



***Darwin Initiative for the Survival of Species***  
***Annual Report***

***Fisheries Management for Biodiversity  
Conservation in the Brazilian Amazon***

***Imperial College***  
***London UK***  
***&***  
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## 1. Darwin Project Information

Project title	<i>Fisheries Management for Biodiversity Conservation in the Brazilian Amazon</i>
Country(ies)	<i>UK, Brazil</i>
Contractor	<i>Imperial College, London</i>
Project Reference No.	<i>08/126</i>
Grant Value	<i>£ 121,347</i>
Start/Finishing dates	<i>01/04/99-31/03/02</i>
Reporting period	<i>01/04/00-31/01/01</i>

## 2. Project Background

While public interest has concentrated on the destruction of the Amazon rainforest, another great tropical frontier, the Amazon floodplain, is also under increasing pressure. Though comprising only a small fraction of the basin, the floodplains of the Amazon river system have an importance in terms of biodiversity, economic activity, and the ecological services that the floodplains perform that far outweighs their relative area. The sustainable development of fisheries plays a key role in the conservation of floodplain biodiversity, firstly because the Amazon fish stocks are the most diverse found in any river system in the world, and secondly because the fisheries depend on the ecological services of the floodplain system and provide a major economic incentive for the conservation of this key habitat.

Amazon floodplain fisheries are currently under threat from two sources: direct fishing pressure and habitat modification. Over the last 30 years, Amazon fisheries have undergone dramatic changes. The introduction of modern fishing technology, combined with the growth of urban and export markets, have led to unprecedented pressure on Amazon fish stocks. Stocks of several commercially important species are considered overexploited, and locally many other species are also under excessive pressure. Amazon fisheries are exploited commercially by mobile, mostly urban-based fishers, and for subsistence by local communities in the varzea. The expansion of commercial fishing has resulted in increasing levels of competition and conflict between the two groups, and communities have increasingly sought to restrict the exploitation of local floodplain fisheries through community management schemes.

If present trends continue, the likelihood is great that Amazonian fisheries will follow the same path of overexploitation that other major river systems of the world have experienced, resulting in the progressive impoverishment of the fish fauna and ultimately the collapse of the regional fishery. Habitat modification for transport, flood control, cattle ranching etc. is potentially a far greater threat to floodplain

biodiversity, including the diversity of fish stocks, than excessive fishing pressure. However, the sustainable development of the fisheries and the consequent generation of a substantial economic rent from the intact floodplain system may in itself provide an important incentive to conserve floodplain habitats.

This is a critical period in the process of fisheries development, and the future of amazonian fisheries will depend in a large part on the policies which are developed and their effectiveness in reconciling the complementary objectives of conserving biodiversity and taking advantage of the long term productive potential of the floodplain ecosystem. While considerable research effort has been expended on understanding the ecology of amazon fisheries, the economics of fishing and fisheries management has received little attention. As a result, biological conservation needs have been identified, but a limited understanding of the actual fisheries has proved a major obstacle to the development of effective conservation policies.

This project will contribute to the development effective conservation policies through the evaluation of alternative policies in terms of their likely impacts on fish stocks and the levels of direct and indirect income and employment generated by the commercial fisheries. In this way, the project will also quantify the economic benefits to be derived from development policies which seek to maintain the productivity of fisheries and the ecological integrity of floodplain habitat.

### **3. Project Objectives**

The central objective of the project is the evaluation of fisheries management approaches to the conservation of floodplain (varzea) habitats and the associated biodiversity. The project recognises that the sustainable development of commercial fisheries is of key importance to biodiversity conservation in the varzea systems, not only with respect to the fish stocks themselves but respect to the conservation of varzea habitats upon which the fishery depends and to which the fishery adds economic value.

This principal objective will be addressed through the achievement of a set of discrete outputs as follows:

- (1) Analysis of the economic strategies of the different types of commercial fishers
- (2) Analysis of the responses of fishers to alternative management measures
- (3) Analysis of the role of the fisheries sector within the amazon regional economy.
- (4) Development of a bio-socio-economic model to predict the responses of commercial fisheries to alternative management regimes
- (5) Evaluation of management regimes

## 4. Progress

### *4.1 Progress prior to beginning of reporting period*

Following initial reviews and data collection on the commercial fisheries, a project review meeting with the Brazilian partners was held in November 1999. Current fisheries management issues in the Amazon were discussed in depth to focus the project on key issues. Government policy now favours local community management of floodplain fisheries, but the overall benefits and costs of such schemes and consequences for biodiversity conservation are poorly known. This was highlighted as a key issue to be investigated in the project.

In order to evaluate the impacts of community management agreements on economic benefits generated by the fisheries and the resultant incentives for conservation, information on fishing patterns and related socio-economic data for local communities is required in addition to the existing data on urban-based commercial fishers. This has effectively broadened output (2) to include local as well as urban-based fishers. In response to this new requirement, a local fishing and socio-economic survey was designed and pre-tested.

### *4.2 Progress during reporting period*

#### *4.2.1 Activities*

Activities during the reporting period have concentrated on three areas: economic analysis of commercial fisheries, household surveys in rural communities, and a survey to quantify the overall contribution of the fisheries sector to the regional economy.

Socio-economic data collected on commercial fishers landing in four major ports of the basin (Tefe, Manaus, Santarem and Belem) have been analysed to establish the degree of regional differentiation in key fleet characteristics and in economic efficiency.

The household survey (see 4.1) was carried out in 18 communities, 9 each with and without management agreements. On average, 14 households were surveyed per community. Interviews covered details of fishing activities and catches as well as agricultural and other activities, asset ownership, and basic social characteristics. These data will allow to establish the effects of management agreements on the productivity of local fisheries, and on socio-economic factors influencing fishing activities. Data analysis is ongoing.

The survey of the fisheries post-harvest and support sector in the Amazon basin has been completed, and will be analysed by Brazilian project staff during the first months of the next reporting period. The survey will quantify the economic importance of the industries associated with fishing.

#### 4.2.2 Results

The characterisation and economic analysis of regional commercial fishing fleets has been completed as planned, and a paper submitted. This first basin-scale analysis of Amazon fisheries has identified regional differences between the fleets with important implications for management. The fishing industry in the lower Amazon around Santarem is unusual in that it consists predominantly of rural-based owner/operators, who are affiliated with a formal industry organisation (Colonia) and 40% of whom have sources of income other than fishing. These characteristics have obviously facilitated collective action in rural areas towards community management of fisheries, and indeed such agreements are exceptionally common in the area. By contrast, commercial fleets in all other regions consist predominantly of urban-based fishers, boats are usually skippered by persons other than the owner, levels of affiliation to formal organisations are lower, and less than 20% have alternative sources of income. These characteristics pitch the commercial fishers in opposition to local management initiatives. However, there are indications that commercial fishing is increasingly being taken up by varzea residents in the upper Amazon, so that the urban dominance in this area may diminish.

The economic analysis shows that overall, the fishery is characterised by diminishing returns to scale, i.e. the smaller boats are more economically efficient overall. Furthermore, the partial income elasticity of labour is much higher than that of capital, indicating good potential for local varzea fishers with limited access to capital. Both these results imply comparatively good prospects for locally-based fishers in varzea areas where capital is scarce and labour relatively abundant.

The short-run production function analysis also showed significant regional effects on returns even when all differences in inputs had been accounted for. This may reflect differences in the overall level of exploitation and resulting stock abundance, an issue that will be further investigated with the full bio-economic model.

#### 4.2.3 Progress against milestones

Progress is outlined below against the project milestones defined for 2000/01:

- 1) Analysis of the responses of fishers to management measures and other external conditions completed. This milestone has been broadened to include urban and rural based fishers, focusing on community management agreements. An additional survey has been undertaken, the analysis of which is ongoing. This milestone has slipped as a result of the additional work, but will be achieved in by July 2001.
- 2) Start the study of the role of the fisheries sector in the Amazon regional economy. This milestone has been met.
- 3) Review meeting II (Brazil). A review meeting has been held in Santarem in January 2001. This milestone has been met.
- 4) Interviews with firms in the fisheries (post-harvest and support) sector completed. This milestone has been met.

- 5) Complete the analysis of role of the fisheries sector in the Amazon regional economy. This milestone has slipped as a result of additional work (see (1)) but will be achieved by July 2001.

As a consequence of the survey work in local communities that is being undertaken in addition to the work programme defined in the proposal, two of the milestones have slipped by about three months. This is a result of additional work required to provide policy advice on the effects of community management agreements, the key issue in Amazon fisheries management at present. There have been no significant problems, and we expect to be able to deliver all outputs agreed in the proposal.

#### *4.3 Workplan for final year of project*

Four major activities are planned for the final year of the project:

- 1) Complete analysis of household survey data to establish responses of fishers to management measures (specifically, the introduction of co-management agreements). This will be carried out in London during May-July 2001.
- 2) Complete analysis of the fisheries post harvest and support sector survey. This will be carried out by the IPAM in Brazil with input from IC London during June-July 2001.
- 3) Formulate the bio-economic model. This model will integrate the results of all previous analyses with existing stock dynamics data to allow the assessment of management strategies at a regional level. The main period of model development will be in August-October 2001.
- 4) Evaluation of management strategies. This will be achieved using the bio-economic model. A scoping workshop in November 2001 will bring together a selected group of key scientists and other stakeholders to review management strategies and the model structure and assumptions. The model may have to be modified in the light of workshop results. The identified management strategies will be evaluated in terms of economic benefits derived from the fishery and impacts on stocks. A final, larger policy workshop with representatives of all relevant stakeholders is planned for March 2002.

## **5. Partnerships**

Collaboration with the Brazilian partner institution IPAM has remained excellent. IPAM staff have carried out field surveys in collaboration with London-based staff, and maintained contact with key stakeholders in fishing communities, government institutions and NGOs.

## 6. Impact and Sustainability

The project has interacted with a wide range of stakeholders, including fishing organisations, governmental and non-governmental organisations and the international PPG7 programme. The main publicity and dissemination activities will take place in the coming (final) year of the project, when a major policy workshop will bring together all relevant stakeholders and the results will be published in a policy document.

The partner institution (IPAM) has been supported in its bid to obtain funding for follow-up work from the PPG7 programme. Although the outcome is not yet known, it is very likely that IPAM will undertake further research and facilitate the implementation of policy recommendations resulting from the Darwin project after the project ends.

Discuss the profile of the project within the country and what efforts have been made during the year to promote the work. What evidence is there for increasing interest and capacity for biodiversity resulting from the project? Are satisfactory exit strategies for the project in place?

## 7. Outputs, Outcomes and Dissemination

**Table 1. Project Outputs (According to Standard Output Measures)**

Code No.	Quantity	Description
11B	1	Paper on characteristics and fishing strategies of the regional commercial fleets submitted
8	24	Weeks spent in the field in Brazil by UK staff

The submission of a second paper had been envisaged in the project framework, this has slipped as a result of additional survey work carried out to provide key data for this paper. The paper will be submitted in the course of next year.

The total time spent in Brazil by UK project staff has been higher than planned, again as a result of additional survey work.

**Table 2: Publications**

<b>Type *</b> (e.g. journals, manual, CDs)	<b>Detail</b> (title, author, year)	<b>Publishers</b> (name, city)	<b>Available from</b> (e.g. contact address, website)	<b>Cost</b> <b>£</b>
Journal Article	O.T. Almeida, D.G. McGrath and M.L. Ruffino (2001): The commercial fisheries of the lower Amazon: an economic analysis. Fisheries Management and Ecology 8	Blackwell Science	o.almeida@ic.ac.uk	-

## 8. Project Expenditure

**Table 3: Project expenditure during the reporting period**

Item	Budget	Expenditure
Total	39,958	39,958

The project expenditure has remained in line with the agreed budget.

## 9. Monitoring, Evaluation and Lessons

Progress is being monitored regularly by the project partners. Progress of surveys is being measured against survey design specifications. The development of the bio-economic model is central to achieving the project purpose (evaluation of fisheries management approaches), and the other outputs are evaluated in terms of their contribution this integrated assessment tool.

## 10. Author(s) / Date

*Dr Kai Lorenzen, 30 April 2001*