

Management of Amazonian Fisheries and the Potential for Sustainable Fishery Development in South-Eastern Peru



(Goulding 2003: 94)

Philip Bulterys

Professor Bill Durham

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ABSTRACT

This paper seeks to determine the potential for sustainable fishing in South-Eastern Peru, and to critically evaluate various approaches to fishery management. Fishing activities in South-Eastern Peru are generally minimally understood; however, in more urban areas like Puerto Maldonado, important trends have revealed the need for a long-term management strategy focused on protecting migratory fish populations. Aquarium fisheries and aquaculture, whilst still in the experimental phase, are providing a great deal of optimism for sustainable development. Effective fishery management strategies must accommodate both regional concerns as well as the needs of local populations. Given the migratory nature of many coveted fish species, conservation and development policies should emphasize comprehensive regional or even international guidelines. Ultimately though, local populations must take an active role in managing the resources which they depend upon.

INTRODUCTION

Biologists estimate that in the entire Amazon basin, 150,000-200,000 tons of fish are harvested annually by subsistence and commercial fishers (Goulding 2003: 72). Fish comprise an integral part of Amazonian diets as a vital source of protein, and fisheries provide a source of employment in extremely underemployed areas. Unfortunately, fishing is traditionally an extractive process with the potential to over-exploit fish stocks; however, more sustainable management plans are currently being explored. Although fishing activities in the Madre de Dios region of South-Eastern Peru remain poorly understood, noticeable patterns are revealing the need for a long-term management plan.

The aim of this paper is to determine the potential for sustainable fishing in South-Eastern Peru, and to critically evaluate various approaches to fishery management.

HYPOTHESES

This study is subject to several potentially-falsifiable hypotheses listed below.

- Increased pressure and demand for fish have led to excessive extraction by South-East Peruvian fisheries, revealing the need for more environmentally conservative measures.
- South-East Peruvian fisheries will likely function more sustainably under a community-based management model rather than under a state-controlled model because local people are more suited to protect the fish resources which they depend upon.

By exploring the validity of these two statements, this paper seeks to uncover more concrete solutions to fishery management in South-Eastern Peru, specifically in the Madre de Dios region (Figure 1).

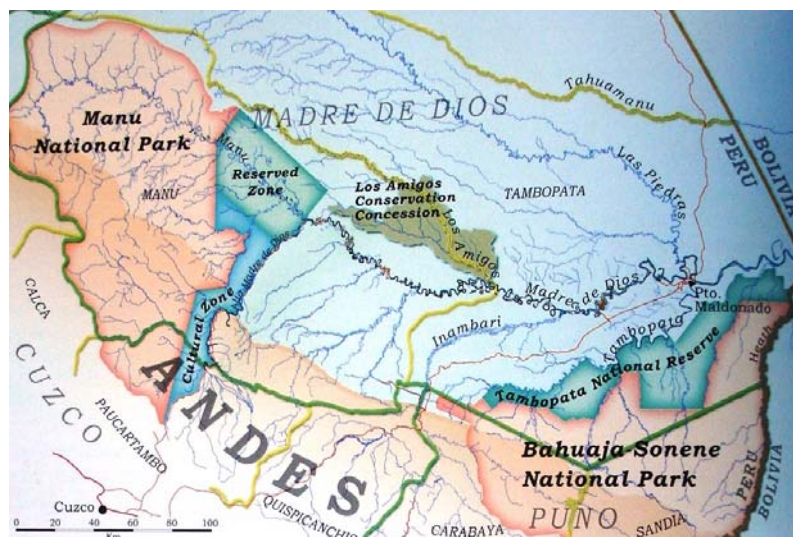


Figure 1: Map of the Madre de Dios region. (Goulding 2003: 22)

ECOSYSTEM DYNAMICS OF THE MADRE DE DIOS REGION

An understanding of the ecological realities of the Peruvian river systems is critical to developing an effective fishery management strategy. Peruvian river systems, including the Madre de Dios region, can be collectively described as Amazonian headwaters with their source in the Andes Mountains. Headwaters are loosely defined as mountainous drainage and the alluvial sediment deposition zone which reaches up to 150 kilometers from the Andes (Goulding 2003: 16). The rivers in the lowland headwater zone hold many endemic fish species, contributing to the Madre de Dios' reputation as "the biodiversity capital of the world" (Goulding 2003: 21). Lowland rivers meander extensively (Figure 2), allowing for the formation of oxbow lakes and huge floodplains. These inundated forests serve as excellent aquatic habitats for many fish species, especially during the rainy season. The composition of the water in these lowland areas has also shaped many fish diets. The high turbidity of the water prevents light penetration for photosynthesis, so instead of relying on phytoplankton, fish generally feed on seeds, insects, or dead organic matter. A frugivorous species like the Tambaqui (*Colossoma macropomum*) for example relies on the presence of forest fruits during the flood season.



Figure 2: A meander on the rio Tambopata (near Posadas Amazonas) with a member of the Infierno community. The haze in the air is a result of slash and burn activities. (Personal photograph)

The Madre de Dios region also serves as an important reproductive zone for many migratory fish species. Many migratory species arrive annually from Brazil or Bolivia to spawn in the headwaters, and subsequently return downstream to nursing habitats. The Dorado catfish (*Brachyplatystoma flavicans*) for instance, an important food fish in the Amazon, can travel up to 5,000 km to spawn upstream (Goulding 2003: 72). Large migratory fish species also tend to be the most exploited by commercial and subsistence fishers. Not surprisingly, over-exploitation of migratory fish species in one country will have international repercussions. Decisions made in one country almost certainly impact fish populations elsewhere. As a result of the international existence of migratory fish species, conservation efforts pose the added challenge of coordinating management projects at the international level.

FISHING ACTIVITIES IN SOUTH-EASTERN PERU

Fishing activities in South-Eastern Peru are generally minimally understood; however, in more urban areas like Puerto Maldonado, important trends have been documented. Puerto Maldonado has approximately 100 fishermen who fish six-eight months a year when the water level is low (Goulding 2003: 60). The other four months is spent on harvesting Brazil nuts, agriculture, mining, and logging. In general, the local economy is not focused on fishing (Werner 2007). More than 50 fish species are exploited in Madre de Dios fisheries, but 12 species, including several large catfish like the Dorado, make up 90% of the fish market. Fishing canoes can hold approximately two tons of fish, but ice isn't readily available, so fishermen must regularly return to port or salt their catches. Fishing in the Madre de Dios region is largely for subsistence (Werner

2007). In comparison to Brazilian fisheries or others downstream, the fisheries in Peru are generally small-scale and not overly exploitative.

CONSERVATION CHALLENGES

One challenge to conservation lies in the fact that fish rely on both aquatic and forest conditions. The rainforest creates a unique and complex web of interactions which allows for aquatic diversity. Deforestation will thus have a massive impact on aquatic diversity. Nigel Smith argues that deforestation will adversely affect tambaqui populations in particular. Gold mining also poses a threat to aquatic ecosystems because gold miners tend to destroy the floodplains where they work (Figure 3). Miners have reached many streams and almost all the floodplain lakes, as well as palm swamps, resulting in major changes in water chemistry. Furthermore, mercury released from the mining process could contaminate food fish populations, creating a public health concern.



Figure 3: Gold miners on the rio Tambopata. (Personal photograph)

As already alluded to, the international existence of many migratory fish also presents a serious challenge. Many migratory fish have spawning habitats in the Andean foothills, whereas their nursing habitats are in the central Amazon. Therefore, Peru, Brazil, and Bolivia will have to work together to form long-term management schemes. Peru and Bolivia will need to protect spawning habitats, whereas Brazil will need to control over-exploitation of stocks. Furthermore, migration of fish species precludes very narrow community-specific policies because fish habitats must also be considered on a regional or even international scale (Goulding 2003: 63).

AQUARIUM FISHERIES AND AQUACULTURE AS A WAY FORWARD

Whilst sustainable fishery and conservation face severe challenges, several budding industries are offering a great deal of optimism. Aquarium fisheries, for instance, have the potential to become very successful in South-Eastern Peru, although their viability is yet to be determined. Aquarium fishing in the Madre de Dios watershed began in 2002 and is still in the experimental phase. The Madre de Dios region appears to be ideal for aquarium fishery development because it contains many endemic species. So far more than 30 potential aquarium fishes have been identified (Goulding 2003: 64). Furthermore, the seasonal flooding isn't as long and deep as in other countries, meaning that aquarium fishers could work year-round.

Aquaculture may also be very successful in South-Eastern Peru where natural headwater fish yields are relatively low. Aquaculture generally consists of introducing fry to natural spawning habitats. Several aquaculture experiments are underway near Puerto Maldonado. Tilapia and Carp are most commonly used, and scientists are cautious to use

exotic species for fear that they will damage or change the ecosystem. Increasing the reproductive yield of fish species through aquaculture may be an effective management plan because it will stock fish populations so that human extractions won't have as severe an impact. From a developmental perspective, the combination of fishing and aquaculture could be a gateway to sustainability. Aquaculture essentially transforms fishing from an extractive process to a sustainable one. In addition, fishing and aquaculture serve as alternative professions to logging and gold mining; therefore, from an environmental standpoint, fishing and aquaculture could prevent damage to other natural resources.

HUMAN DYNAMICS

The human dimensions of fisheries must be considered in the development of sustainable fisheries. The Madre de Dios region houses approximately 7,000 indigenous peoples from at least 18 different indigenous communities (Goulding 2003: 32). Local populations live in close symbiosis with their environment and their sustenance depends on the use of available resources, fish included. Although many indigenous groups are experts on fishing and likely have an understanding of fish spawning patterns, their input has yet to be substantively incorporated into fishery management projects. Major professions include logging and gold mining, whereas large-scale fishing and aquaculture industries are essentially absent in the region, with most fishing activities concerning basic subsistence. Aquaculture in particular is still in the experimental phase with the potential to become economically feasible in the future.

The Mamiraua project is an interesting example of an initiative which focuses on local human populations in order to achieve sustainable development. The Mamiraua

project, located in the western portion of the Amazonas state, is based on the notion that “successful conservation strategy is highly dependent upon the effective participation of reserve inhabitants” (Hall 1997: 147). Several important lessons can be learned from the Mamiraua experience. Primarily, researchers found that local populations can effectively monitor their resource use and environment. However, an inevitable conflict arose between the “preservationist priorities of natural scientists and the immediate livelihood concerns of local groups” (Hall 1997: 161). In the Madre de Dios, compromises will have to be made by local human groups as well as preservationists; nonetheless, local involvement must be considered a prerequisite for sustainable fishery development in South-Eastern Peru.



Figures 4, 5: (left) a makeshift soccer field in the middle of the rio Tambopata (Personal photograph), and (right) a Dorado catfish catch (Goulding 2003: 71).

RESOURCE MANAGEMENT PRACTICES

Traditionally, government organizations like IBAMA have taken control of fishery management, but more community-based management schemes are gaining in respectability and popularity. In the community-based system, local user-group populations can guide planning for fisheries and limit access to floodplain lakes. Several

scientists fear that populations will typify the “tragedy of the commons” phenomenon, whereby small-scale fishermen will seek short-term sustenance at the possible expense of the long term productivity of the resource (Poggie 1991: 94). According to David McGrath, this model will supposedly deal better with the pressure placed on certain fish species, as well as avoid the “tragedy of the commons” (Hall 2000: 180). IBAMA is integrating local initiatives into their management plans, but an entirely locally-based model is unrealistic ecologically according to Michael Goulding. A regional plan is more realistic because of the migratory nature of fish populations and their various habitats (Goulding 2003: 63). As a result of the international existence of fish, communication must occur at the governmental level to create viable cross-border plans.

In this regard, an entirely community-based management scheme that focuses on individual lakes may be ideal, but not always realistic or feasible. Nevertheless, involvement of local communities is crucial to the success of any management scheme. Anthony Hall stresses that local communities will be marginalized if they are not actively incorporated into research initiatives, planning, and policy making (Hall 1997: 162). According to Hall, local involvement could be the key to sustainable management plans. Other management practices aimed at sustainability include gear regulations. For instance, mesh sizes can be increased to prevent the catch of premature fish (Barthem 1997: 125).

CONSERVATION AND DEVELOPMENT POTENTIAL

The major question is, “can fisheries be successful for humans and the environment?” Aquaculture and aquarium fisheries appear to have the potential to

develop fisheries into sustainable industries in South-Eastern Peru. Local-based projects and grassroots management also appear to hold great promise for sustainable fishery development in Peru. Ecologically sensitive policies must prevail though, and management plans which focus on individual lakes or rivers must be integrated into regional and international policies that consider fish migrations. Government support for projects is vital, as is international communication on fishery development schemes. Because the Madre de Dios region has not yet been over-exploited like areas downstream, conservation efforts should focus on preserving spawning habitats. Furthermore, fisheries should be encouraged to fish for a variety of species so that specific species aren't over-exploited, resulting in ecosystem imbalances.

CONCLUSION AND RECOMMENDATIONS

In conclusion I would like to return to my earlier hypotheses in the hope of deriving some meaningful inferences. Data suggest that my first hypothesis should be accepted in that it calls for conservative management practices; however, Peruvian fish populations have not actually been over-exploited as is the case in much of Brazil. Trends indicate that fishing activities are not yet over-exploitative because of the smaller fishing industries in Peru, as well as the inaccessibility of many oxbow lakes (protected by parks, or just hard to reach). Rather than restricting fishing, the focus of conservation should be placed on preserving the natural spawning habitats of the migratory fish species. Methods of aquaculture and aquarium fishing may help boost stocks by increasing reproductive rates, as well as providing economic opportunities to locals.

My second hypothesis states that community-based fishery management will function more effectively than government-based management because locals have more invested in the well-being of their resources. Local community involvement, which provides valuable indigenous knowledge and consistent monitoring capacity among other things, is key to sustaining small-scale fisheries. However, government support is crucial for both financial and diplomatic purposes. Given the migratory nature of many coveted fish species, conservation and development policies must incorporate comprehensive regional policies that acknowledge the conservation potential of varied migratory habitats. Paramount to the success of such a comprehensive plan is a keen avoidance of the “standard package” approach (Poggie 1991: 98). Ultimately, locals who live *in situ* and depend on the fish resources must generate grass-roots management capacity and circumvent reliance on distant bureaucracies to determine what is best for them and their environment.

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