

The biology, socioeconomics and management of the barramundi fishery in the Fly River and adjacent coast of Papua New Guinea (FIS/1998/024)

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Project number	FIS/1998/024
Project name	The biology, socioeconomics and management of the barramundi fishery in the Fly River and adjacent coast of Papua New Guinea
Collaborating institutions	<ul style="list-style-type: none">■ Australia: CSIRO Marine Research, Cleveland, Queensland; James Cook University, Townsville, Queensland■ Papua New Guinea: National Fisheries Authority (NFA), Port Moresby; Ok Tedi Mining Limited (OTML), Tabubil
Project leaders	Dr S.J.M. Blaber, Mr P. Polon, Mr Charles Tenakanai and Dr M. Wood
Duration of project	1 July 1999 – 30 June 2002; extension 1 July 2002 – 31 December 2003
Funding	ACIAR A\$699,491; Ok Tedi Mining A\$525,000, CSIRO A\$406,065
Countries involved	PNG and Australia
Commodities involved	Miscellaneous diadromous fish
Related projects	FIS1996/081; FIS2001/059; FIS2002/056

Motivation for the project and what it aimed to achieve

Barramundi is the most economically important species in the artisanal fisheries of Western Province, Papua New Guinea (PNG), with the largest stock in the Fly River region. Until the early 1990s, barramundi formed 80% of the catch in the coastal fishery and supported over 200 small-scale fishers. A similar artisanal fishery existed in the Fly River and its tributaries. Barramundi was the fourth most valuable export fishery in PNG, but collapsed in 1990 due to poor catches. At the start of the ACIAR project in 1999, the coastal artisanal fishery was continuing to decline with catches as low as 10 tonnes a year. This consisted mainly of juvenile fish less than 1 year old and a smaller quantity of adults. Regular surveys by Ok Tedi Mining Ltd (OTML) in the Fly River since 1984 also showed declining catches.

For the above reasons, rehabilitating the barramundi populations in Western Province had become an important issue, and CSIRO was approached in 1995 to undertake a preliminary study of the situation. An ACIAR-funded 1-year study by CSIRO and the National Fisheries Authority (NFA) (FIS/1996/081) had as its main objectives the collation and analysis of all the original commercial barramundi logbook data collected since 1970 and, with the cooperation of OTML, the amalgamation of these data with data collected by OTML since 1984 on barramundi in the Fly River.

The results of this small project indicated serious gaps in knowledge of many aspects of the fish's biology and the characteristics of the traditional fishery. In particular, there were conflicting reports on the state and delineation of the stocks, and the location of spawning areas.



Typical barramundi fishing site on the middle Fly River, Papua New Guinea.

The primary objective of this project was to develop for PNG a draft management plan for the barramundi fishery that was acceptable to all stakeholders. In order to develop such a plan, the main project activities were:

- to re-examine the biological basis for the current understanding of the life cycle of barramundi in PNG
- to identify the most vulnerable life-history stages that needed to be protected in order for the population to increase to such levels that would allow a sustainable fishery in the Fly River and along the adjacent coast
- to conduct socioeconomic surveys with the active and close involvement of local stakeholders to determine the importance of barramundi to the local economy.

What the research project produced

Technical outputs

There were two main technical outputs:

- Conclusive genetic and biological evidence demonstrated that there is only one stock of barramundi living in the Fly River and adjacent coastal waters. The stock extends into Irian Jaya, thereby constituting a cross-border resource, but differs from barramundi found in the far east of PNG. This was especially useful to management because, based on studies conducted in Australia, the expectation was that there would be more than one stock of barramundi in the fishery. This new knowledge meant that the fishery could be managed as a single unit stock.
- Biological studies showed no evidence of changes from 1970s estimates of parameters of growth, reproduction and feeding. However, otolith microchemistry data showed conclusively that the migration patterns of barramundi do not follow a regular pattern as they do in Australia. Many fish only visit the sea once during their lives and some individuals remain upriver for extended periods. A key factor then is that coastal and estuarine populations of barramundi form the majority of spawners, with little input from middle and upper Fly River fish. This has important fisheries management consequences because it indicates a necessity to minimise catches of large fish (spawning females) on the coast.

Policy outputs

A barramundi management plan was the ultimate policy output, but there were three intermediate outputs important to development:

- Reductions in the catch of large females could be achieved by restrictions on the use of large mesh gill nets (7 inches or greater) and these were included in the management plan.
- The completed bioeconomic model was demonstrated to project staff at the final project meeting in April 2002. NFA staff were trained in the application and use of the model for evaluating different management options.

- The socioeconomic study found that villages along the waterways had no indigenous knowledge or attitude that resources, in particular barramundi, are finite and must be managed for sustained yield. No local group had indigenous knowledge of the complex breeding and migratory habits of this species in waters claimed and fished by a long string of different villages and language groups. Although coastal villages and river clans claimed rights (contested by other groups) to exclude outsiders from waters over which they claimed tenure, no group had traditional resource-management practices that could form part of the management plan.

The Barramundi Fishery Management Plan developed by the project with the aid of four community consultation meetings involving the participation of all stakeholder and community groups was accepted by the National Fisheries Board in March 2003, signed into law on 15 April 2003 and Gazetted by the PNG Government on 16 April 2003. The plan involves net mesh-size restrictions as well as closed seasons and areas. Under the terms of the management plan, an Interim Barramundi Management Advisory Committee (BMAC) was set up in 2003.

A four-page coloured pamphlet about barramundi management was produced and distributed throughout Western Province.

Capacity developed by the project

Development of skills and knowledge included socioeconomic survey training to three OTML community liaison staff, and biological research training provided by CSIRO to two OTML and one NFA scientist. The NFA scientist was subsequently the recipient of a John Allwright Fellowship and undertook PhD studies on barramundi as part of the project.



Ok Tedi River showing bed aggradation cause by mining. Barramundi no longer occur here.

Development of research tools included training of NFA scientists by CSIRO in the use of a management strategy evaluation model for assessing different management options. This continued the long-term collaborative relationship between CSIRO and NFA and hence capacity building within NFA. The outputs of projects such as the present barramundi project contribute to NFA developing sustainable fishery-management plans.

Adoption—how the project outputs are being used

The key output was the new Barramundi Fishery Management Plan, which was supported by the series of technical and policy outputs outlined above.

Users of the Barramundi Fishery Management Plan

National Fisheries Authority

This is the PNG Government agency responsible for fisheries regulations. As such, it was responsible for adopting the plan drafted by the project, and seeing it through the various administrative and legal processes that led to it being gazetted into law in 2003, and the subsequent measures to ensure its uptake at industry and community levels.

Ok Tedi Mining Limited

The Environment Department of OTML adopted the recommendations of the project as specified in the management plan as the basis for continued monitoring of barramundi populations in the Fly River at Kwambit, Bosset and Ogwa. This monitoring provides the only independent data for assessing the status of barramundi populations

Ok Tedi Development Foundation (OTDF)

OTDF was formed in order to promote sustainable development in the mine-affected corridor of the Fly River and Western Province coast. OTDF has the community networks and logistic capabilities to enable the development of sustainable projects along the Fly River and adjacent coast. The site location choice and technical inputs for the OTDF-funded barramundi aquaculture project are at least partially dependent on data provided by the project and OTML monitoring.

The fishing companies based at Daru and Obo

The companies that buy most of the barramundi have fully supported and adopted the regulations specified in the management plan. The companies refuse to buy fish greater than 1 m in length or less than 36 cm, and do not supply or use nets with a mesh size of 7 inches or more.

Fishing village communities

The ways in which the many different fishing communities have adopted the outputs of the project vary depending on location and the relative importance of barramundi to them. Adoption of the new regulations by traditional fishers has been almost complete in areas close to commercial markets, and least in villages far from markets and in recent immigrants to the coast around Daru.

Adoption of technical and policy outputs

The Barramundi Fishery Management Plan, the ultimate vehicle for delivery of project results in terms of changing fishery regulations and influencing the sustainability of the fishery, was adopted into law in 2003. This plan also indirectly played a major role in influencing future planning for an aquaculture industry in Western Province.

Once the plan was gazetted, NFA and OTML followed up with a series of regional meetings in Western Province and produced (with the help of the project) a pamphlet that was widely distributed among fishing communities. There was a change in fishing practices following the promulgation of the new regulations, particularly with regard to the ban on net-mesh sizes of 7 inches and greater. These larger mesh sizes were no longer imported or sold in Western Province.

The NFA instituted a new catch-reporting system for the companies that buy most of the barramundi. Records of sales by fishers to the Daru companies since 2003 indicate that the fishery has stabilised on the coast, suggesting that the sustainability objective of the management plan is working. However, the minimum size (36 cm) regulation is not being strictly adhered to, and large numbers of undersize fish are still sold on the open market in Daru.

A successful fish-processing facility was developed in Obo. It employs about 10 local people in the plant as process workers, and supports up to about 100 local fishers delivering barramundi to it.

Barramundi catches at the conclusion of the ACIAR project were over 100 tonnes per year and possibly not sustainable. The implementation of the new management plan was thus vital for this fishery. The latest data from the Obo fishing company indicate that, unlike the situation on the coast, there has been a marked decline in barramundi sold to the processing plant at Obo since about 2001. The reasons for this decline are not clear, but may not be related to overfishing, because research monitoring by OTML does not show a decline in numbers of large females. The decline may be due to a reduction in the numbers of fishers, less fishing activity due to high river levels, changes in the migration patterns of the fish as a result of environmental changes and, finally, the high proportion of people in the Obo region now receiving OTML compensation payments.

An important part of the new management plan was the formation of a Barramundi Management Advisory Committee composed of government, technical, community and industry representatives which, according to regulations, should meet once a year to monitor, review and recommend any changes required to the legislation as the fishery changes. Unfortunately, this committee has met only once, at its inauguration in 2003.



First meeting of the Barramundi Management Advisory committee in 2003.

Impact—the difference the project has made or is expected to make

Community impacts—the beneficiaries of the project

The fishing companies at Daru and Obo have adhered to the new catch regulations and are hence promoting sustainable fishing by their suppliers—the small-scale fishers. These fishers are able to sell their catch directly to the processors and should be able to look forward to the long-term viability of the fishery. Additionally, the provision of employment to at least 100 staff by the four fish-processing plants is significant in an area with few paid employment opportunities.

The development of barramundi aquaculture, subsidised by Ok Tedi, is vital for long-term sustainability of the fishery. The integration of wild fisheries and aquaculture in providing product to the processors should ensure increased employment for fishers and for local people in the processing industry. The aquaculture plan currently being developed is projected to have major positive benefits for food security in Western Province within about 10 years.

The project has affected the many different subsistence fishing communities in two main ways according to their location in relation to fish-processing plants and the market chain.

Fishers in the middle Fly, Fly River delta area, and the coastal region around Daru have continued to benefit from being able to sell their fish to the various fishing companies, which lend them nets and, in some cases, provide a cold chain and fuel subsidised through OTML or OTDF. It is noteworthy that these same fishers are also almost all beneficiaries of compensation payments from OTML.

On the other hand, fishers who are remote from markets have not benefited directly from the project. Nevertheless, if the management plan is ultimately successful and the sustainability of the barramundi assured, this will be of great significance in terms of future food security.

Local communities along the Fly are also beginning to benefit from OTDF-sponsored tourist developments (such as the Suki Lodge on the middle Fly) for wealthy, mostly expatriate, recreational barramundi fishers. The staffing needs of such lodges provide paid employment. There are also payments for services through the provision of boats and crew for recreational fishers.

Factors affecting the size and extent of the impact

Factors that may affect the size and extent of the impact of adoption of the management plan include:

- the future of the Ok Tedi mine, which is scheduled to close in 2013 and is the region's major employer and buyer of fish from the middle Fly. If the mine closure goes ahead, replacement markets will need to be found for the barramundi from the Obo Fishing Company.
- changes to the OTML compensation payments situation. The cash currently paid to people along the Fly River and Western Province coast reduces the numbers of people fishing for their livelihood. Any cessation of payments is likely to increase fishing pressure.
- the export price of barramundi—particularly fish for the Australian market.

Although the results of the project and the reasons for the new regulations were made known to fishing communities, there is no enforcement of the regulations and their adherence depends on continuing community support. Reinforcement is hampered by logistics and lack of infrastructure throughout Western Province, where government has almost no capacity. The current community liaison being undertaken by OTML and OTDF, mostly developed during the project and now being reinforced by the Western Province Sustainable Aquaculture Co., represents the best hope for adoption of the new regulations and the continuing sustainability of the fishery.

The ever-increasing population in the Daru area, caused by migration of people from inland (driven partly by compensation payments from Ok Tedi that are paid out at Daru) is placing greater stress on all natural resources on the coast, and must be viewed as a long-term threat to the viability of a sustainable barramundi fishery. Finally, management of this, or any fishery, is dependent on good catch data, and the current system instituted by NFA is working largely through good liaison between fishing companies and NFA. Without the continued provision of catch data, any changes needed to the management of the fishery in future would be difficult to detect and implement.