Amazonas has implemented a fairly comprehensive policy and institutional framework for the co-management of state fisheries within the context of the broader program for the conservation of biodiversity and sustainable development of natural resources within the state. Consequently, the fisheries program has a strong conservation orientation and is focused primarily, though not exclusively, on the network of state and also federal reserves. The high level of integration of fisheries into a broader state-wide program is evident in the annual report of the Secretary of Environment and Sustainable Development (SDS) that presents the results of the entire program for the year 2011 (SDS 2011). It is worth noting, though, that while the SDS has a greater presence than its counterpart in Pará, fisheries management suffers from the same problems of enforcement as Pará.

Case study 3: Development of a certifiable management system for the pirarucu

Perhaps the best example of the potential for developing management and marketing system that can provide the documentation needed to meet FLEGT²-like requirements is the management system and supporting policies now being developed for the pirarucu (*A. gigas*). The pirarucu is a large, commercially valuable species, which has been intensively exploited for at least 150 years. While populations are now quite depleted over much of its range, the pirarucu is well suited for

2 Forest Law Enforcement, Governance and Trade (FLEGT. http://www.euflegt.efi.int/portal/home/flegt_intro/).

community management. It is largely sedentary, breeds in floodplain lakes and must surface on a regular basis to gulp air.

In the late 1990s a community-based management system was developed at the Mamirauá Sustainable Development Reserve in Amazonas that involves trained teams of fishers making accurate estimates of the numbers of adult and juvenile individuals in a given lake. With this information community management teams can develop and implement management plans that establish quotas for the sustainable harvesting of fish while also enabling populations to recover. Between 1999 when the system was implemented in the Reserva de Desenvolvimento Sustentável Mamirauá and 2007, the adult pirarucu population almost tripled from 4500 to 12 000 individuals, while the number of fishers doubled from 40 to over 100. In the neighboring reserve of Maraã the managed pirarucu fishery increased from 50 fishers and a total catch of 5.5 tons/yr, to 510 fishers and a total catch of 119 tons between 2002 and 2009. The state of Amazonas has developed policies and institutional arrangements in support of the sustainable management of the pirarucu. As of the end of 2011 there were 13 management areas in the state with 2100 registered pirarucu fishers. Total production from nine state management areas was 721 tons in 2011. In contrast, the state of Pará has not implemented any measures to bring the pirarucu fishery under effective control, although a proposal for such a law was submitted to the governor in 2010. However, there is a major pirarucu management initiative underway in the Santarém region based on the approach developed in Mamirauá.

The community-based-management system for pirarucu is probably the most successful community management system currently utilized in the Amazon basin. It is also the most promising from the perspective of developing sustainable artisanal fisheries management systems that could meet the requirements of FLEGT-like import policies. However, a number of major barriers will have to be overcome before this potential can be realized.

Conclusions and recommendations

This report shows that significant, though variable, progress has been made in many key elements of the formalization process, including the construction of the basic legal and regulatory framework for the co-management of artisanal fisheries and the integration of fishers and their families into the formal economy. However, even in the state of Amazonas there is still a long way to go before artisanal fisheries are ready to meet the requirements of a FLEGT-type system (Elson 2008). None of the basic components of fisheries commodity chains from management and capture through to national and international markets can be completely documented. There is not yet a reliable government registry of artisanal fishers. The policy and institutional framework for monitoring and enforcing management regulations and ensuring the sustainability of local fisheries ranges from precarious to nonexistent. Finally, the market channels from fisher to fish processing plants and urban wholesale and retail markets, are largely outside the formal economy.

Furthermore, with the exception of the state of Amazonas, it seems that federal and state governments do not sufficiently appreciate the enormous productivity of healthy, sustainably managed fisheries, the critical role fish and fishing play in the incomes and food security of the rural and urban poor and the potential for well-managed fisheries to improve incomes and the quality of life of fisher peoples throughout the region.

A comprehensive program in support of the modernization of artisanal fishers is needed that implements policies, programs and institutional arrangements for: 1) the co-management of inland

and coastal fisheries, 2) the community-based management of floodplain lake fisheries, 3) programs to provide technical and organizational assistance, 4) improved and appropriate technology for capture, storage and processing of fish and fish products, 5) infrastructure for sustainable management and marketing of fish products, and 6) subsidized loan programs to enable fishers and fish communities to acquire the infrastructure, equipment and training they need to meet national and international hygiene requirements.

1. Introduction

A major trend in the global trade in tropical forest products is the implementation of importation policies to promote the sustainable management of natural resources in the countries of origin. In many cases, efforts to ensure sustainable origins involve requirements that small-scale rural producers and managers cannot meet. These agro-extractivist groups are often only partially integrated into the formal economy. Many lack the basic documents required to engage the government bureaucracy, and most production, local processing and marketing take place through informal channels that are outside government regulatory frameworks. This is especially true of small-scale extractive activities such as artisanal fisheries. They face four major problems: 1) community management systems rarely produce the verifiable information on the sustainability of resource use required by import regulations; 2) The small scale, diffuse and informal nature of local fisheries means that there is minimal documentation of origins and the networks through which products pass before entering formal markets; 3) extraction, storage and processing technologies rarely meet government sanitary requirements; and 4) government regulatory processes impose excruciating costs on those attempting to comply with bureaucratic requirements. Given this situation, importing countries' efforts to ensure the sustainable origins of products entering their markets are likely to have the unintended consequence of accelerating the exclusion of these community fisheries from access to all but local markets. Rather than helping artisanal fishers, these policies could simply contribute to their demise.

This paper examines the evolution of policies and institutional arrangements for the co-management³ of floodplain (or “várzea”) fisheries in the Brazilian Amazon involving floodplain communities and government management agencies, in order to evaluate the extent to which the ongoing process of formalization strengthens the ability of artisanal fishers to participate in national and international markets and meet FLEGT-type requirements. Three case studies are presented that illustrate different trajectories in the development of formal co-management systems in the Amazon (Fig. 1): 1) development of co-management policies and institutions for fisheries in the state of Pará, with a focus on the Lower Amazon region; 2) development of fisheries co-management policies in the state of Amazonas; and 3) the development of policies for the community-based management of the pirarucu (*Arapaima gigas*), an economically important species of fish endemic to Amazonia. These three case studies illustrate many of the problems as well as the potential of certification of artisanal fisheries as a means of ensuring the sustainable management of local fisheries and improving the quality of life of artisanal fishers, their families and communities.

3 Co-management refers to management systems in which user groups and government management agencies collaborate in defining, implementing, monitoring and, in some cases, enforcing regulations for access to and use of a natural resource.



Figure 1. Map of case study areas: states of Pará and Amazonas and Lower Amazon region of Pará (Source: Google Maps)

I. Background

2. History of fisheries sector: 1800–1990

Fisheries have played a central role in the Amazon economy since early in the colonial era, providing the major source of animal protein for rural and urban populations. While dried-salted fish, especially the pirarucu, known as the *bacalhau* or cod of the Amazon, have been exported from the Amazon for centuries, fish were more important as a regional trade good that traders and local merchants exchanged for forest products, such as rubber and Brazil nuts, sought by the export market (Veríssimo 1970; Weinstein 1983). For much of Amazon history commercially oriented fishing was quite seasonal, practiced more in the low-water season when fish migrate upstream in dense schools or become concentrated in lakes and channels that do not completely dry out as river waters recede. At this time of year, fishers would gather to catch fish on lake margins or on the shore of the river where schools of fish were passing. After salting and drying, the fish were traded to local merchants in exchange for a diverse range of manufactured goods including liquor, salt, sugar, flour, cloth, metal pots and pans, iron tools and guns and ammunition. For centuries floodplain fisheries helped to sustain a dynamic river-based economy in which dried fish, turtle meat and oil from turtle eggs helped to maintain extractive labor in headwater regions of the basin (Weinstein 1983).

This system began to undergo significant changes in the 1960s as a result of technological innovations resulting, in part, from government policies, as well as from broader changes in the Amazon economy (Meschkat 1960). Key technological innovations included the adoption of diesel engines, the introduction of synthetic fibers for nets and, with the construction of ice-making plants, the storage of fish in Styrofoam™-lined ice chests. These innovations enabled fishers to travel further, and catch and store larger amounts of fish (McGrath *et al.* 1993). At the same time government development policies were contributing to the rapid growth of Amazon cities and investments in processing plants exporting frozen fish to other parts of Brazil. These changes transformed Amazon fisheries from a seasonal activity involving the production of dried-salted fish to a year round activity providing fresh, iced fish to urban and export markets. In addition, these changes in Amazon fisheries led to the rise of a class of full-time professional fishers, known as *geleiros*, based in the main fishing ports and travelling increasingly longer distances to exploit fish stocks in floodplain lakes and the upper portions of tributary rivers (Goulding 1983, Smith 1985).

This trend in the modernization of Amazon fisheries was partially the result of parallel trends in the modernization of fisheries management. In the mid-1960s the *Superintendencia de Desenvolvimento da Pesca* (SUDEPE) was created with the mission of modernizing Amazon fisheries through investments to create a modern fish processing industry in Belém, modernize the fishing fleet and implement a scientific approach to fisheries management (BASA 1993, SUDEPE 1988). Fisheries engineering programs were created in federal universities to produce fisheries professionals trained in scientific management approaches and use of industrial fishing technology. However, the scientific management approach was only partially implemented, and largely focused on the industrial fisheries in the estuary. Upstream in the Amazon River system there was little or no investment in monitoring fishing activity or measuring fish catches. Consequently, there was little or no scientific basis for the new management regulations. A top-down government-centered management system was adopted in which commercial fishers had no input. At the same time the very limited governmental presence in the interior meant that there was in fact little or no regulation of fishing activity, and fisheries resources were therefore exploited according to informal local practice (Crampton *et al.* 2004).

Meanwhile, the intensification of commercial fisheries brought unprecedented pressure to bear on floodplain lake fisheries. Whereas in the past these fisheries were exploited on a seasonal basis by part time fishers from floodplain communities, who sold dried salted fish to local merchants and itinerant traders (known as *regatões*), now commercial fishers would enter floodplain lakes with teams of fishers to exploit local fisheries with little or no benefit to the local communities (McGrath *et al.* 1993). Concerned that local lake fisheries were being depleted, communities organized to prevent commercial fishers from entering lakes, resulting in the proliferation of fisheries conflicts throughout the basin. In some cases these confrontations escalated to armed conflict (Chapman 1989, Hartmann 1989, Junk 1984).

The growing conflict between floodplain communities and outside commercial fishers had its origins in broader regional social movements that gave rise to the Rubber Tapper and Forest People's Movement (Allegretti 1995, Hall 1997, McGrath 2000). This broader movement was to a large extent the product of efforts by Catholic Church Programs such as *Movimento Educacional de Base* (MEB) (Mainwaring 2004). These programs were heavily influenced by Liberation Theology, with its emphasis on community, the rights of the poor, subsistence rather than market orientation and, in the case of fisheries, preservation of nature. MEB and related Church programs transformed rural settlements into communities with a Catholic Church and community center, and also created community organizations including community governing councils, mothers' clubs, youth clubs, catechism groups and soccer clubs. MEB also invested heavily in developing rural leadership and a whole generation of rural labor leaders grew up, who had been trained by the Catholic Church in the 1970s and 1980s.

The work of Catholic Church organizations laid the foundations for the rural labor movements that developed in the 1980s (Esterci 2004, Mainwaring 2004). In the Amazon the best known of these movements was the Forest People's Movement uniting rubber tappers and indigenous groups (Allegretti 1995). While the Community Fishers' Movement was not as organized, it had its origins in the same Catholic Church-related organizations. Furthermore both the Forest People's and Lake Reserve Movements were a response of rural communities to forms of rural transformation that threatened their way of life, including the expansion of logging and ranching in the case of forest peoples and the modernization of commercial fisheries in the case of floodplain peoples (Lima 1999). Both movements led to the transformation of government policies regarding traditional peoples and the management of key forest and floodplain resources (McGrath 2000).

3. Fisher organizations

3.1. Colônia de Pescadores

The main formal organization of Brazilian fishers is the *Colônia de Pescadores* (Fishers' Colony). The *Colônia de Pescadores* is an institution that was created by the Brazilian Navy in 1917 (Campos 1993, Hurley 1933). The *Colônia* had both humanitarian and strategic objectives. From a humanitarian perspective, *Colônias* were created to provide fishers with access to basic health care and other government social services. From a strategic perspective, *Colônias* were created to enlist fishers in the monitoring of coastal waters, serving as a first line of defense against potential enemy ships and submarines. *Colônias* were traditionally led by local naval commanders or members of the local elite such as politically influential ranchers or merchants. In both cases *Colônias* were paternalistic organizations designed to serve the interests of the local elite rather than those of local fishers.

Municipal *Colônias* were integrated into state and federal organizations called *Federação de Pescadores* (Federation of Fishers or Fisheries Federation), which ostensibly had the mission of promoting fishers' interests at state and federal levels. These organizations were also firmly under the control of state and federal elite. In the Amazon these *Colônias*, in contrast to the Rural Labor Unions, were largely beyond the influence of the Catholic Church and related organizations committed to promoting social change, and played little or no part in grass roots movements.

This began to change in the 1980s as regional grassroots organizations began to make deliberate efforts to take over Rural Labor Unions and some *Colônias* (Leroy 1991). In 1984 a group of fisher leaders with support from FASE⁴ competed in elections and took over the *Santarém Colônia de Pescadores*, putting real fishers in leadership of the *Colônia* for the first time in its history. As a result, the *Santarém Colônia* was one of the few *Colônias* that played a leadership role in the regional lake reserve movement (Rocha *et al.* 1996).

Originally, the *Colônias* were outside the formal institutional structure of unions created during the Vargas era (1930–45). In the 1988 Constitution, however, the legal status of *Colônias* was changed to bring them into the formal government union structure so that today they are equivalent to the rural labor unions, which represent smallholders and agricultural laborers. In the past, membership in a *Colônia* was not required and access to government benefits was not conditional on *Colônia* membership. However, membership became mandatory with modifications to the Closed Season Unemployment Insurance Program, known as *Seguro Defeso*, implemented in 2003. In addition, the revised Aquaculture and Fisheries Law signed in 2009 gave *Colônias* the right to organize the marketing of their member's fish catch either directly or through cooperatives or other kinds of organizations (Brasil 2009).

3.2. Other fisher organizations

At the same time that social movements in some regions were seeking to take over *Colônias*, national efforts were underway to create an alternative institutional structure to replace the

4 Federação de órgãos de Assistência Social e Educacional. <http://www.fase.org.br/v2/>.

government-controlled Fisheries Federation⁵ system. This process led to the creation of MONAPE, *Movimento Nacional dos Pesadores Artesanais*. In Pará movement leaders created MOPEPA, the *Movimento dos Pescadores do Pará* (Campos 1993). MOPEPA was composed of representatives of those *Colônias* that were taken over by fishers involved in regional social movements. These organizations played an important role in promoting the interests of fishers at state and federal levels. This phase of revolutionary dynamism lasted into the early 1990s, but like most of the social movements of the Amazon, once political objectives were achieved they lost momentum. MONAPE was not able to replace the state and Federal Fisheries Federation structures, which continue to be “good old boy” organizations tied into state and local patronage networks, and today the two parallel institutional structures co-exist.

Important Church-related institutions involved in fisheries issues are the *Comissão Pastoral da Terra* (CPT) and the *Comissão Pastoral da Pesca* (CPP). The CPT was created by the Catholic Church to address primarily land tenure issues on the Amazon frontier. However, in the state of Amazonas, which was little affected by frontier expansion until recently, the CPT has been the lead organization in addressing fisheries conflicts and has promoted the Lake Preservation Movement (CPT 1992a & b). The CPP has played an important role in fisheries issues in northeast Pará but has had little involvement in fisheries issues in the Lower Amazon region until quite recently (Rocha *et al.* 1996).

3.3. The *Colônia de Pescadores* and the Closed Season Unemployment Benefits (*Seguro Defeso*) Program

One of the main national fisheries regulations is the Law for the *Defeso* (closed season), which requires that commercial fishing of key species be suspended during a 3–4 month spawning season, which in the Amazon is defined as extending from November 15 to February 28. This measure was rarely taken seriously in the Amazon because it coincided with the beginning of the flood season when fish populations dispersed in an expanding volume of water (Goulding 1983, Isaac *et al.* 1993). In 1991 the *Seguro Defeso* Program (Closed Season Unemployment Insurance) was created with two objectives: to protect mature fish during the spawning season and to compensate fishers for lost income as an incentive to respect the closed spawning season (Abdallah and Sumaila 2007, Brasil 1991, Teixeira and Abdallah 2005). Initially, to be eligible for the benefit a fisher had to have had his professional fisher’s license for at least 3 years, be registered with the Social Security Program and be up to date with monthly social security payments. The law did not require membership in the *Colônia*. In 2003, shortly after President Lula took office, the 1991 law was substituted by Law No. 10.779, of November 25, 2003, which changed some elements of the original law. It substituted the professional license issue the *Instituto Brasileiro de Meio Ambiente e Recursos Renováveis* (IBAMA) with one issued by the Secretary of Aquaculture and Fisheries (SEAP) and reduced from 3 to 1 year the period before a fisher was eligible to receive the *Defeso* insurance. Subsequently, fishers were required to be members of the *Colônia* of their municipality with their dues up to date. These changes facilitated access to *Defeso* insurance and strengthened the relationship between fishers and their municipal *Colônia*.

Initially, this program had limited impact because the requirements for eligibility were quite rigorous and few fishers were paid up on their *Colônia* dues and therefore eligible for the benefits. Consequently, the numbers of fishers receiving the benefit grew slowly. However, after the

5 Federação Nacional de Pescadores do Brasil.

government loosened requirements, the number of fishers receiving the benefit and the total volume of funding involved increased more rapidly, almost six fold between 2003 and 2008 and doubling between 2008 and 2011, so that by 2011 the total volume of payments to fishers in Brazil exceeded 1.2 billion reais (Fig. 2).

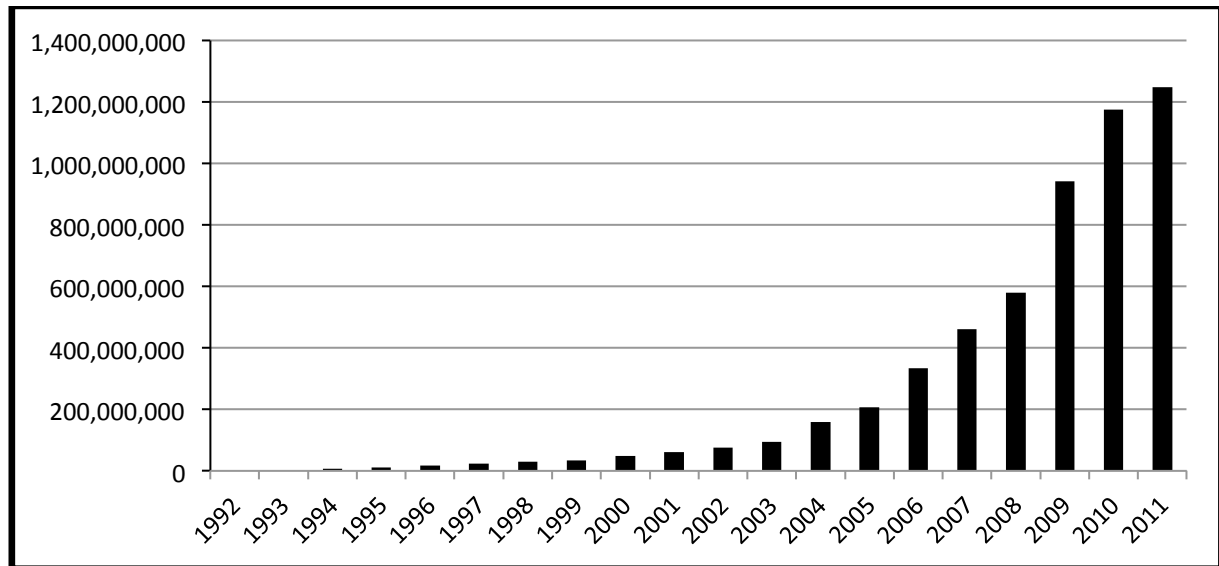


Figure 2. Evolution of payments to fishers under the *Defeso* Unemployment Insurance Law: 1992–2011

A similar trend is evident in the state of Pará where the number of beneficiaries increased from 14 032 in 2003, the last year of the original law, to 78 040 in 2007. The total value of benefits provided increased from 10.3 million reais in 2003 to 106.9 million in 2007. For comparison, this is equivalent to almost 50% of the estimated value of the combined catch of the artisanal and industrial fisheries in the state. In some regions of Pará, such as the Lower Amazon, the total volume of benefits is equivalent to almost two-thirds of the income generated by the fisheries sector (Fig. 3; McGrath *et al.* 2008b).

The *Seguro Defeso* Legislation, especially after it was modified in 2003 to loosen requirements and to require *Colônia* membership, has had an enormous and not entirely beneficial impact on Fisher *Colônias* throughout Brazil. The number of *Colônia* members began to grow in the 1990s, but growth was limited due to the combination of stricter requirements for eligibility but without requiring *Colônia* membership. In 2003, after more than 10 years, only 14 000 fishers received benefits in the state of Pará. This number doubled between 2003 and 2004. The *Santarém Colônia*, Z-20, grew from fewer than 2000 members in 1998 to almost 8000 members in 2004 (Amaral *et al.* 2006). Since the legislation required that members be up to date on their monthly dues to receive the *Defeso* payments, the revised legislation greatly increased *Colônia* income. On the one hand, the *Defeso* unemployment legislation strengthened *Colônia* membership and income by attracting more fishers. On the other hand, it transformed *Colônias* into service providers for the Ministry of Labor, responsible for the payments, since the *Colônias* had to prepare and submit each member's application. While the increase in administrative demands has forced *Colônias* to improve their administrative capacity, it has also shifted their focus from issues related to the status of the fishery to those involving access to government payments such as the *Defeso* unemployment insurance (McGrath *et al.* 2008b).

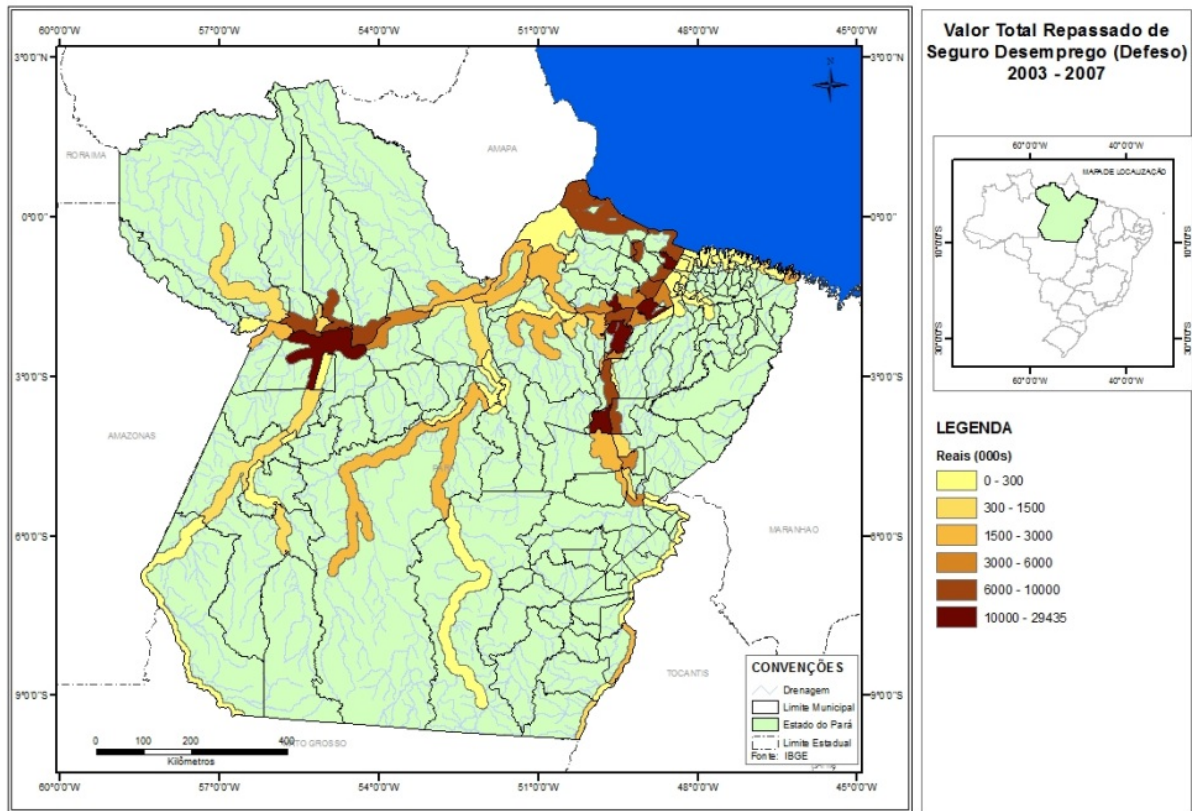


Figure 3. Distribution of Defeso unemployment insurance payments in the state of Pará: 2002–07. (Source: McGrath *et al* 2008b).

The experience with the *Defeso* has also revealed the fragility of *Colônia* administration. From the beginning the *Defeso* program has been plagued by accusations of corruption, and in particular allegations that people who were not fishers were receiving the benefit.⁶ In August 2008, the Ministry of Fisheries and Aquaculture (MPA) released a decree cancelling the registry of 3166 people in 23 *Colônias* in Pará because they were not fishers (MPA 2008). In the case of *Colônia* Z-36 of São Sebastião de Boa Vista, the registry of half the members of the *Colônia*, 1566 people, was cancelled. The Superintendent of the MPA in Pará, Sr. Carlos Alberto da Silva Leão, commented that in some *Colônias* in Pará criminal gangs had taken over administration of the *Defeso* Program and registered hundreds of individuals who were not fishers in return for half the payment. While Pará has the largest absolute number of cases of fraud, the problem affects *Colônias* throughout the country. The *Colônias'* administration of the *Defeso* Unemployment Program underscores the deep problems with *Colônias* and raises serious questions about the viability of using *Colônias* as the organizational vehicle for efforts to develop certifiable sustainable management systems for local level fisheries.

6 See, e.g. “Bolsa Pesca é paga sem controle pelo governo e usada até como moeda eleitoral,” <http://oglobo.globo.com/politica/bolsa-pesca-paga-sem-controle-pelo-governo-usada-ate-como-moeda-eleitoral-2744078#ixzz2AEY4ABF9>, accessed November 28, 2012.

4. Community fishing agreements

The evolution of a formal policy and institutional framework for the co-management of floodplain fisheries grew out of the conflicts between floodplain communities and more capitalized outside commercial fisheries. As previously mentioned, isolated conflicts occurred as early as the mid-1960s when the technological and commercial transformation of Amazonian fisheries began (Hartmann 1989). They increased in frequency in the 1970s and 1980s as the number of commercial fishers and market demand increased. The growth of regional grassroots movements inspired by Liberation theology, land conflicts and opposition to the military dictatorship also fueled fisheries conflicts, as community and inter-community organization was strengthened through the efforts of MEB and related educational programs. In addition, a decline in demand for jute, the mainstay of the *várzea* economy from the 1950s through the 1980s, led many floodplain residents to shift from commercial agriculture to commercial fishing, increasing dependence on local fisheries as a source of both income and subsistence. The added pressure on local fisheries exacerbated competition between local and outside fishers resulting in more and more conflicts over access to and control over local fisheries (Brabo 1981, McGrath *et al.* 1993).

4.1. Floodplain habitats, resource use and tenure rights

The Amazon floodplain or *várzea* varies considerably over its extent so that any description of the floodplain landscape must of necessity be restricted to a particular segment of the river. In the Lower Amazon the predominant features are the presence of large shallow lakes, ranging in size from a few hundred square meters to hundreds of square kilometers, and a vegetation cover that is 90% natural grasslands and 10% forest (McGrath *et al.* 2008a). The lakes are actually networks of lakes, varying in size and frequency of annual permanence. The resulting lake systems can cover large areas and have considerable spatial variability in environmental characteristics and resource abundance.

From the perspective of smallholder resource management, there is a horizontal zonation of habitats and resources, and associated patterns of settlement, economic activity and land tenure rights. Extending from the main river channel to the *terra firme* (literally “solid ground”, i.e. ground that does not regularly flood) shore we can distinguish four main habitat types: the major river channels, forested natural levees bordering these channels, permanent floodplain lakes that occupy much of the floodplain interior and seasonally inundated grasslands that cover the transitional zone between forested levees and permanent lakes (Fig. 4).

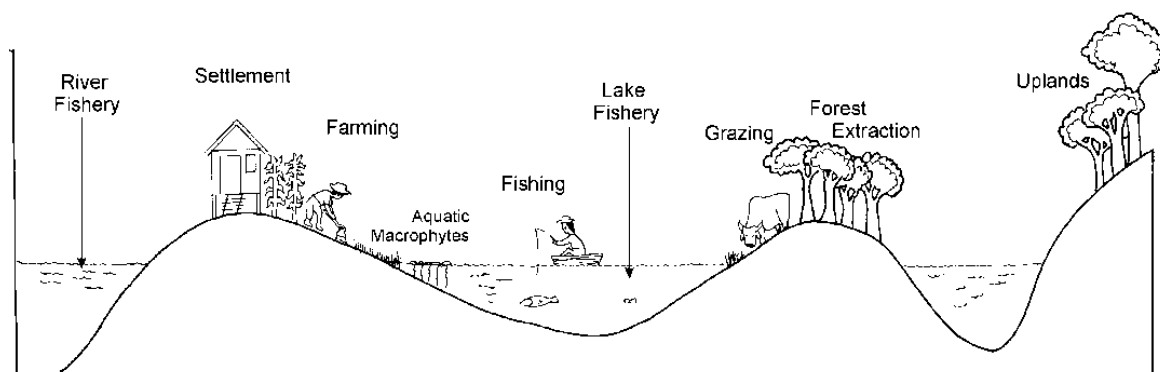


Figure 4. Habitats and economic activities of the Lower Amazon floodplain or *várzea*

Household economic strategies exploit the resources of each habitat type. Settlements are located on the levees and most annual and perennial crop production is also concentrated on these sites. Cattle are grazed on the seasonally inundated grasslands. Households fish in floodplain lakes and on a more seasonal basis in river channels. Properties are defined in terms of meters of frontage and extend inland to the lakes and canals that occupy the floodplain interior. This system gives each household access to all the main ecological zones as well as to the river (Fig. 5; McGrath *et al.* 2008a).

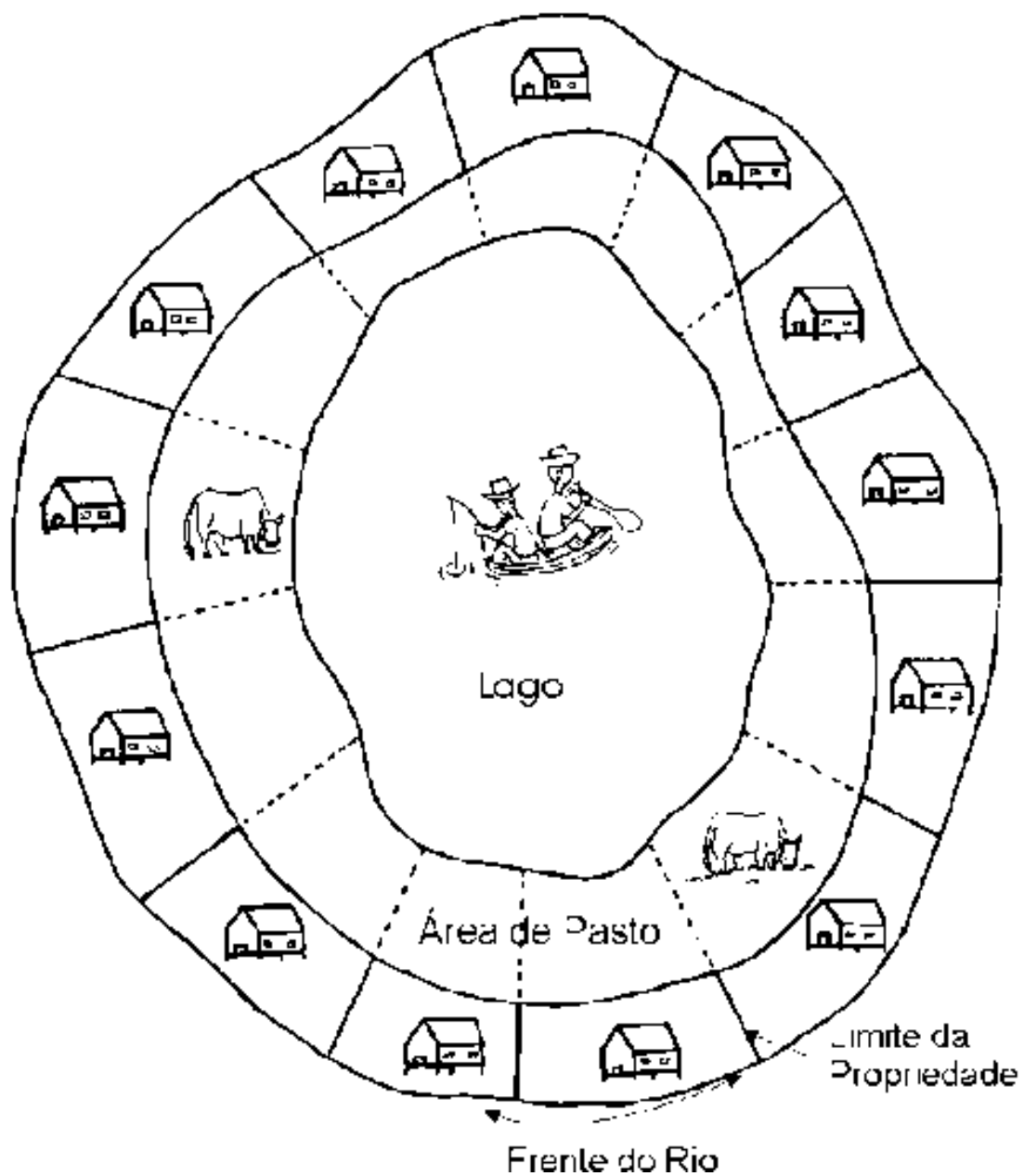


Figure 5. Principle zones of property rights on the Lower Amazon floodplain

Floodplain communities recognize a gradation in land tenure rights from individual to collective as one moves inland from the levee. Levee sites are considered to be individual property with lateral boundaries clearly marked and usually fenced. Individual tenure rights are more fluid in the seasonally inundated grasslands inland from the levee. Lateral boundaries, though recognized, are rarely fenced and cattle are allowed to move freely across properties in this zone. Lakes are considered to be collective property and individual rights are not recognized. However, the community bases its claims for ownership of neighboring lakes on the fact that community lands surround much of the lake. There are then two major floodplain commons, the seasonally inundated grasslands and the interior lake system. It should also be noted that the logic of the community's claim to rights over local lake fisheries is the same as that of ranchers who claim ownership of lands surrounding a floodplain lake system. These varied and potentially conflicting tenure rights are key elements in the evolution of the floodplain co-management system (Benatti 2005, McGrath *et al.* 1999).

4.2. Community lake management agreements

The co-management system developed out of the regional grassroots movement to take control over access and use of lake fisheries and limit commercial fishing pressure in lakes claimed by one or more communities (McGrath *et al.* 1993). While the original motivation was usually to exclude outside commercial fishers, it soon became evident that excluding outsiders was not sufficient and that it was also necessary to define rules for fishing by community members. Beginning in the early 1980s, floodplain communities throughout the region began developing collective fishing agreements, called *acordos de pesca*, to define rules of access and use of local lake fisheries (Castro 2000).

The general objective of fishing agreements is to control fishing pressure in local lake systems. They typically seek to achieve this objective indirectly by restricting the type of gear (e.g. fishing nets) that can be used, storage capacity and/or the sale of catch. Few, if any, of these agreements specify catch limits or minimum size requirements, measures that would be more difficult to enforce. While few agreements seek to prohibit commercial fishing entirely, many do seek to contain it. A central concern of floodplain fishers is to maintain the productivity of local fisheries at satisfactory levels with the gear they have. While the discourse is preservation and/or conservation, another underlying motive is to promote equal conditions of access to the resource (Almeida *et al.* 2009). Floodplain fishers typically engage in a number of economic activities, including annual cropping, small animal husbandry and cattle raising, and do not have either the time or the resources to compete with full-time commercial fishers (Castro and McGrath 2003, McGrath 2000).

A second important feature of fishing agreements is that, in contrast to conventional fisheries management policies, which seek to protect fish during the spawning season, most floodplain collective fishing agreements seek to restrict fishing effort during the low water season when fish are concentrated in smaller water bodies and vulnerable to overexploitation (Isaac *et al.* 1993). Fishers believe that the rising water levels that coincide with the spawning season provide species with adequate natural protection from fishing pressure. Typical measures during the low-water period include the prohibition of gill nets and in some cases restrictions on the sale of fish outside of the community. Flood season restrictions of fishing gear, on the other hand, are quite rare, and tend to be site specific (Castro and McGrath 2003).

Surprisingly, given the formal presentation of the agreement document itself, most original agreements are fairly sketchy on how monitoring and enforcement are to be organized (Castro and

McGrath 2003). Few contain instructions regarding who is responsible for and how these activities are to be carried out, and most of these refer vaguely to community members or leaders. Only the most recent agreements provide adequate information on how monitoring and enforcement are to be undertaken. Those that do address the question of sanctions frequently specify graduated punishments, progressing from verbal warnings for first offenders to seizure of gear and registration of complaints with IBAMA for those caught a second or third time. Frequently, gear are either held until the end of the closed season or turned over to the *Colônia* or to IBAMA.

5. Development of Amazon Fisheries co-management policy: 1990–2006

In the early 1990s IBAMA's Iara Project, a bilateral collaboration between the German and Brazilian governments began working with local non-governmental organizations (NGOs), the Municipal Fishers' Union and floodplain communities to develop a co-management system for regional fisheries that incorporated the collective fishing agreements described in the previous section into the formal structure of fisheries management (IBAMA 1995, McGrath *et al.* 2004). Integration of fishing accords into the formal institutional framework for fisheries management involved several steps whereby IBAMA moved from its initial position – i.e. that the collective fishing agreements were illegal – to one in which they have become a fundamental component of the new co-management system for Amazon fisheries. The construction of this co-management system had to deal with three major challenges in formalizing community fishing agreements, as follows:

1. While most communities had some form of elected leadership, very few had the capacity to actually organize and implement anything but isolated, short-term activities. Furthermore, with the exception of those areas where the Catholic Church and the Fishers' Union provided a regional organizational framework and leadership, there were no multi-community organizations to serve as the institutional base for fishing agreements. Both these organizations, however, had other priorities, organization of church activities in the first case, and more political, union-oriented activities in the second.
2. Communities have difficulty ensuring equitable representation in the process of defining and approving fishing agreements. Typically, interested individuals, who may or may not have been members of their respective community's leadership, initiated the process by inviting members of neighboring communities to a meeting to discuss creation of the fishing agreement. Through a series of such meetings a document was eventually produced that satisfied the participants. Those who were opposed to the fishing agreement tended not to participate in the process and therefore felt little obligation to comply with its regulations. Additionally, because opponents were typically the more commercially oriented fishers, the resulting fishing agreement was fatally flawed. Without exceptional resolve on the part of proponents, such agreements were likely to disintegrate if community members suspected that others were not complying.
3. As noted earlier, most collective fishing agreements did not describe in adequate detail procedures for organizing the monitoring of fishing agreements nor for judging those accused of infractions. Monitoring has tended to be haphazard with irregular patrols of lakes typically conducted by a few community members while the great majority have shirked their responsibilities. While such a system may be adequate for dealing with the occasional incursions of outsiders, it is problematic for dealing with situations where violators are members of the community. The informality and lack of representation of patrols and leadership left those apprehending violators vulnerable to the charge of bias and favoritism, clouding fundamental issues and calling into question the credibility of the whole endeavor. This is especially problematic in Amazonia where people are predisposed to assuming that others are dishonest and prone to favor their friends and relatives. While the structuring of Regional Fisheries Councils helped to inject a significant degree of institutional formality into the process of development and implementation, the absence of a legal basis for the developing system was a problem.

5.1. Formalization of fishing agreements

The first attempt at defining a co-management policy based on collective fishing agreements, was released as an internal memorandum in 1997. This memorandum specified criteria and procedures for the legal recognition of the agreements, making possible their transformation into formal fishing regulations via *portarias complementares*.⁷ Three criteria were especially relevant to the subsequent development of the co-management system: 1) the fishing agreement cannot specify who can and who cannot fish in a lake; 2) a collective fishing agreement must be proposed by an organization that represents all the communities located within a lake system's boundaries and that takes responsibility for implementing the accord once it is approved; and 3) no local organization can charge any type of fee for fishing in the lake. While only an internal memorandum, this document provided the basis for development of regional co-management systems based on collective fishing agreements.

To address the combined problems of organizational base and representation, efforts in Santarém focused on creating intercommunity councils for the major lake systems. Called Regional Fisheries Councils, they are composed of representatives of all the communities sharing a common lake system. These councils were created to take responsibility for organizing the process of defining, approving and implementing fishing accords for their respective lake systems. Through an iterative process in which proposals for a fishing accord are developed at the community level, taken to the Regional Council for discussion and development of a common proposal, evaluated and where necessary amended by participating communities, a definitive version is finally developed and approved by the Regional Council and participating communities. While this process does not guarantee adequate representation, it does ensure that all communities have roughly equal representation in developing the regional fishing accord and provides abundant opportunities for anyone to participate in the process.

Once a fishing accord becomes law, IBAMA is obligated to enforce it. However, merely legalizing the accord does not address the problems that have limited IBAMA's ability to enforce fisheries legislation, namely the lack of personnel, equipment and funds for maintaining an effective presence in the field. To resolve this problem IBAMA created the position of Volunteer Environmental Agent (VEA) (IBAMA 2001a, c, 2005). These agents are community members who receive training in environmental legislation and enforcement procedures and are responsible for monitoring local compliance with environmental regulations. They do not have the power to make arrests or confiscate equipment, but only to issue citations, which they subsequently turn over to IBAMA field agents who decide whether to pursue it or not (Fig. 6). IBAMA organized training courses for VEAs of regions that have legal fishing accords and certified those who successfully completed the program. Each community could choose one or two people to participate in the training.

7 This document served as the basis for the definitive *Instrução Normativa* published in January, 2003 (IBAMA 2003).

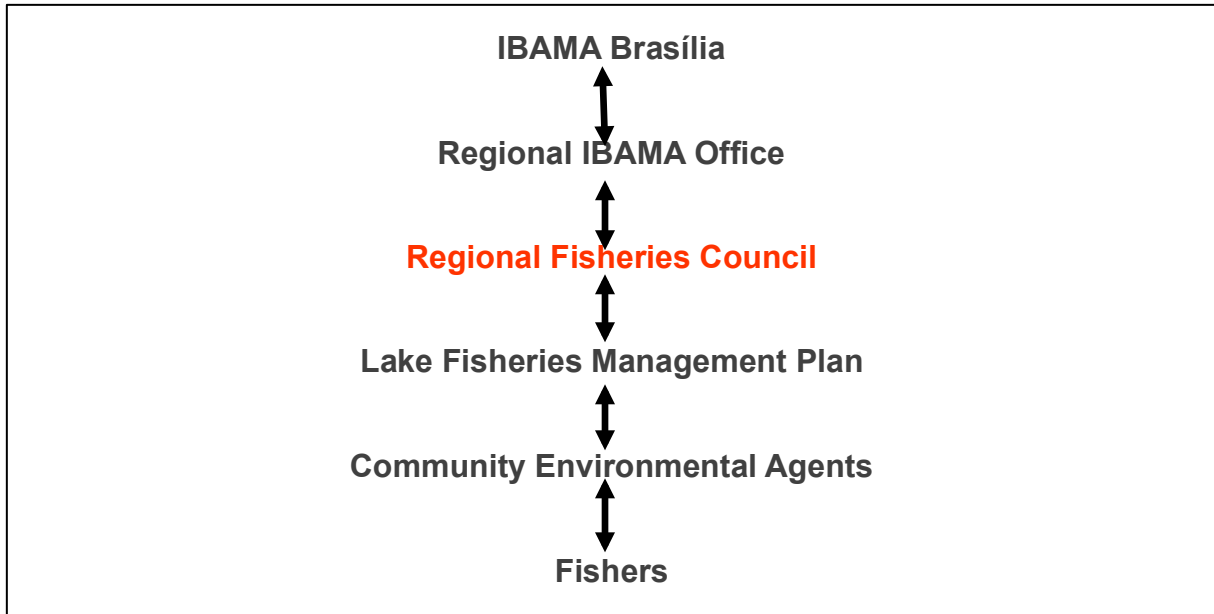


Figure 6. Institutional structure for fisheries co-management in Santarém

With the creation and training of the VEAs, the main components of the co-management system were now in place. The major lake systems of the floodplain in the Santarém area were transformed into Regional Fisheries Council districts, and the Fisheries Councils were composed of representatives of all the communities of a given lake system. The Council defined a fishing agreement that listed the management regulations and submitted the document to the regional IBAMA office. If the agreement met IBAMA’s criteria for approval it was forwarded to the national office in Brasília for final review, signed by the President of IBAMA and published in the official government registry as a complementary law valid for 1–3 years. Once the agreement became law, IBAMA would train VEAs who, after certification, assumed responsibility for working with community members to monitor compliance and organize regular patrols. When violators were apprehended, VEAs would issue citations and report the incident to IBAMA’s enforcement office, which would pursue the case as deemed appropriate.

By 2001 the basic elements of the regional fisheries co-management system had been constructed. Seven Regional Fisheries Councils (eight if the Santarém Urban Council is included) had been created covering some 2600 km² of Lower Amazon floodplain and including 180 communities and roughly 40 000 people (Fig. 7). With these changes a regional co-management system was created in which Regional Fisheries Councils formulate lake management agreements and submit them to IBAMA for evaluation. IBAMA evaluates the agreements and if approved transforms them into administrative decrees (*Instrução Normativa*). The Regional Fisheries Councils together with the VEAs are responsible for implementing fisheries agreements at the community level once approved by IBAMA.

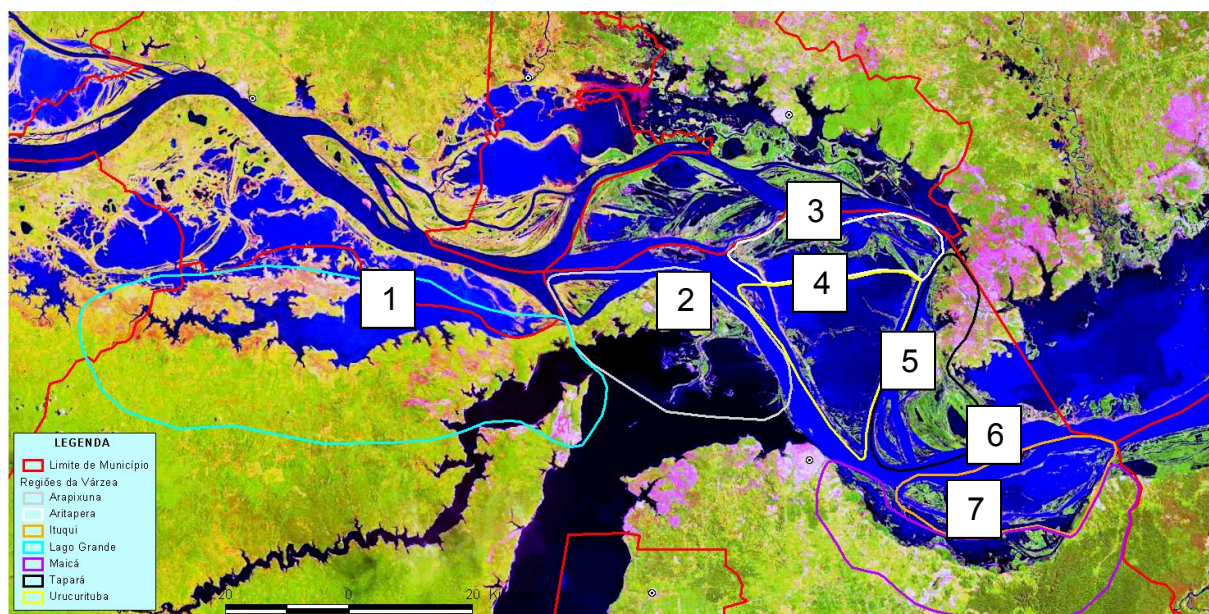


Figure 7. Municipal co-management system floodplain fisheries: 1997–2006

5.2. Evaluation of the performance of the co-management system

By 2002 the system had been functioning for several years and it was possible to evaluate its performance in terms of providing an effective system for sustainably managing fisheries, and in terms of its institutional sustainability efficiency and sustainability. Towards this end, several studies were conducted to evaluate the performance and impacts of the co-management system.

5.2.1 Ecological performance

Almeida (2006a) undertook a comparative study of fishing and fishing productivity (catch per unit effort, CPUE) in nine pairs of managed and unmanaged community lake fisheries. She found that while fishing activity in the two types of lakes was essentially the same, on average, fishing in managed lakes was 60% more productive. Since there was no significant difference in fishing activity between the members of each pair, the difference in productivity seemed to be due primarily to the exclusion of larger commercial fishing boats from managed lakes. Her results support the idea that lakes can be effective management units for floodplain fisheries and that fishing agreements can have a positive effect on floodplain fish populations, despite large seasonal variation in water level and the movement of fish between floodplain and river over the course of the year.

5.2.2 Institutional performance

Co-management systems tend to have fairly high transaction costs from the perspective of users when compared to the conventional resource management model (Pereira 2002). This is because users must participate actively in the management process, attending meetings to decide the rules for fishing activity, patrolling lakes and apprehending those breaking the rules. In the Amazon case, these costs tend to be quite high for several reasons. Many of the lake systems are quite large, up to 40 km across and few community members had motorized transport. Participation in local

management activities can require a considerable investment in time to travel to and from inter-community meetings and to patrol lakes.⁸ Participation also involves small but significant financial expenditures for participants since there are no mechanisms to cover these costs. Finally, enforcement can be very stressful, especially when violators are neighbors and relatives. This is exacerbated, as we will discuss below, by the fragile institutional status of VEAs (see Fig. 8).

A second critical problem with the co-management model is the requirement that communities maintain local lake fisheries open to outsiders. While fishing agreements can specify how to fish, including what gear may be used, they cannot specify who can fish. Technically, this position is based on the 1934 Water Resources Code (Brasil 1934) that guarantees access to all water bodies for purposes of navigation. However, this interpretation confuses two fundamentally distinct issues: navigational rights and rights of access to the fish in the water. Use in the former case has no effect on the resource, while use in the latter reduces the amount available to others (subtractibility) (Feeny *et al.* 1990). IBAMA officials have also voiced concern over the very real and complex distributional issues involved in granting exclusive use rights for individual lakes to specific communities, especially with respect to urban canoe fishers.

While there are good reasons for insisting on some degree of accessibility for outsiders, the position taken by IBAMA undermines two basic tenets of the theory of collective action: clear definition of the group of users and the right of that group to the fruits of its own labor without competition from free-riders (Olson 1965, Ostrom 1990). As it stands now, anyone can fish in a given lake and so gain access to the benefits generated by community managers, but they do not have to share in the obligations of maintaining the system. Thus, those who invest in managing the lake must compete with all other users to obtain a share of whatever benefits their efforts generate. From a theoretical perspective, this attribute alone is sufficient to ensure the eventual failure of the collective enterprise.

As noted earlier, it is possible to restrict access by imposing gear restrictions, such as prohibiting gill nets and other measures that make it uninteresting for outsiders to travel long distances to fish in the lake. The problem is that these kinds of restrictions also affect the efficiency of local fishing effort and so impose an additional cost on those participating in the fishing agreement (McGrath *et al.* 1994). Furthermore, the present system contains no mechanisms through which outsiders could share in the cost of maintaining the system. In fact, Fisheries Councils are specifically prohibited from charging user fees, an attribute of the federal government (IBAMA 2003). Nor can they force individuals to participate in lake patrols and other regulatory activities. By charging such fees, it would be possible to compensate members for the time they invest in management activities. In the absence of a mechanism such as user fees, Fisheries Councils have had to resort to sponsoring events, such as raffles, bingo and football competitions, to raise funds. While this may solve the immediate financial problem of generating resources to cover management costs, it is an exogenous solution divorced from participation in the lake fishery. Thus it tends to separate economic and regulatory interests, making returns from management even more diffuse and difficult to protect from free-riders (see Jentoft and McCay 1995).

⁸ Originally, Councils did not receive any basic equipment such as flashlights and motorized boats for patrols. This seems to be changing somewhat with the Provárzea program.

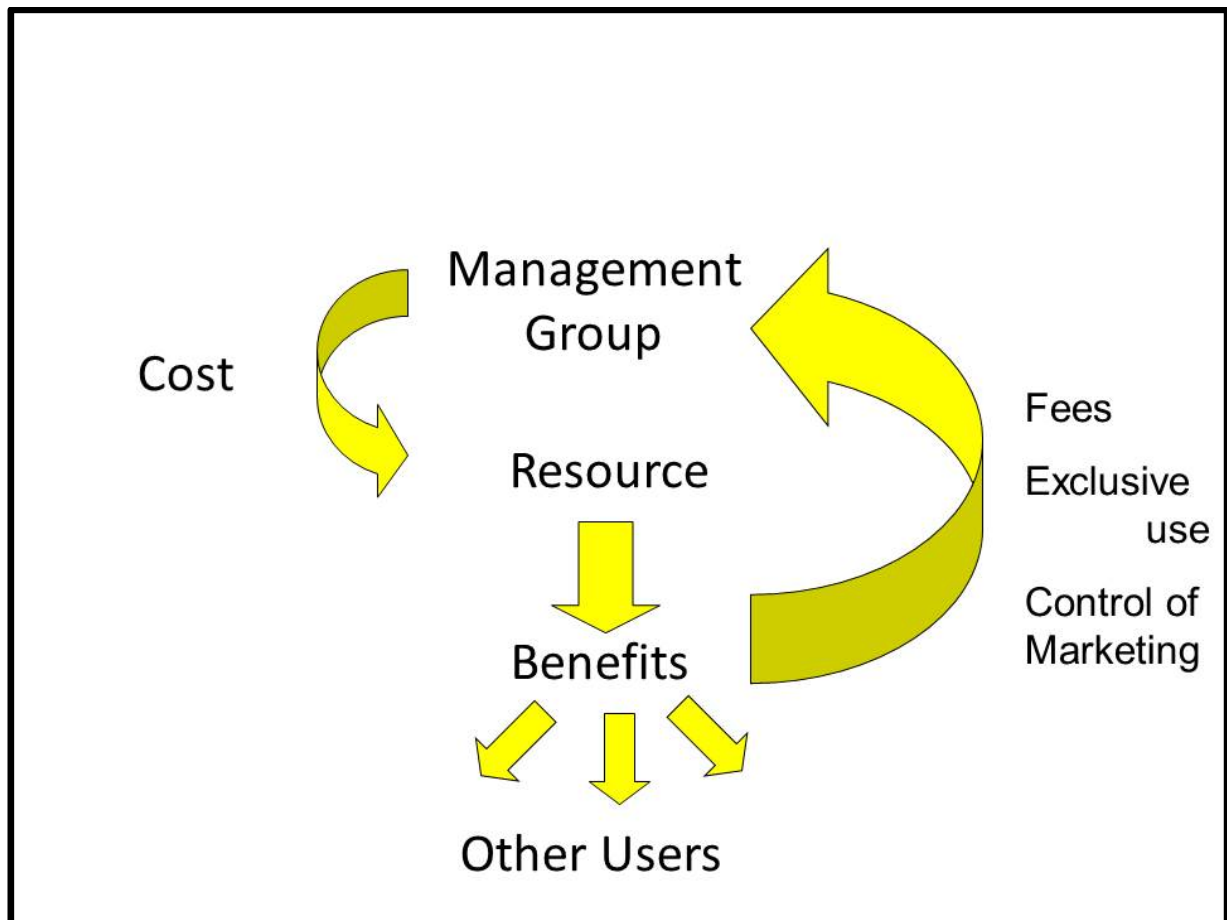


Figure 8. Costs and benefits of managing resources

A second question was the distribution of costs between communities and IBAMA. Inhetvin (2004) estimated the costs incurred by meetings, patrols and training sessions. Total costs for the co-management system were estimated to be 1.6 million reais per year. This figure is equivalent to about 20% of the value generated by the regional fishery. In addition, roughly 83% of the total cost was borne by communities, five times IBAMA's level of expenditure. Clearly, the implementation of the co-management system had shifted much of the cost of enforcing the system from IBAMA to the communities.

These logistical and financial difficulties can be exacerbated by problems involving enforcement. Existence of efficient mechanisms for punishing those who violate rules and resolving conflicts is another critical aspect of the design of community-based management systems (Ostrom 1992). IBAMA's relatively small portion of the total cost resulted from its limited involvement in enforcing agreements. In the Amazon co-management experiment, the main problems encountered related to the role of VEAs. On the governmental side of the co-management system, collaboration with IBAMA field agents was problematic. IBAMA field agents have often shown that they do not take citations brought by VEAs seriously and have occasionally declined to pursue normal procedures in cases VEAs have brought to their attention. Part of this behavior can be attributed to the lack of resources to undertake patrols, but, more problematically, it also reflects IBAMA agents' resistance to sharing authority with community members.

Because of this lack of support, many VEAs have found themselves in a difficult position. There is little they can do on their own since their authority depends on the support they receive from IBAMA and their communities. Offenders see that the citations VEAs have issued are not enforced by IBAMA, and feel increasingly confident that they can act with impunity. In a few cases, offenders have taken environmental agents to court, and these agents have had to defend themselves with little support from IBAMA.⁹ Frustrated and humiliated by their lack of power and support, a number of agents have quit and many others have stopped carrying out monitoring and enforcement activities.¹⁰ The ambivalence of government officials undermined community commitment to co-management as local leaders saw that there was little government support for their efforts to enforce local fishing agreements. While the unequal distribution of costs is an important issue, it was not the main problem for VEAs. In a survey of environmental agents, 95% of respondents considered lack of support from IBAMA as the main problem for the co-management system. Only a few respondents were concerned with financial compensation (Almeida *et al.* 2006a). As Acala and Vuse (1994: 18) observe, “it is not enough to have laws and organized communities to apprehend offenders. The process must follow through to conviction and penalty when necessary,” if communities are not to lose interest in the co-management system (Pomeroy and Berkes 1997).

In response to pressure from the Regional Fisheries Councils and supporting NGOs, IBAMA increased VEAs’ policing powers. They were permitted to confiscate gear used by offenders, but were still not permitted to make arrests. IBAMA agents were also pressured to take VEAs more seriously, pursue citations and prosecute offenders when appropriate. In entering co-management agreements with the state, communities sought to both legitimize fisheries agreements and to obtain state support in enforcing them. What they have found is that only the first half of their concerns has been met. At the same time prohibitions on access restrictions and charging of fees limit community capacity to solve enforcement problems. For many floodplain residents things were better before the co-management system was implemented, when they enforced agreements unilaterally without worrying about what was or was not permitted by IBAMA.

IBAMA’s legal department continues to be stuck on a concept of continental fisheries that seems to confuse water bodies and the fish that swim in them. One thing is the right to navigate across a body of water, another is to take fish from it. The former is a public good and use by one individual does not affect future availability, while the latter is a common pool resource and in this case use by one individual does affect use by others (Feeny *et al.* 1990). Given this principle of equal access for all, the only way to define a distinct user group is to implement a licensing system with a fixed number of licenses. Even here, though, there must be equal access to the licenses, so in theory there is no legal mechanism to ensure that licenses go to community members. IBAMA’s principle of equal access is in conflict with the idea of territorial rights to a fishery, the central premise of the community lake reserve movement, and a growing consensus in fisheries management policy throughout the world. While IBAMA no longer has responsibility for managing inland fisheries, this position underlies the co-management policies adopted by the states of Pará and Amazonas.

9 There seems to be some uncertainty within IBAMA regarding the legal status of VEAs and their relationship to IBAMA.

10 VEA frustration led to the takeover of IBAMA offices in Manaus at the end of December 2001 as VEAs and community leaders sought to force IBAMA to provide more support for their efforts. The problem is much more serious in the state of Amazonas, mainly due to the very large number of community agents that were trained and but received little or no supervision or support thereafter.

6. Changes in federal and state fisheries policies and institutions

Beginning in the 1960s, the policy and institutional framework for fisheries management and development have undergone several major changes. The modern phase in the evolution of federal fisheries policies began with the creation of SUDEPE in 1966. SUDEPE adopted a strongly development-oriented approach with a focus on modernizing Amazon fisheries through the development of industrial-scale fisheries and the modernization of artisanal fisheries (McGrath *et al.* 2008b, SUDEPE 1988). This phase extended from 1966 to 1989, though by the late 1970s this policy had been largely discredited. In 1989 SUDEPE was absorbed into the new federal institute IBAMA, which assumed responsibility for environmental regulation and management of renewable resources. SUDEPE's absorption into IBAMA also marked a shift from a development to a conservation-oriented approach in national fisheries policy. This conservationist-orientation dominated fisheries policy through the 1990s.

In 1998 the fisheries industry succeeded in having a development-oriented Department of Aquaculture and Fisheries created within the Ministry of Agriculture. The director of the department was recruited from the marine-fisheries industry. With the election of the worker's party candidate to the presidency in 2002, the department was transformed into SEAP with the status of a ministry and linked directly to the Presidency. Subsequently, SEAP was transformed into the MPA. While the Department of Aquaculture and Fisheries was oriented towards the interests of industrial fisheries, SEAP and its successor the MPA were oriented towards artisanal fisheries. In fact, SEAP was created in recognition of the importance of the artisanal fisheries movement within the broader coalition that had helped to elect the Workers' Party (PT) candidate, Luis "Lula" Inácio da Silva to the Presidency. Consequently, while SEAP and its successor the MPA had a clear development orientation, there was also a strong emphasis on supporting the artisanal fisheries sector. Towards this end, artisanal fishers obtained access to subsidized credit programs such as PRONAF (*Programa Nacional de Agricultura Familiar*), which were originally designed for small-scale farmers, and could now use these lines of credit to finance the purchase of fishing boats and gear. It should be noted that these programs did not fund management initiatives. Cooperatives with facilities for ice production, refrigerated storage space and, in some cases, limited fish processing capabilities, were constructed in some parts of the country. Most failed in a fairly short time since *Colônias* and other fisher organizations generally lacked the administrative and organizational skills needed to run such operations efficiently.

The creation of the MPA resulted in considerable confusion regarding the division of responsibilities within the fisheries sector. Initially, it seemed that the MPA would be responsible primarily for fisheries development and IBAMA¹¹ for fisheries management. However, the MPA insisted on taking responsibility for all fisheries-related activities and gradually took over management functions as well. The problem with this position was that the MPA had little technical capacity in fisheries management. State level supervisors were often chosen from the artisanal fishers' movement and

11 In 2006 IBAMA was divided into two institutions with the creation of the Instituto Chico Mendes de Biodiversidade (ICMBIO), responsible for the national reserve system, and IBAMA, responsible for environmental licensing of federal infrastructure projects.

MPA programs tended to focus on issues of importance to artisanal fishers, with much less concern over the status of fisheries resources. Furthermore, while offices with a core staff were established in each state, the MPA had virtually no presence in the field and no enforcement authority.

The question of responsibility for fisheries management began to be defined with the passage of the 2009 law, which established the National Policy for the Sustainable Development of Aquaculture and Fisheries (Brasil, 2009), which replaced the 1967 Fisheries Code as the basic fisheries legislation for Brazil. The 2009 National Policy had four main objectives: 1) sustainable development of fisheries and aquaculture, 2) fisheries management, 3) conservation of fisheries and aquatic environments, and 4) socioeconomic development of fishers and their communities. With regard to fisheries management, the 2009 law states that management policies should reconcile sustainability of fisheries resources with improvements in social and economic well-being. It transfers responsibility for fisheries management from the federal government to the states, though it is more ambiguous regarding responsibility for enforcement. It should be noted that no mention is made of co-management, nor of fisher participation in defining fisheries regulations. The 2009 law also establishes that all commercial fishers must be registered with the General Registry of Fishing Activity (*Registro Geral da Atividade Pesqueira*, RGP) and the Federal Technical Register (*Cadastro Técnico Federal*, CTF). These requirements were also present in previous legislation, but the MPA has now made the implementation of this Registry a priority for 2012-2013,¹² together with efforts to clean up the membership rolls of *Colônias* throughout the country (Sr. Albertinho pers. comm.).

Complementary legislation passed in 2011 specified more clearly the responsibilities of the federal, state and municipal governments in environmental management and has been interpreted as transferring to the states responsibility for managing inland fisheries (Brasil 2011). This legislation consolidates the process of decentralizing environmental management functions from the federal government (IBAMA) to state environmental agencies (*Secretaria de Meio Ambiente*, SEMA), including environmental licensing (except for federal infrastructure projects), monitoring and enforcement. The degree to which these state agencies have taken on fisheries management and enforcement functions and the degree to which they have adopted co-management policies vary from state to state, as will be seen in the two case studies discussed later. In this regard, the restructuring of the government fisheries sector that began with the creation of the SEAP significantly disrupted the further development of the policy and institutional framework for fisheries co-management. Even where states have adopted co-management policies, in most cases they do not have the physical presence throughout their respective territorial jurisdictions to support local co-management institutions in monitoring and enforcing local fisheries agreements.

There was some initial hope of continuity when the Coordinator of the PPG-7 Provárzea Program, Mauro Ruffino, was named Director of Management, Control and Statistics for Aquaculture and Fisheries (DICAP) of SEAP, later MPA. While a national program recording fish-landings statistics was implemented, little progress was made in developing a national policy and institutional framework for fisheries co-management. Towards the end of the second Lula administration (2007–10) an ambitious multi-institutional proposal for fisheries co-management was developed, but after Ruffino was removed from the Directorship early in 2011 the proposal was abandoned (Ruffino pers. comm. 2011).

12 An article in the on-line version of the *O Globo* newspaper states that in the first 10 months of 2011 the registration of 87 160 people had been cancelled due to fraud. <http://oglobo.globo.com/politica/bolsa-pesca-paga-sem-controle-pelo-governo-usada-ate-como-moeda-eleitoral-2744078#ixzz2AEY4ABF9>.

MPA priorities in the administration of President Dilma have focused on cleaning up two major problems, the disastrous initiative to register artisanal fishers and provide them with professional licenses issued by the MPA and the problem of corruption and swollen *Colônia* membership resulting from the loosening of requirements for *Defeso* Unemployment Insurance. In addition the MPA has been the victim of the complex process of alliance formation in preparation for the October 2012 municipal elections. To strengthen support among protestant evangelicals, the Ministry was given to the head of a major evangelical party. On taking office the new minister admitted that he had no experience with fisheries and did not even know how to bait a hook.¹³ The choice of a Minister with no connections with the fisheries sector is an indication of the political weakness of fisheries interests in state and national politics. It is increasingly evident that for the foreseeable future, any further development of fisheries co-management policies will depend on state level initiatives.

6.1. Conclusions

In conclusion several points can be made regarding the evolution of federal policies for artisanal fisheries in the Amazon:

1. Through the 1990s the basic elements of a co-management policy and institutional framework were developed for Amazonian fisheries in response to conflicts between floodplain communities and outside commercial fishers. This policy suffered from structural problems, specifically the question of access restrictions and prohibitions on charging fees and fines, as well as, operational problems, the lackluster support to communities for monitoring and enforcing community fishing agreements. In addition, the changes in the institutional structure and orientation of fisheries management, disrupted the development of co-management policies. While the MPA has assumed formal responsibility for managing artisanal fisheries, in practice no institution, state or federal, has been able to fill the space left by transfer of regulatory responsibility from IBAMA to the MPA and state-level Secretaries of Environment. Consequently, the continued development of fisheries co-management policy is stalled at the federal level and further development seems now to depend on state-level initiatives.
2. There have also been important changes with regard to the integration of artisanal fisheries into the formal economy and social services bureaucracy, including the *Seguro Defeso* benefit, other government social programs (*Bolsa Família*, retirement, etc.), access to government loan/credit programs such as Pronaf (*Programa Nacional da Agricultura Familiar*). Here the main vehicle responsible for this process has been the implementation of the Closed Season Unemployment Insurance, especially after the less restrictive requirements for access to the benefit were implemented in 2003. The incentive of the *Defeso* Insurance benefit, led increasing numbers of fishers to obtain the basic government documents that define citizenship: birth certificate, social security card and identification card. Fishers also became more involved in the formal economy, acquiring bank accounts and obtaining government loans. One other important factor has been the improvement in education in rural areas, beginning in 1996, including more schools, more grades per school, and better qualified teachers, so that most students can now study through the equivalent of 8th grade in their or an adjacent community. Consequently, not only has the educational level of the rural population improved considerably, but the younger generation of artisanal fishers today is better educated, better prepared to deal with government bureaucracies and participate in formal economy.

13 “Crivella toma posse como novo ministro da Pesca,” <http://www1.folha.uol.com.br/poder/1056209-crivella-toma-posse-como-novo-ministro-da-pesca.shtml>. Accessed November 28, 2012.

3. While these changes are important, they are far from providing the policy and institutional framework needed for the modernization of artisanal fisheries so that fishers and fisher communities are able to participate effectively in increasingly formal domestic and export markets.

II State-level case studies

While the previous description of the development of fisheries co-management policies and institutions was focused on the Lower Amazon region of the state of Pará, the co-management policies developed by IBAMA were also being applied in the state of Amazonas. In fact, from a fisheries perspective, the two Amazon states are linked ecologically by the Amazon River system, economically through their exploitation of the same basin-scale fishery, socially through regional grassroots social movements for floodplain lakes, scientifically through the community of scientists studying fisheries at key institutions in Belém and Manaus, and in terms of policy development, since the Provárzea Program of the PPG-7 based in Manaus, began as the Iara Project in Santarém (IBAMA 1995, 2001b). Despite these common characteristics, the two neighboring states, Pará and Amazonas, have followed quite different paths in developing co-management systems for their inland/floodplain fisheries.

In the case of Pará, while the state government has taken important steps towards developing the institutions and policies for co-management including the creation of SEPAq, thus far little progress has been made in developing a state level co-management system. Consequently, the state has played a limited role in the evolution of the Lower Amazon co-management system, though that may change. Instead, the co-management system has evolved into a settlement-based system that involves other government institutions. In the case of Amazonas, the state government developed an ambitious fisheries management program focused on the large network of state and federal reserves, building on the very successful experience of the Mamirauá Sustainable Development Reserve (Queiroz and Crampton 1999). In the following two sections we describe the basic elements of the two systems.

7. Case study 1: Development of fisheries co-management in Pará

In Pará the evolution of co-management is taking two distinct pathways. A state-wide process begun in 2002 by the Secretary of Science, Technology and Environment (SECTAM) and later continued under SEPAq, and SEMA has concentrated on replicating IBAMA's federal co-management policy framework at the state level. A second process is underway in the Lower Amazon, where the original co-management system developed in collaboration with IBAMA has been integrated into the formal settlement policy adopted by the National Institute for Colonization and Agrarian Reform (INCRA) for the regularization of floodplain settlement and land tenure. This has resulted in a new settlement based model distinct from the collective fishing agreement (*acordos*) model of IBAMA and the reserve-based model implemented by the state of Amazonas.

7.1. Development of state legislation, institutions and policies for the co-management of floodplain fisheries

The development of a fairly comprehensive state policy framework for fisheries and aquaculture began in 2005 and 2006, with the passage of legislation similar to that developed by IBAMA (Pará Law 6713, Jan 25, 2005 and Decree 2020, 24 Jan, 2006). The state law designated the State Secretary of Agriculture (SAGRI) as the institution responsible for coordinating state fisheries and aquaculture policy in collaboration with three other state institutions: the SECTAM, the state extension service (*Empresa de Assistência Técnica e Extensão Rural do Estado do Pará*, EMATER), and the state agency responsible for agricultural sanitation, *Agencia Estadual de Defesa Agropecuária do Estado do Pará* (ADEPARÁ).

The 2005 and 2006 legislation states that fisheries management is based on the division of responsibilities between the government and fisheries sector organizations and is coordinated by the State Council of Fisheries and Aquaculture. It also gives to Municipal Environment Councils responsibility for implementing state fisheries policy at the local level. The law directs SECTAM to develop and implement fisheries management regulations in collaboration with government and non-government institutions. The legislation states that fisheries management regulations will be enforced by communities under the direction of VEAs who have been trained and certified by SECTAM. These agents are given the power to issue citations (*Auto de Constatação*), but not to make arrests.

Several other measures are included in the 2005/06 law. It creates a fisheries extension program, Fisheries Technical Assistance (ATEP). ADEPARÁ is responsible for certifying that fish products meet state and national sanitary standards. Mention is also made of the possibility of third-party certification of community-managed fisheries.

In 2007 the incoming state government made several changes in the institutional structure for fisheries and environmental policy (Pará 2007). First, SECTAM was separated into two institutions, a Secretary of Science and Technology and SEMA. SEMA assumed a number of functions that were formerly the responsibility of IBAMA, such as environmental licensing and approval of forest management plans. In addition, the independent SEPAq was created and took over responsibility for functions related to fisheries and aquaculture that had formerly been the responsibility of the SAGRI.

The first Secretary of SEPAq was a person who had played a significant role in the fisher movements of the Lower Amazon and in the lead NGO involved in developing co-management policies and institutional arrangements for Lower Amazon floodplain fisheries, the Instituto de Pesquisa Ambiental da Amazônia (IPAM). Two important initiatives during her tenure as Secretary were a state-wide assessment of the principal modalities of fisheries – artisanal, subsistence, industrial, recreational, ornamental and aquacultural – and the implementation with the MPA of a state-wide monitoring system based on landing data collected from a large number of sites throughout the state. These two initiatives resulted in a comprehensive and geographically detailed compilation of information on the status of fisheries in the state of Pará.

While the 2005/06 state fisheries law did not specifically mention collective fishing agreements, the intent is clearly to implement a co-management policy based on the policy framework developed by IBAMA in the 1990s (IBAMA 2003). Many key elements of a co-management system were included, and provide most of the basic legal instruments needed to implement a co-management system. Furthermore, the legislation was influenced by experiences with the formalization of collective fishing agreements in various parts of the state. Although there is as yet no published state government document defining criteria or procedures for legalization of collective fishing agreements, it appears that the state is following the co-management policy and criteria for legalization developed by IBAMA in the 1990s. Legalization of agreements is to be designed for the following purposes: 1) to resolve local conflicts/disputes; 2) to control pressure in areas where there are indications of overfishing; or 3) to protect fisheries from other important local threats.

There is as yet little evidence of a statewide policy or institutional framework for implementing a co-management system,¹⁴ although SEPAq is working in several regions of the state, notably the Lower Tocantins where some 99 communities have informal *acordos de pesca*, which they are anxious to have legalized. SEPAq submitted five agreements to the State Environmental Council (*Conselho Estadual de Meio Ambiente*, or COEMA) for approval, in 2007/08. Currently, SEPAq plans to legalize some 120 collective fishing agreements around the state. However, the process is stalled for lack of funding, the MPA plans to direct its funding towards solving the problems created during the previous administration, especially the licensing of all artisanal fishers, and the Seguro Defeso corruption problems in *Colônias* throughout Brazil.

7.2. Evolution of formal settlement-based co-management system in the Lower Amazon

The focus of this case study is the evolution of the Lower Amazon co-management system. Towards the end of this case study we describe changes in state fisheries policy and related changes in fisheries management policy. Following on the earlier discussion of the evolution of fisheries co-management policy, there were three main problems that had to be resolved in the construction of a comprehensive co-management system for Lower Amazon floodplain fisheries: 1) implementation of effective management control over lake fisheries, 2) regulation of cattle and water buffalo ranching on the floodplain, and 3) implementation of a land tenure system that recognizes individual and collective rights to the main *várzea* habitats. The first phase in this process, which involved the development of a potentially national co-management policy for floodplain fisheries, was described

¹⁴ This is especially evident with regard to enforcement. SEMA is responsible for enforcement, but has only a limited presence and virtually no monitoring and enforcement capacity outside of Belém.

earlier since it applies to both cases studies. In this section, we focus on the following two problems, gaining effective user-based management control over grazing on *várzea* grasslands, and implementing a land tenure system that recognizes individual and collective rights and is therefore compatible with the co-management systems that have developed.

7.2.1 Collective agreements for cattle and water buffalo ranching on floodplain grasslands

While conflicts over lake fisheries have been the major focus of floodplain resource conflicts, cattle and water buffalo ranching on floodplain grasslands have also been a major source of conflict (Sheikh 2002, Sheikh *et al.* 2006). Due to the large expanses of natural grasslands, extensive cattle grazing has probably been practiced on Lower Amazon floodplains since at least the nineteenth century (Sternberg 1998) In the past, herd size was limited by the need to maintain cattle on raised platforms and feed them cut grass during the flood season (McGrath *et al.* 1993). In the last two decades, innovations in river transport – especially the proliferation of motorized boats capable of transporting cattle, the expansion of upland pastures through government loans and the creation of colonist settlements along the main river – enabled floodplain ranchers to move cattle between upland pastures during the flood season and floodplain grasslands during the low water season.

This system of seasonal movement between upland pastures and floodplain grasslands enabled ranchers to maintain much larger herds on the floodplain during the dry season. The resulting expansion and intensification of unregulated cattle ranching on the floodplain was a classic tragedy of the commons, characterized by deforestation, overgrazing of grasslands and degradation of remaining forests as well as a likely reduction of habitat quality for major commercial fish species (Hardin 1968, Sheikh *et al.* 2006). In addition, because cattle were grazed on what was considered to be a commons, control of herds was limited. Fences were precarious and considered to be the responsibility of the farmer (McGrath *et al.* 1993). Consequently, crop damage by cattle and water buffalo was a major source of conflict in many areas. In addition, in walking through lake shallows, which are important zones for fishing activity, cattle and water buffalo damaged nets and generated conflict between cattle owners and fishers.

Rules for cattle ranching on *várzea* grasslands were not included in the fisheries co-management system and seemingly were not considered a problem within the sphere of responsibilities of IBAMA. Instead, communities developed a second institutional pathway to address the problem of cattle grazing conflicts. Inspired by the experience with fishing agreements, communities sought the support of the Public Ministry and *várzea* NGOs to develop a form of collective agreement to establish rules and sanctions for managing cattle and water buffalo on the *várzea*. A working group was formed by the Public Ministry to adapt the approach taken for co-management of lake fisheries to the regulation of cattle grazing. The legal device chosen by the Public Ministry was the “Term of Adjustment of Conduct” (TAC); these are legally binding agreements that are negotiated between two or more parties, in this case local cattle owners and representatives of community associations. The TACs mediated by the Public Ministry (PM) following the guidelines established by the working group, defined rules for raising cattle and water buffalo on the floodplain (McGrath *et al.* 2007).

Issues addressed in these agreements include the period when cattle may graze in community grasslands (a major source of complaint) and procedures for compensating farmers and fishers for damage caused by cattle. Over the next few years some 54 agreements were signed and implemented covering much of the *várzea* in the municipality of Santarém. Enforcement was problematic, however, because the Public Ministry (PM) is not responsible for enforcement and

must rely on other institutions, such as IBAMA or the federal police, to enforce its decisions. But while enforcement was patchy, TACs did provide the most effective legal mechanism available for controlling the major cause of environmental degradation and a major source of risk for floodplain farmers (McGrath *et al.* 2008a).

These collective agreements for fisheries and grasslands and the institutional arrangements through which they were implemented, provided regulatory frameworks for the co-management of two major and interconnected floodplain common-pool resources. However, they were two distinct frameworks involving different government institutions, IBAMA and the PM, and different community institutions, Regional Fisheries Councils in the first case, and community associations in the second.

7.2.2 Property rights to floodplain land, habitats and resources

The third component of the evolving co-management system involves land tenure policy. Land tenure on the floodplain has long been a source of confusion. Technically, the floodplain is the property of the federal government and legal titles cannot be issued for floodplain lands (Benatti *et al.* 2005; Santos Vieira 1992). In practice most of the floodplain is divided into individual properties, which are bought and sold in local land markets, though transactions do not involve legal titles (Fig. 9). Because of the insecurity of these informal arrangements and the inability to use *várzea* property as collateral for loans, legal recognition of their claims has long been a concern of *várzea* landowners.



Figure 9. Individual properties of Ituqui Island and adjacent mainland, Santarém, PA

Note: Colors indicate individual properties.

From the perspective of collectively managing the main common-pool resources of the floodplain, the prevailing system was problematic, because no one had any formal right to the land they occupied, nor was there any formal recognition of collective use rights. Consequently, land use has developed according to the norms of private property and regional market opportunities in which individual landowners are free to make more or less unilateral land-use decisions. With no

government authority to enforce land- and resource-use rules, individual land owners cannot be coerced into entering collective agreements and complying with provisions, which they consider to infringe on their interests.

In addition, traditional property rights, vary regionally along the Amazon floodplain. For example, in the Tefé region some communities claim collective territorial rights and recognize individual use rights to agricultural fields and whatever investments have been made (fences, buildings, etc.). Low population density and the more ephemeral nature of floodplain communities in this region may make explicit recognition of property rights unnecessary in some areas (Lima and Alencar 2001). There is also evidence that the alignment of properties does not always follow the perpendicular orientation described earlier. Maps of the island of Careiro from the early twentieth century, for example, show some properties that occupy just the levee and are oriented parallel to the river (Sternberg 1998). Population density is also modifying land tenure patterns. In some Lower Amazonian communities smaller properties are now being subdivided parallel to the river with married offspring constructing their houses behind those of their parents.

State and federal government roles with regard to floodplain lands have also varied. The agency responsible for the floodplain is the SPU (*Serviço de Patrimônio da União*) and its regional office in Belém is the GRPU (*Gerência Regional do Patrimônio da União*). However, only a tiny handful of properties have been registered with the GRPU and there is no documentation at all for the thousands of “properties” of the Lower Amazon floodplain. Iterpa, the state agency responsible for registering properties on state lands has never assumed responsibility for *várzea* lands. The state of Amazonas, in contrast, used a dubious legal argument to claim responsibility for administration of *várzea* lands and maintained separate registers for *terra firme* and *várzea* properties (McGrath and da Gama 2005). This system was discontinued when the state land agency was shut down.

A Provárzea study of floodplain land tenure systems defined four design principles to orient development of an appropriate land tenure policy for the floodplain (McGrath and da Gama 2005):

1. Based on the **pulse concept** management should seek to maintain interactions between aquatic and terrestrial components of the floodplain ecosystem, conserving floodplain vegetation (grasslands and forests) and also avoiding physical modifications to the floodplain that affect flows of water between the river and the floodplain such as dykes and canals (Junk *et al.* 1989).
2. **Integrated management** of floodplain resources, combining fishing, farming and small and large animal husbandry, in order to optimize global production rather than intensifying individual activities such as cattle ranching or agriculture.
3. **Lake systems** as the basic settlement and management unit. This will ensure that the functional integrity of the lake system is maintained.
4. **Zoning of use rights** following existing patterns of individual and collective use of different ecological zones of the floodplain.

In late 2005 the GRPU transferred responsibility for regularization of Amazon floodplain land claims to INCRA (McGrath *et al.* 2008a). This transfer was motivated by the fact that the GRPU/SPU does not have the capacity to regularize lands at the necessary scale. Initially, rather than recognizing individual claims, INCRA proposed converting floodplain settlements into Agro-extractive Settlement Projects (PAE), a colonization model developed in 1988 and designed originally for rubber tappers in Acre (INCRA 1996). It is comparable to the Extractive Reserve created by IBAMA shortly thereafter (Benatti 2003). As with the Extractive Reserve, the land is owned by the federal government and residents are granted concessions to live in the settlement. Both individual and collective property rights can be recognized. Since 2006 some 41 PAEs have been created on the Lower Amazon *várzea*,

covering 745 000 hectares with a resident population of roughly 11 000 families or 53 000 people (McGrath *et al.* 2011).

Several aspects of the PAE settlement model are interesting from the perspective of the consolidation of floodplain co-management. The PAEs can cover entire lake systems and include all communities that depend on the fishery. In the case of Santarém the pre-existing Regional Fisheries Council jurisdictions provided the basis for the creation of PAEs, although the *terra firme* portions of these PAEs were not included. Initially, both large and small properties were included in the PAE, despite the fact that only smallholders are recognized as clients of agrarian reform and qualify for government benefits. Smallholder communities are regularized collectively through community associations, which may in turn grant concessions for individual properties. Formal concession of the PAE will depend on approval of a Utilization Plan (UP) for the PAE. UPs are also required to integrate existing collective agreements for lake fisheries and cattle grazing. Thus in the Santarém region, at least, PAEs should reinforce the institutional and policy framework for co-management of floodplain resources.

The environmental licensing process requires that PAEs have approved UPs and settlement development plans¹⁵ (*Plano Básico*, PB, or *Plano de Desenvolvimento do Assentamento*, PDA) (INCRA 1996). The UP provides the regulatory basis for sustainable use, individual and collective, of the PAE territory (INCRA 1997, McGrath *et al.* 2011). The PM required that these plans incorporate pre-existing fishing agreements and cattle TACs. The UP provided a mechanism to integrate pre-existing cattle and fishing agreements and other land-use activities into a single comprehensive document that was under the responsibility of the same two institutions, the PAE association and INCRA, providing a common institutional and regulatory framework for managing floodplain resources, land use and territory. Even more important, INCRA agreed to a provision in the UP that gives PAE residents exclusive use rights to floodplain fisheries, finally resolving a key structural defect in the co-management system developed with IBAMA. In addition, the right to live in the PAE is conditional on compliance with the UP, potentially reinforcing regulatory controls. Finally, the PAE association that represents residents and is the actual holder of the concession ceded by INCRA has the right to charge user fees and organize marketing conditions. The PAE settlement model, then, has the potential to provide an effective formal regulatory framework for the collective management of the PAE territory. The challenge is to develop the PAE organizational capacity and institutional arrangements to take advantage of this potential.

The Settlement Development Plan (PB or PDA) lays out a comprehensive plan for the sustainable development of the PAE including infrastructure investments, land use and resource management (including specific plans for annual and perennial agriculture, animal husbandry, fisheries and resource management, and even craft production), organizational structure and capacity building. Preparation of this document for each PAE provided an opportunity to bring together key sustainable management and land use systems and technological innovations for sustainable energy, sanitation and potable water that had been developed for the várzea.

15 The plans that were produced for *várzea* PAEs combine attributes of two different types of development plans, basic plans (acronym in Portuguese PB) and settlement development plans (acronym in Portuguese PDA). The PB is more environment-oriented than the PDA, but otherwise the two plans are very similar.

INCRA contracted a local NGO and the state extension service (*Empresa de Assistência Técnica Rural, EMATER*) to work with PAE residents to prepare UPs and PB/PDAs for some 25 PAEs. UPs and PDAs were completed for 15 PAEs, which are now completing the environmental licensing process required to be fully legal and eligible for all relevant government credit and investment programs. These 15 PAEs and a further 9 that are to be included in a follow up INCRA contract provide the basis for a regional co-management system in which the individual *várzea* PAEs serve as the basic territorial units for the co-management of floodplain fisheries and other *várzea* resources (Fig. 10).

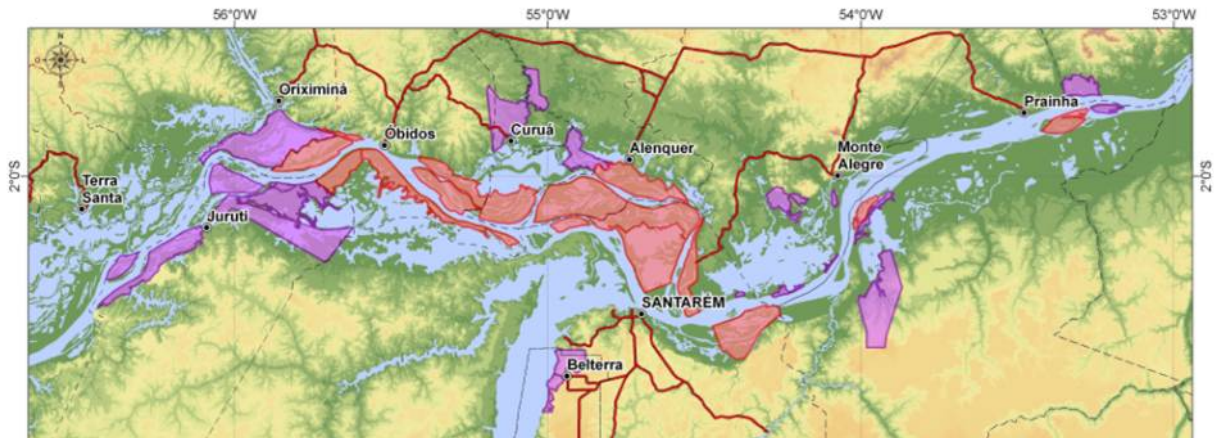


Figure 10. Mosaic of 24 PAEs included in two contracts between IPAM and INCRA

This mosaic of 24 PAEs covers 480 000 hectares and includes much of the floodplain of the Lower Amazon (Fig. 10). The resident population is estimated at 8,500 families or 43,000 people. Next steps in the consolidation of this mosaic of *várzea* PAEs include building of PAE institutional capacity for sustainably managing their respective land and resource use potential and development of institutional arrangements for co-management of fisheries and other resources. For example, based on Almeida *et al.*'s (2006a) conclusions, sustainable management could increase the productivity of lake fisheries by 50% or more.

The leaders of 23 PAEs came together to create a Forum of *Várzea* PAEs, which in addition to the 23 PAEs includes representatives from EMATER, INCRA and IPAM. The Forum is discussing the creation of a regional association to provide technical assistance for floodplain farming and fisheries management and to increase their collective negotiating power with municipal, state and federal government agencies. This Forum could be an important step in creating an organization for sustainably managing floodplain fisheries and marketing fish products that could eventually be certified.

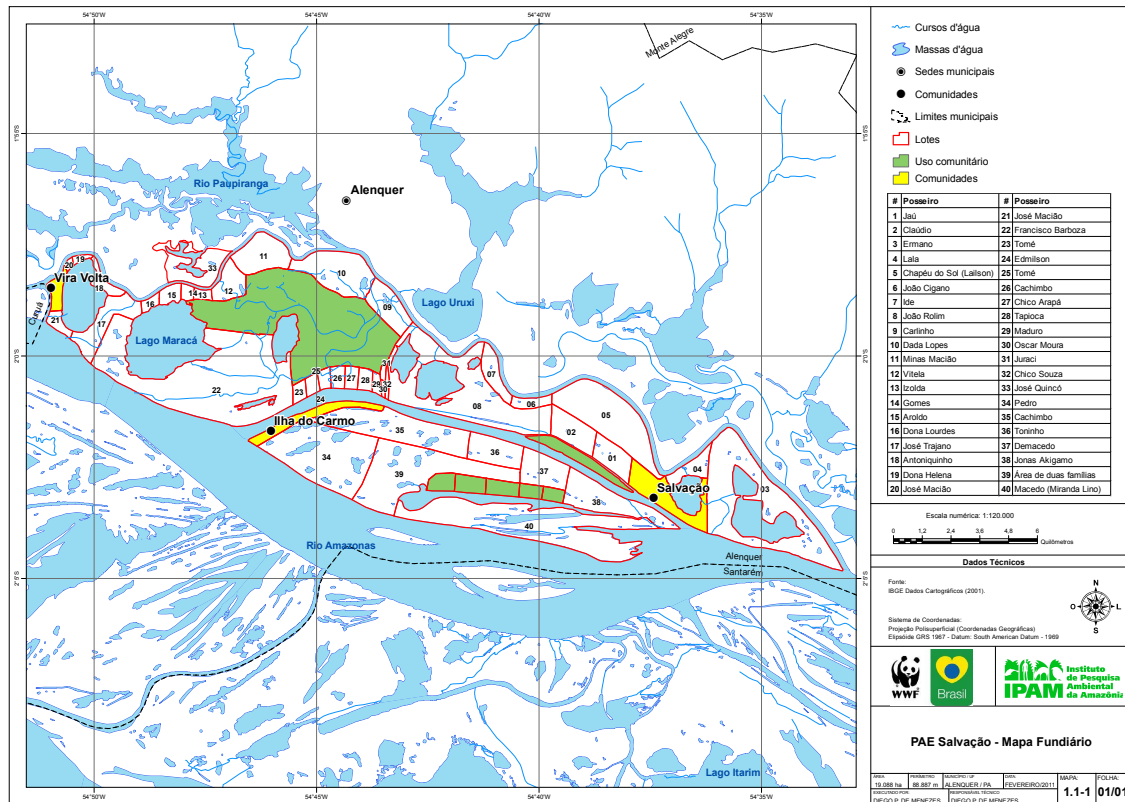


Figure 11. Communities and rural properties of the PAE Salvação, Alenquer, PA. Source: IPAM Varzea Project 2011.

Notes: Communities in yellow. Larger rural properties in white. Green unclaimed areas.

There are several major problems that have not been resolved with the creation and environmental licensing of floodplain PAE settlements. First, the creation of the PAEs is only partially completed from a land tenure perspective. Thus far, none of the larger properties whose owners are not considered clients of agrarian reform have been expropriated (Fig. 11). This is due in part to problems with the initial process of creating these PAEs, which skipped one or more key steps in the process so that the creation of these PAEs could conceivably be overturned if a landowner were to contest the process in court. An exacerbating factor is that because the individual owners do not have legal ownership of the land they can only be compensated for infrastructure investments, which in most cases have been minimal. Consequently, owners have no interest in agreeing to be expropriated. The result is that the legal residents of individual PAEs have direct control over only part of PAE territories and PAE associations will have to negotiate with ranchers to assert control over their respective PAE territories and land and resource use.

In addition, while the PAE settlement model and associated UP provide the potential for sustainably managing the floodplain, achieving that potential will require not just effective local governance capacity but the support of government agencies with enforcement authority. In that sense, creation of PAEs does not in and of itself solve the problem of enforcing PAE regulations. Especially in the initial phase of consolidating PAE governance, the support of government agencies such as INCRA, the state Secretary of Environment (SEMED) and local police is essential. Thus far, this support continues to be inadequate.

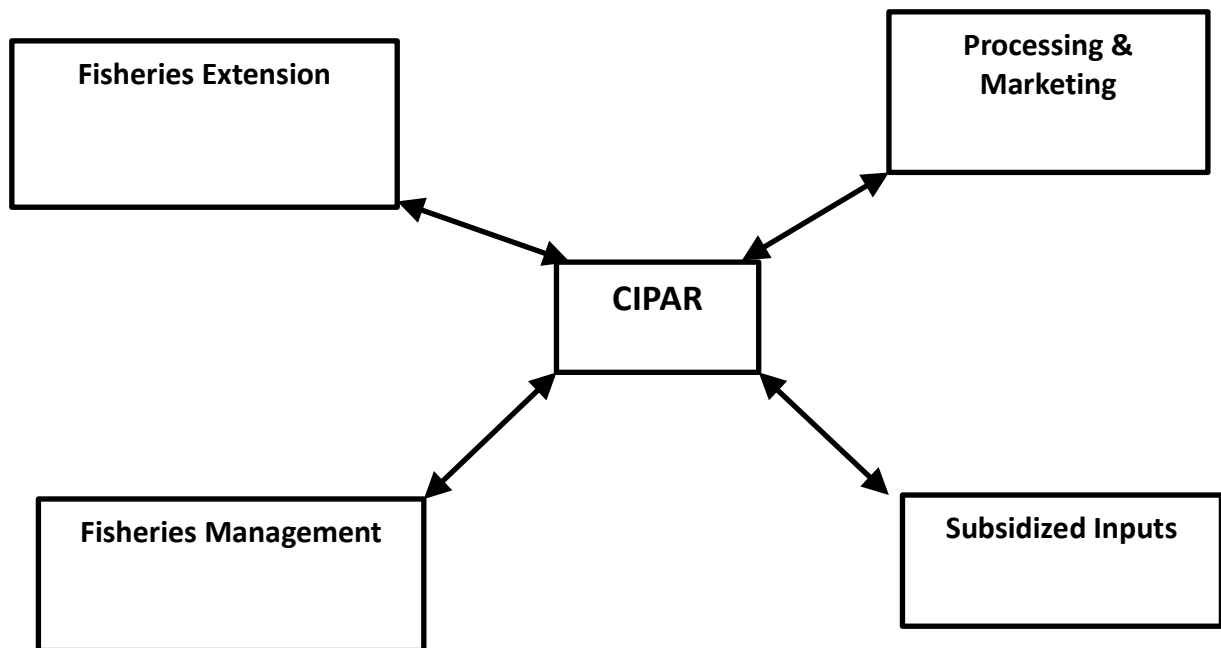


Figure 12. Main functions of the proposed Integrated Center for Artisanal Fisheries (CIPAR)

A key element in the institutionalization of the evolving co-management region, is the proposed Centro Integrado de Pesca Artesanal (CIPAR, Integrated Center for Artisanal Fisheries), to be constructed in Santarém by the MPA. CIPAR is intended to promote the sustainable development of regional fisheries through three main activities: 1) building organizational of fishers and fisher organizations, 2) extension and technical assistance for managing fisheries and processing and marketing catch, 3) managing a facility to receive, process and distribute fish to local markets, and 4) sale of subsidized fuel and ice (Fig. 12).

This center could provide the long-term institutional support needed to ensure the consolidation of the evolving regional co-management system by working in three major areas: managing floodplain fisheries, processing and marketing catch and monitoring and enforcing management regulations. In addition, CIPAR staff can provide the technical assistance needed to design projects for the infrastructure investments needed to manage, capture, process and store fish products under the sanitary conditions required for export to the eurozone. CIPAR could also assist PAEs in the process of obtaining certification for their lake fisheries and fish products.

7.3. Pará case study summary and conclusions

In summary, we find two distinctive characteristics of the process of formalization of sustainable management systems with regard to fisheries in the Brazilian Amazon. First, the process has been driven by community-based fisher/smallholder movements that seek to obtain control over local resources, especially fisheries but also other resources. This situation contrasts with that in many other countries where the process of formalization is largely a top-down process that is being imposed on informal sector activities. Second, a key element in this process is the involvement of a few NGOs: IPAM in the Lower Amazon and the Instituto Mamirauá in Tefé, among others. These NGOs have worked closely with floodplain communities and the leadership of fisher organizations (*Colônias*) and also with key government agencies: IBAMA, the Public Ministry, and INCRA at the federal level and SEMA, SEPAq and EMATER at the state level. They have, in effect, taken over the role once played by Catholic Church organizations such as MEB. These NGOs have played a leading

role in defining and implementing long term strategies for developing sustainable management systems, building the technical and organizational capacity of fisher and community organizations, negotiating with government agencies to develop policies and legislation. They have provided crucial continuity in the development of policies and institutional arrangements while government agencies come and go. A crucial role played by these organizations has been in taking advantage of government initiatives and policies to mold them to the overall objectives of developing and consolidating the policies and institutions for formal co-management of fisheries.

The main changes that have occurred in artisanal fisheries policies and institutions include the following:

1. **Co-management legislation:** The basic state legislation for co-management of inland fisheries has been passed and now awaits implementation.
2. **Land tenure regularization:** By transforming informal communities into PAE settlements, residents obtained secure tenure rights in the form of long-term concessions.
3. **Territorial use rights:** Through a different process involving primarily federal agencies, formal floodplain territories with exclusive use rights to fisheries and other natural resources have been created and are now in the process of becoming functional territorial units for fisheries management. As with co-management policies, these territories are far from functional and resident fishers do not yet have exclusive access to local fisheries, nor effective control of their territories
4. **Sustainable development of artisanal fisheries:** Despite the rhetoric, there is little evidence that the state government considers the modernization of artisanal fisheries to be a priority. This is surprising given the fact that the state's fisheries are one of the most important in the country and that it has the largest number of artisanal fishers.

8. Case study 2: Formalization of floodplain fisheries in the state of Amazonas

8.1. Introduction

The development of fisheries co-management in the state of Amazonas was part of the same region-wide processes that led to the development of fisheries co-management policies in the state of Pará. However, there were important differences in how co-management policies have developed in each region, which can be attributed in large part to the broader conservation/sustainable development strategies adopted by each state. Pará has never adopted an overarching strategy of sustainable development while the government of Amazonas made green development the centerpiece of an ambitious state-wide program of sustainable development based on the creation of a huge network of sustainable development reserves. Thus, while fisheries co-management in Amazonas has essentially the same origins as those of Pará, it has been largely incorporated into a reserve-based policy and institutional framework for environmental management and sustainable development.

8.2. History of co-management in Amazonas

In both cases the Catholic Church, through programs such as MEB, created organized communities along the major rivers of the state and developed politically conscious rural leaders motivated by the vision of Liberation theology (Lima 1999, Mainwearing 2004). In both Pará and Amazonas the technological and infrastructural changes transformed commercial fisheries at the same time that growing urban and export demand provided markets for the increased capacity to capture and store fish. As with Pará, the Amazonas fishery changed from a seasonal activity based on dried salted fish to a year round activity producing fresh, iced fish and dominated by professional commercial fishing boats working with teams of contract fishers. The differences are in large part related to the intensity of these social and economic changes. The use of purse seines in Amazonas, prohibited in Pará, enabled skilled fishers to capture entire schools of fish and was combined with new transport and storage capacities. These technological innovations opened up the virtually unexploited fish stocks of the western Amazon. Consequently, to a greater extent than in the Lower Amazon, there was a polarization between large-scale, urban-based, commercial fishers and rural subsistence fishers. The use of larger scale commercial fishing boats than those used in the Lower Amazon intensified the polarization, which became a central theme of the “lake preservation movement” (CPT 1992a, b).

While coming from the same origins, there were also important differences in the nature of the social movement in response to the perceived threat that commercial fishers posed for local subsistence fisheries. In Amazonas, the Catholic Church played a more direct role in the development of the lake preservation movement than it played in the Lower Amazon. Within the state, two major poles were Itacoatiara downstream from Manaus on the Amazonas River, and Tefé halfway between Manaus and the Colombian border on the Solimões River,¹⁶ both the seats of

16 The two main sections of the Amazonas River in Brazil have different names. From the Colombian border in the west to the confluence with the Rio Negro, near the city of Manaus, it is called the Solimões River. From the confluence to its mouth it is called the Amazonas River.

Catholic Church dioceses. In these regions charismatic priests played important leadership roles with the support of their respective bishops. At the state level, resistance to the expansion of commercial fisheries was led by the CPT, which in other states focused on land conflicts. This focus on fisheries reflected the riverine orientation of traditional settlement in the state, which at that time was largely outside the zone of frontier expansion.

8.3. Community management in Amazonas

The system of community management that developed in Amazonas was somewhat different from that which developed in the Lower Amazon. First, while on the lower Amazon the focus was on collective fishing agreements, which from the beginning included commercial as well as subsistence fishing, in Amazonas the main theme of the movement was lake preservation, reflecting the overriding concern of Liberation theology with subsistence needs, natural preservation and community (Lima 1999, Oliveira and Cunha 2002)).

Floodplain ecology and land tenure arrangements also seemed to have influenced the design of community lake management systems in the region. While smallholder land tenure in the Lower Amazon was based on individual properties, smallholder communities in Amazonas (at least in the Tefé region) often recognized community territories, and individual property rights to specific sites was not recognized (McGrath and da Gama 2005). Instead, community members had rights over their investments, house sites, home gardens and, for limited periods, their agricultural fields. Also, Western Amazonian floodplain topography differs from that of the lower Amazon. Ox-bow lakes are formed when meanders are cut off through the process of lateral migration. Consequently, lakes tend to be narrower, longer and deeper than in Pará. The result is greater vertical topographic variation, forming a more diverse array of habitats. Leaders of the lake reserve movement designed a management system based on these characteristics.

Community agreements included a zonation system for the lakes within a community territory that distinguishes three categories, subsistence lakes, commercial lakes and preservation or breeding lakes (*lagos de preservação* or *criação*) that sought to reconcile the different needs of the community and in some cases those of outside commercial fishers (Fig. 13).

8.4. Amazonas Reserve system

As noted earlier, the states of Pará and Amazonas have addressed fisheries co-management from within quite distinct policy and institutional frameworks. Roughly a decade ago, the incoming governor and his Secretary of Environment developed an ambitious strategy for the sustainable development of the state based on the creation of a large network of state and federal conservation units and indigenous territories during roughly the same period that the federal government embarked on a phase of reserve creation, mostly in categories that permit sustainable management by resident populations or, in the case of forestry, timber concessions to commercial logging companies. A total of 85 million hectares, 54% of state territory is now incorporated into some kind of reserve, of which 15% are federal reserves, 11% state reserves and 27% indigenous territories. While few of these reserves are consistent with the boundaries of river basins, many of them include large sections of Amazon floodplain with resident populations living on or adjacent to them.

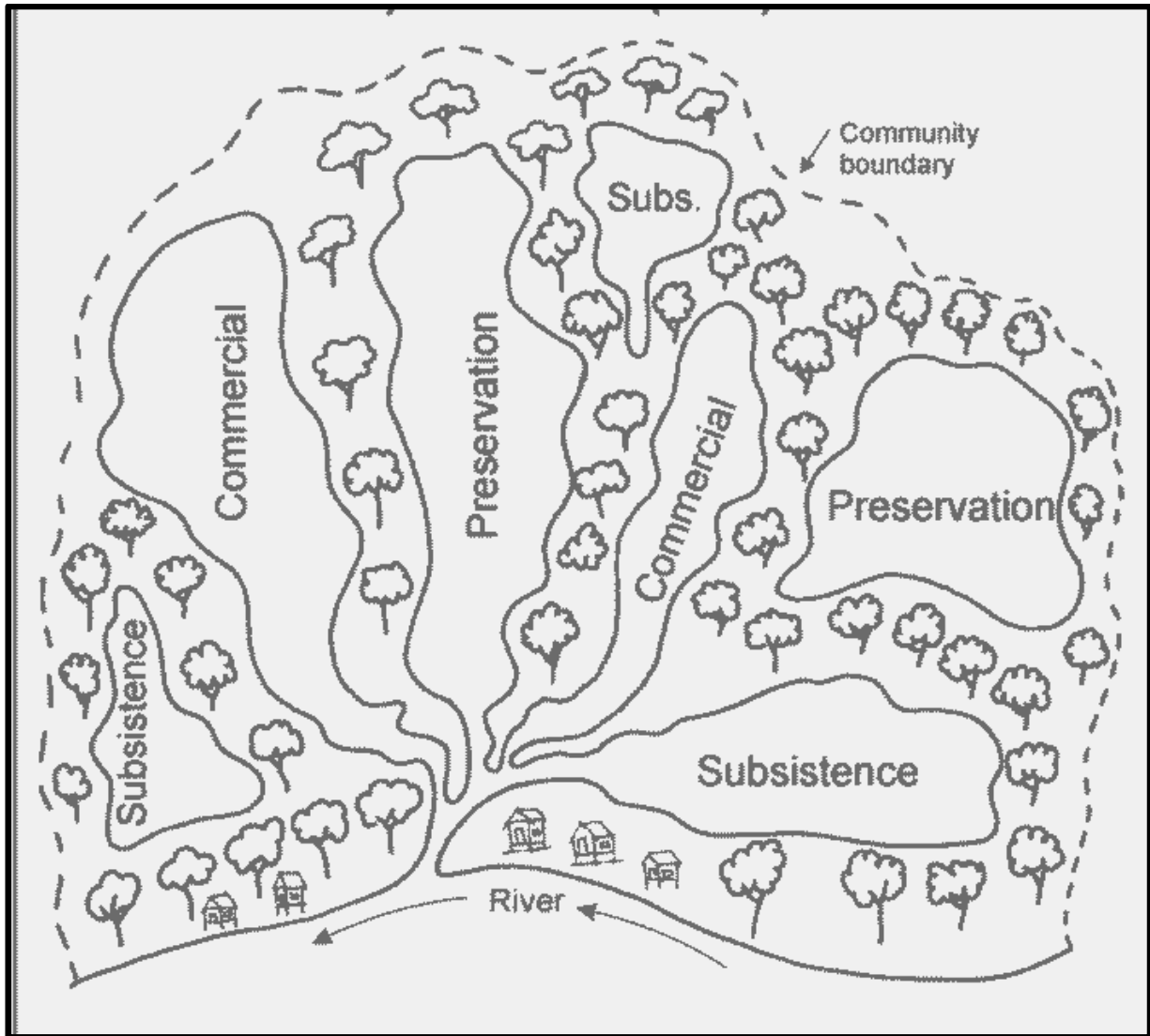


Figure 13. Zonation of várzea lakes within a community territory, Tefé region, Amazonas

The Sustainable Development Reserve (*Reserva de Desenvolvimento Sustentável*, RDS), is a type of conservation unit, which was created as a result of an innovative collaboration between scientists and communities in the Mamirauá region near Tefé (Lima 1999, Queiroz and Crampton 1999). The RDS Mamirauá, has played a pioneering role in the development of co-management policies for floodplain fisheries and especially the adaptive management of the pirarucu (Viana *et al.* 2007). A key feature of this approach has been the close collaboration between scientists and local fishers and other resident resource users in developing the scientific basis for the collective management of key resources. The approach pioneered in the RDS Mamirauá has served as a model for the development of similar co-management systems in other RDSs throughout the state of Amazonas. In this regard, federal and state legislation for several kinds of reserves includes a mechanism through which outside NGOs can be contracted to work with communities and government managers to develop and implement management plans and strengthen governance institutions of reserve residents and their capacity to sustainably management the reserve's natural resources. As the example of the RDS Mamirauá shows, the development of participatory management systems within the controlled context of a reserve in which the use rights of residents depend on their

compliance with government regulations, can greatly increase compliance with management agreements, which reserve communities have developed and implemented.

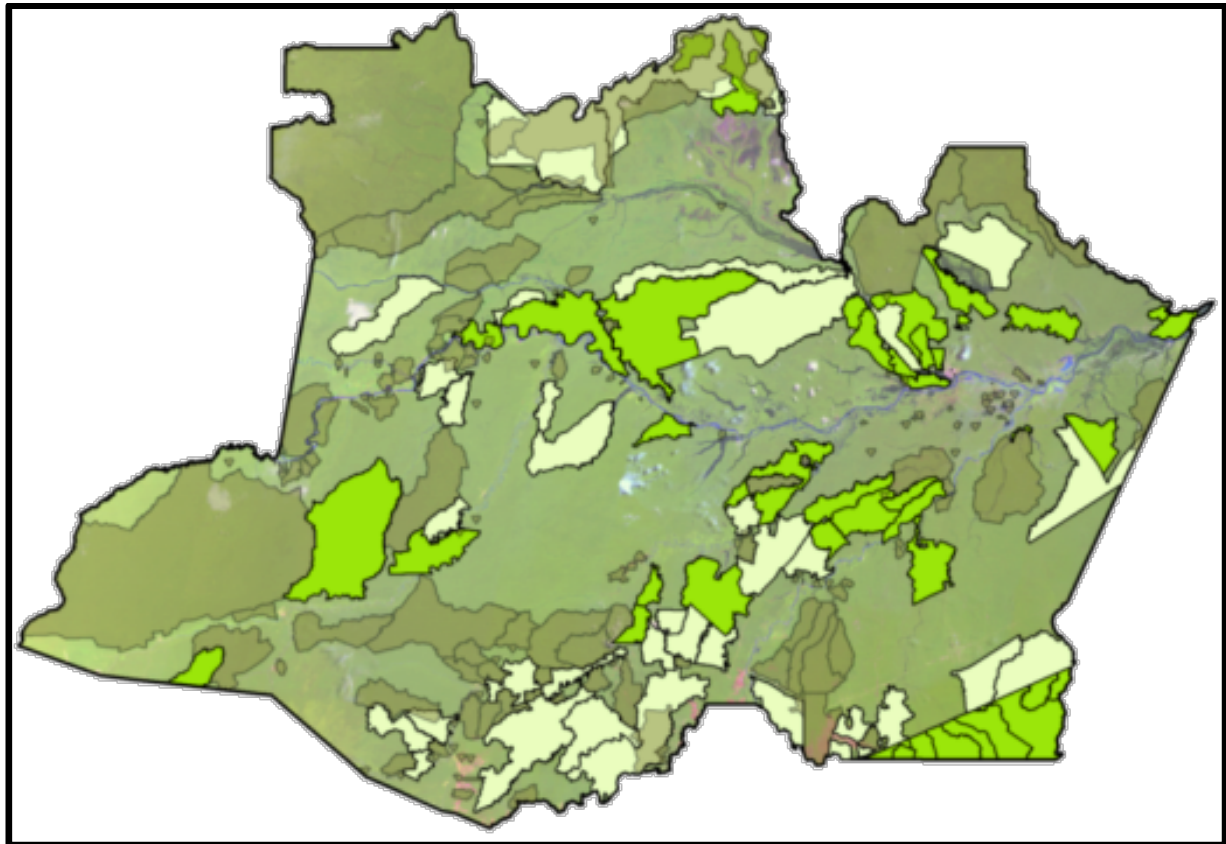


Figure 14. Reserves in the state of Amazonas

Notes: reserves in light green are state reserves of the RDS type.

Source: SDS 2011

8.5. Fisheries policy in Amazonas

Fisheries policy in the state of Amazonas has developed within the context of the state's overall policy and institutional framework for conservation and rural development. Over the last 12 years, the state has developed a remarkably coherent set of policies for the conservation and sustainable development of its inland fisheries. While the focus of fisheries policy in Pará, especially since 2006 when SEPAq was created, has been on artisanal fishers rather than on the resource, the state of Amazonas has been more concerned with the status of the fishery and has invested more effort in the conservation and sustainable management of fish stocks. Thus while in Pará the agenda seems to be driven by artisanal fishers' movement and also aquaculture development, in Amazonas, the focus has been more on managing fisheries within conservation units and commercial/artisanal fishers seem to have had less influence overall on the agenda.

The development of fisheries legislation in the state of Amazonas started earlier and has been more complete than that of Pará. In 2001 the state passed legislation giving the Amazonas Institute of Environmental Protection (*Instituto de Proteção Ambiental do Amazonas, IPAAM*) responsibility for fisheries management (Amazonas 2001). This law makes no mention of co-management or any user/community participation in monitoring and enforcing nor does it mention any role for VEAs. It

was followed up in 2007 by a second law creating the SDS and transferring responsibility for coordinating the formulation and evaluation of fisheries management policies in the state to the SDS (Amazonas 2007). In 2010 the Fisheries Nucleus was created within the SDS, with responsibility for coordinating the development and implementation of fisheries management policies (SDS 2011).

While Amazonas had no formal framework for co-management of fisheries until quite recently, fisheries conflicts in the state of Amazonas were at least as prevalent as in Pará. As in Pará, they also led to the creation of informal fishing agreements throughout the state, most notably in the Tefé and Itacoatiara regions, where the MEB Programs of the Catholic Church received strong support from local bishops (Lima 1999). In the 1990s the Amazonas Superintendency of IBAMA took a highly proactive approach to the problem and was less concerned with the legal issues that constrained co-management development in Pará. Consequently, the recognition of co-management agreements moved forward more quickly in Amazonas and between 1995 and 2000 15 agreements received legal recognition. Between 2000 and 2011 another 38 agreements received legal recognition, most of which are now being reevaluated in light of state legislation passed in 2011 (SDS 2011). These figures do not include the large number of collective fishing agreements created in the 1980s and early 1990s, before the state had instituted criteria and procedures for the legal recognition of these agreements (Fig. 15).

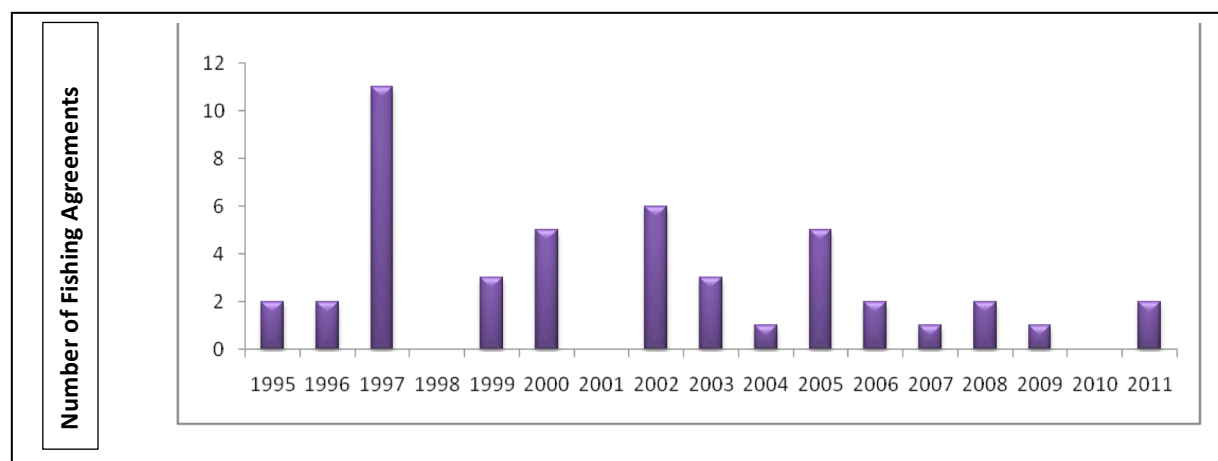


Figure 15. Number of collective fishing agreements recognized each year in the state of Amazonas: 1995-2011

Source: SDS (2011)

The state of Amazonas passed legislation for a fisheries co-management policy, including procedures and criteria for legal recognition, monitoring and enforcement of collective fishing agreements in May 2011 (SDS 2011). As in the case of Pará, the co-management policy closely follows that developed by IBAMA in the 1990s and formalized in regulations passed in 2002 (IBAMA 2003). Four reasons are given for the establishment of agreements: 1) to resolve conflicts; 2) to address overfishing of stocks; 3) to create a mechanism for government where communities have an interest in the management of the local fishery; and 4) to facilitate zonation of a fishery among different stakeholder groups. The legislation requires that no distinction be made between individuals such that rules are applicable to all. It also prohibits the organization responsible for the agreement from levying fines or charging fees, functions that are considered to be the prerogative of the federal government. Agreements can be complementary to, but cannot contradict, existing federal regulations. The law establishes that development and implementation of the agreement must be

undertaken by a committee (*Comitê Condutor do Acordo*) with a president and other officers, and composed of organizations representing users, government agencies and NGOs involved in fisheries. Once approved by participating communities and the Committee, the agreement must be submitted to the SDS for evaluation and approval. The Normative Instruction¹⁷ does not mention how agreements are to be implemented, nor defines responsibilities for monitoring and enforcement. With the passage of this legislation, the SDS began evaluating the 49 agreements recognized between 1995 and 2011. As of the end of 2011 only 14% had been approved and were in the process of being re-implemented. Of the remaining 86%, 11% are being revised (late 2012), 71% are to be revised and 4% have either been revoked or are in the process of being revoked (SDS 2011).

A program of VEAs was initiated in 2008 by the State Council of the Environment. While the program is intended primarily for monitoring state conservation units, VEAs also have been certified to work in areas of pirarucu management. Following the federal legislation VEAs can only issue citations and do not have the power to arrest those who do not comply with management rules.

In summary, the state of Amazonas has implemented a fairly comprehensive policy and institutional framework for the co-management of state fisheries within the context of the broader program for the conservation of biodiversity and sustainable development of natural resources within the state. Consequently, the fisheries program has a strong conservation orientation and is focused primarily, though not exclusively, on the network of state and also federal reserves. The high level of integration of fisheries into a broader state-wide program is evident in the annual report of the SDS that presents the results of the entire program for the year 2011 (SDS 2011). It is worth noting, though, that while the SDS has a greater presence than its counterpart in Pará, fisheries management suffers from the same problems in enforcing regulations as in Pará.

8.6. Summary and conclusions

In striking contrast to the state of Pará, the state of Amazonas has a clear vision and program for the sustainable development of the state that fully integrates its artisanal fisheries. This is well demonstrated by the 2011 Annual Report of the Secretary of Sustainable Development. Some key points include:

1. The state of Amazonas has a well-developed policy and institutional framework for the co-management of artisanal fisheries in the state. Legislation in support of co-management has been implemented, supporting policies defining criteria and procedures for formal community fishing agreements has been implemented and a program VEAs has also been developed. The co-management system is focused largely but not exclusively on reserves. The main problems are a result of limited human and financial resources available for monitoring and enforcing co-management agreements. Consequently, while the co-management system is operational, the quality of monitoring and enforcing regulations is not sufficient to meet the standards of even a moderately rigorous certification program.
2. The state has developed a pioneering program for the sustainable management of the pirarucu based on a scientifically validated management system and is supporting the expansion of the management system within the state. The state is also supporting a pilot project to obtain Marine Stewardship Council (MSC) certification for the Amanã pirarucu fishery. However, once again the state's capacity to monitor and enforce management regulations is remarkably

17 Instrução Normativa (IN)

precarious and in fact the state superintendency of IBAMA is still responsible for evaluating management requests and authorizing annual harvest quotas. Consequently, neither IBAMA nor the SDS are in a position to ensure that counts are adequate, quotas are respected and that only fish from these quotas are being marketed.

3. The state is clearly interested in certifying managed fisheries and other natural resources. However, it is doubtful that more than one or two pirarucu fisheries could qualify to begin the certification process and even these fisheries will probably require a considerable investment of time and resources to reach the point where MSC certification can be granted. However, to a greater extent than any other Amazon state with the possible exception of Acre, Amazonas is committed to developing sustainable management systems that could eventually meet FLEGT-type requirements.

9. Case study 3: Development of a certifiable management system for the pirarucu in Amazonas and Pará

Perhaps the best example of the potential for developing a management and marketing system that can provide the documentation needed to show that products originated in sustainably managed community lake systems is the management system and supporting policies now being developed for pirarucu. Pirarucu has been one of the most important commercial fish species in the Amazon for at least 100–150 years. Until recently the fish were filleted upon capture and dried and salted for storage and marketing, earning the fish the nickname of “*bacalhau* (cod) of the Amazon”. For most of this period, the trade in dried salted pirarucu is believed to have ranged between 1.5 and 5 metric tons, annually, but this estimate only includes fish entering one of the main urban markets and a large proportion of the fish entering the regional trading system, especially during the rubber boom, was shipped directly from source areas to isolated rubber traders throughout the basin (Bessa and Lima 2010, McGrath 1989).

With the development of commercial fisheries, from the 1960s on, pressure on the pirarucu intensified. Bessa and Lima (2010) note that landings in Manaus fell from an average of 99.7 metric tons between 1976 and 1978 to an average of 27.6 tons between 1994 and 1996. A minimum size limit of 150 cm was established in 1989, and a closed season extending from December 1 to May 31 was established in 1991 (IBAMA 1991). Then in 1991 IBAMA decreed a 5 year moratorium on commercially oriented fishing for pirarucu and shortly thereafter the pirarucu was included in Annex II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

9.1. Pirarucu management in the state of Amazonas

The pirarucu has several characteristics that make it well suited for community management. It is sedentary and spawns in floodplain lakes. It surfaces to gulp air at regular intervals and forms pairs that care for their young during the first 4–6 months after eggs are fertilized. Researchers at the Mamirauá Sustainable Development Reserve have developed simple, field-based monitoring techniques that take advantage of these characteristics of the species and the skills of pirarucu fishers to count pirarucus in floodplain lakes. With these techniques, fishers can make reliable estimates of the numbers of adult and juvenile fish in a lake and use these estimates to determine sustainable catch quotas for the annual harvest (Castello 2004).

Castello and his staff at RDS Mamirauá trained teams of community fishers to undertake annual counts of the number of fish in community lakes and to use this information to develop and implement management plans that establish quotas for the sustainable harvesting of fish while also enabling populations to recover. Between 1999 when the system was implemented in the RDS Mamirauá and 2007, the adult pirarucu population almost tripled from 4500 to 12 000 individuals, while the number of fishers doubled from 40 to over 100 (Fig. 16; Castello *et al.* 2009, 2011). In the neighboring reserve of Maraã the managed pirarucu fishery increased from 50 fishers and a total catch of 5.5 tons/year, to 510 fishers and a total catch of 119 tons between 2002 and 2009 (Amaral *et al.* 2011).

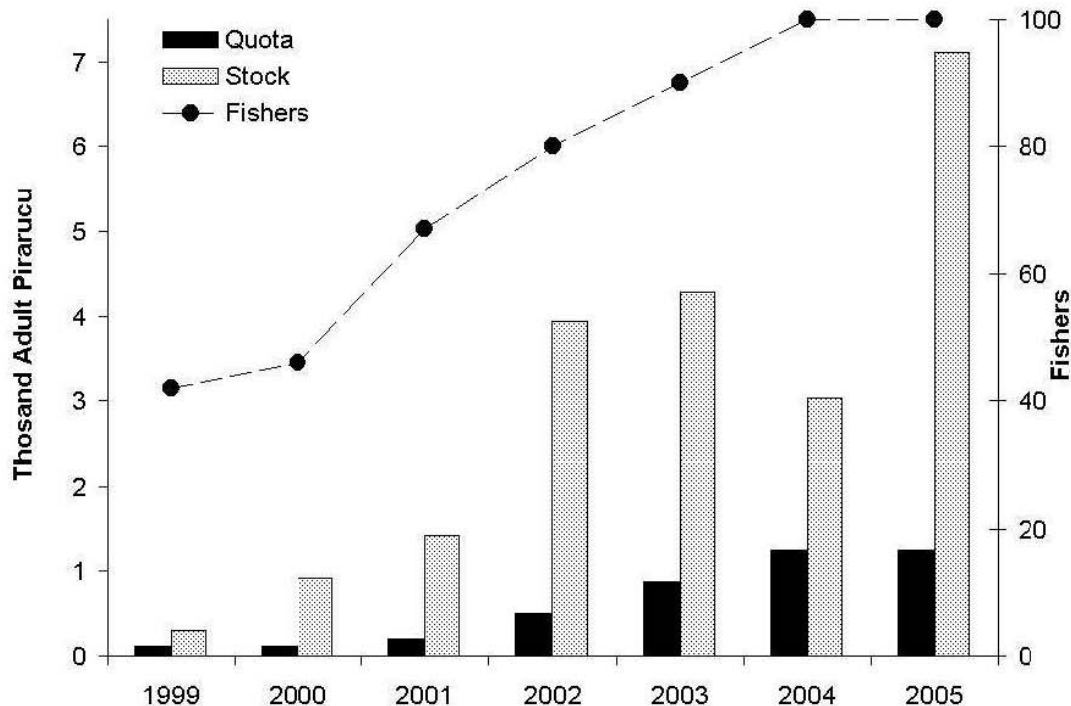


Figure 16. Trends in the abundance of the adult pirarucu population, fishing quotas and number of fishers from four communities participating in the conservation scheme at the Mamirauá Reserve.

Source: Castello *et al.* (2011)

The success of pirarucu management in the Mamirauá–Marãa reserve complex in the Tefé region stimulated the adoption of a state-wide program for the sustainable development of community-based pirarucu fishery. In 2005 the Amazonas Superintendency of IBAMA implemented regulations for the sustainable management of pirarucu based on the management system developed in the RDS Mamirauá (IBAMA 2005). The regulations made possible the sustainable management of pirarucu in conservation units and areas under formal fishing agreements. Under these regulations community groups could submit proposals for management based on counts conducted following the method developed by Mamirauá. IBAMA would then approve an annual quota based on the account. The transport of pirarucu products requires a transit document and each unit of pirarucu fillet is tagged to show origin and to ensure that quantities marketed are the same as the authorized quota. As of the end of 2011, there were 13 management areas in the state with 2100 registered pirarucu fishers. Total production from nine state management areas was 721 tons in 2011. The state is now beginning the process of MSC certification for the Amanã fishery (SDS 2011).

9.2. Pirarucu management in Pará

The pirarucu management system has been disseminated throughout the Brazilian Amazon and has also been widely disseminated in Peru. In Brazil, Acre has passed legislation for the sustainable management of pirarucu. Pará, though, has not implemented any measures to bring the pirarucu fishery under effective control. However, there is a major pirarucu management initiative underway in the Santarém region. Key members of the team that developed the Mamirauá management system are now working with IPAM to train teams of fishers to use the census methodology to monitor local populations, develop management plans and define annual catch quotas. There are now 18 communities and more than 100 trained fishers beginning the process of sustainably

managing pirarucu. Implementation of this management system throughout the mosaic of várzea PAEs in the lower Amazon could significantly increase sustainable production of pirarucu. Estimates based on field research suggest that densities of adult fish could be increased from the present average of 1.5 adults per km² to 31 adults per km². This would increase sustainable production from 44 tons to 914 tons per year and the value of the sustainable catch from R\$200 000 per year to R\$4.1 million per year (IPAM internal report). The consolidation of sustainable management systems for pirarucu would also contribute to more sustainable management of floodplain lake fisheries in general, benefiting not only fish but other aquatic species and the habitats that sustain aquatic productivity.

However, developing a regional co-management system for the pirarucu fishery is complicated by the lack of state legislation in support of pirarucu management, the virtual absence of enforcement of existing regulations for minimum size and closed season, and the lack of markets ready to absorb the higher priced fish products produced by sustainably managed pirarucu fisheries. Proposed legislation developed by IPAM in collaboration with SEPAQ in 2010 was never approved, so the fishery continues to lack effective regulation. However, according to the interim Secretary of SEPAQ, Henrique Sawaki, SEPAQ is preparing a new proposal for regulating pirarucu produced in both aquaculture and managed systems. This legislation will also include measures to certify the origin of pirarucu products. The main focus of this new legislation seems to be production of pirarucu in aquaculture systems, and it is not clear how appropriate the proposed measures will be for the sustainable management of pirarucu under natural conditions.

The construction and funding of the planned CIPAR, currently stalled at the municipal level, could serve as the institutional mechanism for training community management teams and supporting pirarucu management organizations. Through CIPAR programs, individual PAEs could obtain funding and technical assistance to build local infrastructure for harvesting, initial processing and storage of pirarucu, while CIPAR could also organize a regional transport system to supply PAEs with clean ice and other inputs and to transport fish products to CIPAR's receiving facility for processing and sale. This storage, processing and transport infrastructure could significantly reduce loss in post-harvest phases, and help ensure that fish products from artisanal fisheries meet market and government quality standards and are competitive with those of industrial fisheries.

9.3. Conclusions

The community-based pirarucu management system is probably the most successful community management system currently utilized in the Amazon basin. It is also the most promising from the perspective of developing sustainable artisanal fisheries management systems that could meet the requirements of FLEGT-type import policies. In addition, community management of the pirarucu can stimulate the sustainable management of other floodplain fish species, as well as providing incentives to improve habitat for other aquatic species, such as turtles and caiman. Through certification of pirarucu and development of national and international markets, the community-based management of pirarucu could drive efforts to conserve floodplain habitat and aquatic biodiversity throughout the Amazon River system.

There are, however, a number of problems that will have to be overcome before this potential can be realized. While the state of Amazonas has put in place the main elements of a certifiable system, the system is rudimentary and the reliability of the system is precarious. For example, although the SDS is formally responsible for fisheries management, including the management of pirarucu, the Amazonas Superintendency of IBAMA, which no longer has formal responsibility for fisheries

management, continues to be responsible for authorizing quotas, issuing transit documents and tags. There is no state wide training and certification system for fish counters, there have been a number of cases of deliberate overestimates of lake fish stocks, and the monitoring system for quotas and transit documents and tags are too precarious to provide a reasonable guarantee that the origin of any given unit of pirarucu product is correct (Bessa and Lima 2010). Better and more systematic monitoring and enforcement of authorized management systems is needed to ensure that: 1) fishers have been adequately trained as counters; 2) counts are accurate; 3) harvested fish actually come from the lakes where the census was conducted; and 4) transit documents and tags are not used for fish that are not part of the authorized quota.

The other major issue is market access. First, the existing markets in the Amazon do not distinguish between sustainably managed fish and fish that do not meet legal requirements. Consequently, fishers selling fish from sustainably managed lakes must compete with undersized pirarucu and fish caught illegally out of season. Furthermore, since there is only a 6-month harvest season, supplies during this period drive down prices, while fish caught illegally out of season when supplies are lower often obtain higher prices. Ironically, the situation is somewhat different in Pará, because monitoring of markets is virtually nonexistent and enforcement of the closed season is minimal. Consequently, there is less seasonal variation in supplies and prices for fresh pirarucu in urban markets such as Santarém are relatively stable all year round.

Second, while both the traditional dried and salted and chilled fresh pirarucus are highly prized in the Amazon, the species is far less well known in the major markets of Brazil in the northeast and southeast. Consequently, the alternative of avoiding the low prices in traditional Amazon markets and shipping fish directly to markets elsewhere in Brazil is also problematic. Consumer demand in these markets is not sufficient to absorb current levels of sustainable output and the problem is only likely to worsen as sustainable production increases. Two other factors that exacerbate the situation are: 1) competition from cheaper and better-known marine and aquaculture species in southern markets; and 2) a problem with discoloration that can occur in frozen pirarucu.

In summary, while the pirarucu has enormous promise for meeting FLEGT-type import requirements, state governments must make significant investments in monitoring and enforcement before that potential can be captured. In addition, the state government and/or firms interested in marketing sustainably managed pirarucu outside the Amazon must develop marketing campaigns to educate consumers in potential markets about the pirarucu, how to prepare it and the important social and ecological benefits of purchasing certified pirarucu products. The development of these markets would greatly stimulate the sustainable management of not just the pirarucu, but many other floodplain fish species, providing incentives to conserve the habitat responsible for the high productivity of floodplain fisheries.

10. Recommendations for formalization of Amazonian artisanal fisheries

Artisanal fishers are often on the margins of national societies and the formal economy and have limited access to government social services and subsidized credit programs. Furthermore, as a group they are relatively unorganized, with seasonal or intermittent engagement in the local fishery, and are dispersed in small rural communities with highly fragmented marketing structures. Artisanal fishers are a group which by definition would have great difficulty in complying with the requirements of FLEGT-type programs. Consequently, despite the good intentions of this kind of policy, FLEGT-type systems of verification and regulation could further the advantage of larger scale and more highly capitalized fishing and aquaculture operations, which can provide fish products in the quantities, and with the quality and reliability required by large formal markets.

In the Brazilian Amazon, none of the basic components of fisheries commodity chains from management and capture through to national and international markets can be completely documented. There is not yet a reliable government registry of artisanal fishers. The policy and institutional framework for monitoring and enforcing management regulations and ensuring the sustainability of local fisheries ranges from precarious to nonexistent. Finally, the market channels from fisher to fish processing plants and urban wholesale and retail markets, is largely outside the formal economy.

On the other hand, this report shows that significant, though variable, progress has been made in many key elements of the formalization process, including the construction of the basic legal/regulatory framework for the co-management of artisanal fisheries and the integration of fishers and their families into the formal economy. However, even in the state of Amazonas there is still a long way to go before artisanal fisheries are ready to meet the requirements of a FLEGT-type system. Unless federal and state fisheries agencies make it a priority to work with fisher organizations to prepare the artisanal fisheries sector for compliance with the requirements of formal markets, artisanal fishers will find themselves increasingly marginalized as the formalization of local regional and national fisheries proceeds. In the process fish from wild stocks will be replaced by aquaculture production and the link between sustainable fisheries and the conservation of floodplain habitat and the ecosystem services these wetland environments provide will be lost.

With the exception of the state of Amazonas, it would seem that federal and state governments do not sufficiently appreciate the enormous productivity of healthy, sustainably managed fisheries, the critical role fish and fishing play in the incomes and food security of the rural and urban poor and the potential for well-managed fisheries to improve incomes and the quality of life of fisher peoples throughout the region. A comprehensive program in support of the modernization of artisanal fishers is needed that implements policies, programs and institutional arrangements for: 1) the co-management of inland and coastal fisheries, 2) the community-based management of floodplain lake fisheries, 3) programs to provide technical and organizational assistance, 4) improved and appropriate technology for capture, storage and processing of fish and fish products, 5) infrastructure for sustainable management and marketing of fish products, and 6) subsidized loan programs to enable fishers and fish communities to acquire the infrastructure and equipment they need to meet the requirements of FLEGT-type programs.

Specific recommendations include:

1. Policy and institutional arrangements for co-management of floodplain fisheries

In addition to the continued development of co-management policies, significant state support for monitoring and enforcement of co-management regulations is necessary. Ideally, the state should work with fishing communities to develop policies and procedures that meet the needs and capabilities of fishing communities and that give them increasing authority to manage local fisheries. At the same time communities need the support of government agents in monitoring and especially enforcement to ensure that local fisheries are sustainably managed and that the costs and benefits of participating in local fisheries are equitably distributed.

2. Monitoring and control of markets

State, federal and municipal agencies must improve the monitoring of markets to prevent the sale of undersized and out of season fish and fish products. Suppression of illegal sources of fish is critical to encouraging the development of sustainably managed fisheries.

3. Technical assistance programs for artisanal fisheries

While extension programs for rural farmers in the Amazon are far from adequate, there are virtually no such programs for artisanal fishers. Furthermore, what extension activities do exist tend to be oriented towards aquaculture.

3.1 Sustainable, community-based management

Significant investments are needed to train extension agents in the community-based management of inland fisheries, so they can provide technical assistance to communities in order to improve the sustainable management of local resources progressively.

3.2 Technical assistance to improve hygiene standards in artisanal fisheries

One of the major barriers to entering national and international markets is the inadequate hygiene conditions and practices in Amazonian artisanal fisheries. Part of the problem is the lack of awareness of the hygiene practices that should be adopted to avoid contamination of fish and fish products. Consequently, a major investment is needed in educating fishers and their families on the proper hygiene practices. These educational programs should be combined with loan programs to facilitate purchase of the equipment needed to meet national sanitary standards.

3.3 Technical assistance to meet certification requirements

Extension agents should also receive training in certification requirements and procedures so they can assist fisher organizations in making the changes needed to meet required standards.

4. Subsidized loan programs designed to meet the needs of artisanal fishers

One of the problems with existing loan programs is that they are oriented towards increasing fisher capacity to catch fish, thereby increasing pressure on local fisheries and in many cases exacerbating conflicts. There is at present no program designed to support the sustainable development of artisanal fisheries with technologies that are appropriate to the financial and technical capabilities of artisanal fishers and fishing communities.

4.1 Local infrastructure for sustainable management

Today, there are no government loan programs for development of local infrastructure for the sustainable management of local fisheries, and storage and processing of fish. Existence of appropriate infrastructure would encourage sustainable management, improve local sanitary conditions and significantly improve the quality of fish derived from rural fisheries.

4.2 Infrastructure and equipment to improve hygiene conditions

A key problem for artisanal fisheries is the low quality of fish due to inadequate handling and storage between capture and sale in local markets. Loan programs are needed that are designed to address these problems by enabling fishers to purchase modern equipment that in combination with improved handling practices, enable fishers to achieve the quality standards required by national and international markets.

5. Linking loan programs and technical assistance for sustainable fisheries

While the federal government has made a significant volume of credit available to small-scale farmers and fishers, these loan programs have not been linked to the provision of technical assistance. One consequence has been an excessively high rate of delinquency on these loans. Loan programs and technical assistance should be integrated to ensure that fishers have the technical assistance they need not just to prepare loan applications, but to implement their projects once loans have been approved, including administering the funds to ensure that they cover necessary expenditures and a plan for repayment of the loan.

6. Investment in market infrastructure and management

One of the major problems for artisanal fisheries is the precarious sanitary conditions in markets, a consequence of inadequate infrastructure and administration of public fish markets. Municipal and state government funding programs are needed to modernize market infrastructure, including facilities for receiving, washing and classifying and storing fish and fish products. Training programs are also needed for market administrators and their staff to instill an understanding of the practices and procedures needed to achieve required sanitary conditions.

7. Community-industry partnerships to process and market fish from sustainably managed artisanal fisheries

One of the major challenges in the modernization of artisanal fisheries is the administration of collective organizations for processing and marketing fish. The failure rate of such initiatives in the Amazon hovers close to 100%. Partnerships between community management organizations and private-sector processing and marketing firms can provide an effective solution to this problem and enable fishers to meet required hygiene standards and access national and international markets that value certified fish products from sustainably managed fisheries. These partnerships take advantage of the strengths of each side, community capacity to sustainably manage local fisheries and private sector capacity to process and market fish products (Almeida 2006b).

11. References

- Abdallah, P. R. and U. R. Sumaila. 2007. An historical account of Brazilian public policy on fisheries subsidies *Marine Policy* 31: 444–450.
- Acala, A. and F. Vuse, 1994. The role of government in coastal resources management. In: R. S. Pomeroy (ed.), *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experience*, pp. 12–19. ICLARM Conf. Proc. 45, 89 p.
- Allegretti, M. 1995. Reservas extrativistas: parâmetros para uma política de desenvolvimento sustentável na Amazônia. In: R. Arndt (ed.), *O Destino da Floresta*, pp. 17-47, Rio de Janeiro, Brazil: Dumará.
- Almeida, O. (org.). 2006a. *Manejo De Pesca Na Amazônia*. São Paulo, Brazil: Peirópolis.
- Almeida, O. T. 2006b. *A Indústria Pesqueira Na Amazônia*. Manaus, Brazil: PROVARZEA/IBAMA.
- Almeida O, K. Lorenzen, D. and G. McGrath. 2009. Fishing agreements in the lower Amazon: for gain and restraint. *Fisheries Management and Ecology* 16: 61–7.
- Amaral, L., O. Almeida, D. G. Mcgrath. 2006. Sistema de crédito para a pesca artesanal: impacto do fno na renda do pescador do baixo amazonas e inadimplência. In: Encontro Nacional Da Associação Nacional De Pós-Graduação e Pesquisa Em Meio Ambiente e Sociedade, Brasília. Brazil: III ENANPPAS.
- Amaral, E., I S. De Sousa, A. C. T. Goçaves, R. Braga, P. Ferraz and G Carvalho. 2011. *Manejo de Pirarucus (Arapaima gigas) em Lagos de Várzea de Uso Exclusivo de Pescadores Urbanos*. Série Protocolos de Manejo de Recursos Naturais 1, Tefé, AM.
- BASA. 1993. Estudo sobre a pesca artesanal. Belém, Brazil: Banco da Amazônia, Belém, Pará.
- Benatti, J. H. 2003. Direito de Propriedade e Proteção Ambiental no Brasil: apropriação e o uso dos recursos naturais no imóvel rural. Doctoral thesis, NAEA, UFPa, Belém, PA, Brazil.
- Benatti, J. H. 2005. Aspectos jurídicos e fundiários da várzea: uma proposta de regularização e gestão dos recursos naturais. In: *A Questão Fundiária E O Manejo Dos Recursos Naturais Da Várzea: Análise Para Elaboração De Novos Modelos Jurídicos*, pp. 77–100. Final Report. Strategic Studies Component. Manaus, Brazil: IBAMA/Provárzea, MMA.
- Bessa, J. D. and A. de C. Lima. 2010. Manejo de pesca do pirarucu (*Arapaima gigas*) no Estado do Amazonas: Erros, Acertos e Perspectivas Futuros. *Anais do 1 Seminário Internacional de Ciências do Ambiente e Sustentabilidade na Amazônia*, UFAM, Manaus, AM.
- Brabo, M. J. C. 1981. Pescadores, geleiros, fazendeiros-os conflitos da pesca em cachoeira do arari. *Boletim Do Museu Paraense Emílio Goeldi. Série Antropologia*, Belém, no. 77.
- CPT 1992a. Ribeirinhos: uma estação de luta. Dossier 1992. Comissão Pastoral Da Terra, Regional Amazonas E Roraima, Manaus.
- CPT 1992b. Os ribeirinhos: preservação dos lagos, defesa do meio ambiente e a pesca comercial. Comissão Pastoral Da Terra, Regional Amazonas E Roraima, Manaus.
- Campos, A. J. T. 1993. Movimentos sociais de pescadores amazônicos In: L. Furtado, W. Leitão and A. F. Mello *Povos Das Águas: Realidade E Perspectivas Na Amazônia*, pp. 231–242. Belém, Brazil: MPEG.
- Castello, L. 2004. A method to count pirarucu *Arapaima gigas*: fishers' assessment and management. *North American Journal Of Fisheries Management* 24(2): 378–389.
- Castello L, J. P. Viana, G. Watkins, M. Pinedo-Vasquez and V. A. Luzadis. 2009. Lessons from integrating fishers of *Arapaima* in small-scale fisheries management at the Mamirauá Reserve, Amazon. *Environmental Management* 43: 197–209.
- Castello L, M. Pinedo-Vasquez and J. P. Viana. 2011. Participatory conservation and local knowledge in the Amazon várzea: the pirarucu management scheme in Mamirauá. In: M. Pinedo-Vasquez, M. Ruffino, C. J. Padoch, E. S. Brondízio, (eds). *The Amazon Varzea: The Decade Past And The Decade Ahead*, pp. 261–276. New York: Springer-Verlag.
- Castro F. 2000. *Fishing Accords: The Political Ecology of Fishing Intensification in the Amazon*. Bloomington, IN: Center for Studies of Institutions, Population & Environmental Change. Indiana University, Dissertation Series No. 4.

- Castro, F. and D. G. Mcgrath. 2003. Moving toward sustainability in the local management of floodplain lake fisheries in the Brazilian Amazon. *Human Organization* 62(2): 123–133.
- Chapman, M. 1989. The political ecology of fisheries depletion in Amazonia. *Environmental Conservation* 16(4): 331–337.
- Crampton, W.G. R., L. Castello and J. P. Viana. 2004. Fisheries in the Amazon várzea: historical trends, current status, and factors affecting sustainability. In: K. Silvius, R. Bodmer, J. M. V. Fragoso, (eds). *People In Nature: Wildlife Conservation In South And Central America*, pp. 76–95 New York: Columbia University Press.
- Elson, D. 2008. Linking FLEGT Voluntary Partnership Agreements to Jobs and Growth: Potential Challenges and Benefits for Small and Medium Sized Forest Enterprises. *Forest Trends*.
- Esterci, N. 2004. The peasantry and the church on the Brazilian frontier: the significance of the alliance and its repercussions. In: S. Nugent and M. Harris, (Orgs) *Some Other Amazonians: Perspectives On Modern Amazonia*, pp. 128–144. London: Institute For The Study Of The Americas.
- Feeny, D., F. Berkes, B. McCay and B. Acheson. 1990. The tragedy of the commons: twenty two years later. *Human Ecology* 18(1): 1–19.
- Goulding, M. 1983. Amazonian fisheries. In: E. Moran (org.). *The Dilemma Of Amazonian Development*, pp. 89-210. Boulder, CO: Westview Press.
- Hall, A. 1997. *Sustaining Amazonia*. Manchester, UK: Manchester University Press.
- Hardin, G. 1968. The tragedy of the commons. *Science* 162: 1243–1248.
- Hartmann, W. 1989. Conflitos de pesca em águas interiores da amazônia e tentativas para sua solução. In: Diegues, A. (org.) *Pesca Artesanal: Tradição E Modernidade, III Encontro De Ciências Sociais E O Mar*, pp. 103–118. São Paulo, Brazil: IOUSP/F.FORD/UICN.
- Hurley, J. 1933. *No Domínio Das Águas – História Da Pesca No Pará*. Belém, Brazil: Typografia Do Instituto D. Macedo Costa.
- IBAMA. 1995. *Projeto Iara - Administração Dos Recursos Pesqueiros Do Médio Amazonas: Estados Do Pará E Amazonas*. Coleção meio ambiente. Série estudos de pesca, (15). IBAMA.
- INCRA. 1996. Conceito e Metodologia para Implantação dos Projetos de Assentamento Agro-Extrativistas (PAES), Diretoria de Assentamento, Instituto Nacional de Colonização e Reforma Agrária. Brasília, D.F.
- INCRA. 1997. Plano de Utilização do Projeto de Assentamento Agroextrativista Remanso. Diretoria de Assentamento, Instituto Nacional de Colonização e Reforma Agrária. Rio Branco, AC, Brazil.
- Inhetvin, T. 2004. *Custos de Oportunidade e Efetividade da Co-Gestão de Recursos Pesqueiros na Várzea do Rio Amazonas: Estudo de Caso Santarém*. Manaus, Brazil: IBAMA/PROVÁRZEA.
- Isaac, V. J., S. Mota, V. L. C. Rocha. 1993. Algumas considerações sobre a legislação da "piracema" e outras restrições da pesca na região do médio amazonas. In: L. G. Furtado, W. Leitão, and A. F. Melo (org.). *Povos Das Águas: Realidade E Perspectivas Na Amazônia*, pp. 187–211. Belém, Brazil: MPEG.
- Jentoft, S. and McCay, B. 1995. User participation in fisheries management. *Marine Policy* 19(3): 227–246.
- Junk, W. 1984. Ecology, fisheries and fish culture in Amazonia. In: H. Sioli, (org.). *The Amazon: Limnology And Landscape Ecology Of A Mighty Tropical River And Its Basin*, pp. 443–475. Dordrecht, the Netherlands: DR. Publishers.
- Junk, W., P. Bayley and R. Sparks. 1989. The pulse concept in river-floodplain systems. In: D.P. Dodge (ed.). *Proceedings of the International Large River Symposium (LARS) Canadian Special Publication of Fisheries and Aquatic Sciences* 106: 110–127.
- Leroy, J. P. 1991. *Uma Chama Na Amazônia*. Rio De Janeiro, Brazil: Vozes/Fase.
- Lima, D. 1999. Equity, Sustainable development and biodiversity preservation: some questions on the ecological partnership in the Brazilian Amazon. In: C. Padoch, M. Ayres, M. Pinedo-Vasquez, and A. Henderson, (eds). *Conservation and Development of Amazonian Varzea*, pp. 247–263. New York: New York Botanical Garden Press.
- Lima, D. and E. F. Alencar, 2001. A lembrança da História : memória social, ambiente e identidade na várzea do Médio Solimões. *Lusotopie* (2001): 27–48
- Mainwaring, S. (2004 [1986]). *A Igreja Católica e a política no Brasil (1916–1985)*. Editora Brasiliense, São Paulo, Brazil.

- McGrath, D. G. 1989. *The Paraense Traders: Small-Scale, Long Distance Trade in the Brazilian Amazon*. PhD thesis. Geography Department, University of Wisconsin-Madison.
- McGrath, D. G., F. de Castro, C. Fudemma, B. D. Amaral and J. C. Araujo. 1993. Fisheries and the evolution of resource management on the lower Amazonian floodplain. *Human Ecology* 22(2): 167–195.
- McGrath, D., F. de Castro and C. Fudemma. 1994. Reservas de lago e o manejo comunitário da pesca no baixo amazonas: uma avaliação preliminar. In: M. A. D’Incao and I. M. Silveira (org.). *Amazônia e a Crise da Modernização*, pp. 389–402. Belém, Brazil: Museu Paraense Emílio Goeldi.
- McGrath, D. G., F. de Castro and E. Câmara. 1999. Community management of floodplain lakes and their role in the sustainable development of Amazonian fisheries. In C. Padoch, A. Henderson and M. Pinedo (eds). *Diversity, Development and Conservation of the Amazon Floodplain. Advances in Economic Botany* 13: 59–82.
- McGrath, D. 2000. Avoiding a tragedy of the commons: recent developments in the management of Amazonian fisheries. In: Anthony Hall (ed.). *Amazonia at the Crossroads*, pp. 171–197 London: Institute of Latin American Studies.
- McGrath, D. G., A. Cardoso and E. P. Sá. 2004. Community fisheries and co-management on the lower Amazon floodplain. In: R. L. Welcomme and T. Petr (org.). *Proceedings Of The Second International Symposium On The Management Of Large Rivers For Fisheries. Volume I*, pp. 207–222 Bangkok: FAO Regional Office For Asia And The Pacific, Rap Publications.
- McGrath, D. and S. P. da Gama. 2005. Estudo de Áreas Comunitárias na Várzea Amazônica nos Municípios de Santarém-PA, Silves-AM e Tefé-AM. In: J. H. Benatti, (Coord.). *A Questão Fundiária e o Manejo dos Recursos Naturais da Várzea: Análise para Elaboração de Novos Modelos Jurídicos*. Manaus, Brazil: Provárzea-IBAMA. Pages 35-52.
- McGrath, D., O. T. Almeida and F. D. Merry. 2007. The influence of community management agreements on household economic strategies: cattle grazing and fishing agreements on the lower Amazon floodplain. *International Journal of the Commons* 1(1): 101-121.
- McGrath D. G., A. Cardoso, O. T. Almeida and J. Pezzuti. 2008a. Constructing a policy and institutional framework for an ecosystem-based approach to managing the Lower Amazon floodplain. *Environment, Development and Sustainability* 10: 677–679
- McGrath, D. G., O. T. Almeida, N. Vogt, and A. Portilho. 2008b. *Diagnóstico, tendências, potencial, estrutura institucional e políticas públicas para o desenvolvimento sustentável da pesca e aqüicultura*. In: Secretaria de Pesca e Aquicultura do Estado do Pará. (Org.). Secretaria de Pesca e Aquicultura do Estado do Pará. Diagnostico da Pesca e da Aquicultura do Estado do Pará, V. 07: 01-117
- McGrath, D., S. P. da Gama, A. Cardoso, O. Almeida and J. H. Benatti. 2011. Integrating co-management and land tenure policies for the sustainable management of the Lower Amazon floodplain. In: M. Pinedo Vasquez, M. Ruffino, C. Padoch and E. Brondizzio (eds). *The Amazonian Várzea: The Decade Past and the Decade Ahead*. New York: Springer. Pages 119-136.
- Meschkat, A. 1960. Report To The Government of Brazil on the Fisheries of the Amazon Region. Technical Report 1305. Rome: Food and Agriculture Organization, United Nations.
- Oliveira, A. C. and L. H. Cunha. 2002. Manejo comunitário de lagos em la planície inundable de da cuenca media del rio solimões, estado do amazonas, brasil: um modelo de rpeservacion em transformacion. In: R. C. Smith and D. Pinedo, *El Cuidado De Los Bienes Comunes: Gobierno Y Manejo De Los Lagos Y Bosques En La Amazonía*, pp. 244–271 Lima, Peru: Instituto Del Bien Común.
- Olsen, M. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.
- Ostrom, E. 1990 *Governing The Commons: The Evolution Of Institutions For Collective Action*. New York: Cambridge University Press.
- Ostrom, E. (1992). *Diseño de Instituciones para Sistemas de Riego Auto-gestionarios*. San Francisco, CA: ICS Press.
- Pereira, H. S. 2002. *Economia institucional da co-gestão de recursos pesqueiros na várzea do rio amazonas*. Manaus, Brazil: IBAMA/PROVÁRZEA.
- Pomeroy, R. S. and F. Berkes. 1997. Two to tango: the role of government in fisheries co-management. *Marine Policy* 21: 465–80.

- Queiroz, H. L. and W. G. Crampton. 1999. *Estratégias Para Manejo De Recursos Pesqueiros Em Mamirauá*. Brazil: Sociedade Civil Mamirauá/Cnpq.
- Rocha, S. M., S. Z. R. Saraiva, S. C. Moraes and S. C. Guimarães. 1996. Delineamento da situação das organizações sociais de pescadores amazônicos: o caso do nordeste paraense. In T. Ximenes (org.) *Políticas Pesqueiras Nos Países Amazônicos*, pp. 248–310. Belém, Brazil: UFPA/UNAMAZ.
- Santos Viera, R. 1992. *Várzeas Amazônicas e a Legislação Ambiental Brasileira*. Manaus, Brazil: INPA.
- SDS 2011. *Relatório de Gestão do Sistema SDS*. Manaus, Brazil: Secretaria de Desenvolvimento Sustentável. Governo do Estado de Amazonas.
- Sheikh, P. A. 2002. The impacts of water buffalo and cattle ranching on the Lower Amazon floodplain: An ecological and socio-economic comparison. PhD thesis, Department of Ecology, Pennsylvania State University, State College.
- Sheikh, P. A., F. D. Merry, and D. G. McGrath. 2006. Water buffalo and cattle production on the Lower Amazon: comparisons and conflicts *Agricultural Systems* 87: 313–330.
- Smith, N. 1985. The impact of cultural and ecological change on Amazonian fisheries. *Biological Conservation* 32(44): 355–373.
- Sternberg, H. O. (1998). *A Água e o homem na Várzea do Careiro*. Belém, PA, Brazil: Museu Paraense Emílio Goeldi. Original 1956.
- SUDEPE. 1988. Superintendência Do Desenvolvimento Da Pesca – SUDEPE, Coordenadoria Regional No Pará - Coreg. *O Setor Pesqueiro No Estado Do Pará – Diagnóstico*. Brazil: Sudepe.
- Teixeira, G. da S. and P. R. Abdallah. 2005. Política De Seguro-Desemprego E Pesca Artesanal No Brasil: Em Análise O Estado Do Rio Grande Do Sul E A Região Da Lagoa Dos Patos. Paper presented at the VI Encontro De Economia Ecológica, 22 to 25 of November, UNB-Brasília.
- Veríssimo, J.. 1970 (1895) *A Pesca na Amazônia*. Rio de Janeiro, Brazil: Universidade Federal do Pará.
- Viana, J. P., L. Castello, J. M. B. Damasceno, E. S. R. Amaral, G. M. B. Estupinám, C. Arantes, G. S. Batista, D. S. Garcez and S. Barbosa. 2007. Manejo comunitário do pirarucu *Arapaima gigas* na reserva de desenvolvimento sustentável mamirauá - amazonas, brasil. In: *Áreas Aquáticas Protegidas Como Instrumento De Gestão Pesqueira*, pp. 239–226. MMA, Brazil: Secretaria de Biodiversidade e Florestas, Núcleo de Zona Costeira E Marinha.
- Weinstein, B. 1983. *The Amazon Rubber Boom*. Stanford, CA: Stanford University Press.

Legislation:

Federal:

- Brasil. 1934. Código das Águas. Decreto No 24.643 de 17 de julho de 1934.
- Brasil. 1991. Lei ordinária nº 8.287, de 20 de dezembro de 1991. Dispõe sobre a concessão do benefício de seguro-desemprego a pescadores artesanais, durante os períodos de defeso. *Diário Oficial [da] República Federativa do Brasil*, Brasília, DF.
- Brasil. 2003. Lei nº 10.779, de 25 de novembro de 2003. Dispõe sobre a concessão do benefício de seguro desemprego, durante o período de defeso, ao pescador profissional que exerce a atividade pesqueira de forma artesanal. Ministério do Trabalho e Emprego. *Diário Oficial [Da] República Federativa Do Brasil*, Brasília, DF.
- Brasil 2009. Lei No. 11,959, de 29 de junho de 2009. Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca. Poder Executivo. Brasília, DF.
- Brasil 2011. Lei complementar No 140, de 8 de dezembro de 2011. Defines complementary responsibilities of federal, state and municipal levels.
- IBAMA 1991. Portaria IBAMA N° 480, de 04 de abril de 1991. MMA. Brasília, D.F.
- IBAMA. 2001a. Instrução Normativa nº 19, de 5 de novembro de 2001. MMA. Brasília, D.F.
- IBAMA. 2001b. Provárzea: Projeto De Manejo Dos Recursos Naturais Da Várzea, Programa Piloto Para A Conservação Das Florestas Da Amazônia, MMA. Brasília, D.F.
- IBAMA. 2001c. Manual Dos Agentes Ambientais Colaboradores. MMA. Brasília, D.F.

IBAMA. 2003. Instrução Normativa nº 29, de 31 de dezembro de 2002. Regulates formalization of fishing agreements. MMA. Brasília, D.F.

IBAMA 2005. Instrução Normativa No. 66 de 12 de maio de 2005. Refers to Volunteer Environmental Agents. *Diário Oficial da União* No 97 23 de maio de 2005. Brasília, DF.

MPA. 2008. Ministério da Pesca e Aquicultura. Portaria nº 203, de 21 de agosto de 2008. Diário Oficial [da] República Federativa do Brasil, Brasília, DF.

State of Pará:

Pará. 2005. Lei nº 6.713, de 25 de janeiro de 2005. Dispõe sobre a Política Pesqueira e Aquícola no Estado do Pará, regulando as atividades de fomento, desenvolvimento e gestão ambiental dos recursos pesqueiro e da aquicultura e dá outras providências. Diário Oficial do Estado, N° 030365, Belém.

Pará. 2006. Decreto nº 2.020, de 24 de janeiro de 2006. Regulamenta a lei nº 6.713, de 25 de janeiro de 2005, que dispõe sobre a política pesqueira e aquícola no estado do Pará, regulando as atividades de fomento, desenvolvimento e gestão ambiental dos recursos pesqueiros e da aquicultura, e dá outras providências. Diário Oficial do Estado nº 30609, Belém.

Pará. 2007. Lei nº 7.019, de 24 de julho de 2007. Cria a Secretaria de Estado de Pesca e Aquicultura - SEPq, e dá outras providências. Diário Oficial do Estado nº 30973, Belém.

State of Amazonas:

Amazonas 2001. Lei No. 2,713 de 28 de dezembro de 2001. Gives IPAAM responsibility for fisheries management. Governo do Estado de Amazonas, Manaus, AM.

Amazonas 2007. Lei Delgada No. 66, de 9 de maio de 2007. Creates SDS and defines functions. Governo do Estado de Amazonas, Manaus, AM.

SDS 2011. Instrução Normativa No. 03 de 2 de maio de 2011. Regulates formalization of fishing agreements. Secretaria de Desenvolvimento Sustentável. *Diário Oficial* de 24 de maio de 2011. Governo do Estado de Amazonas, Manaus, AM.

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