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1 Executive summary

Outputs

The ACIAR project completed a number of tasks with tangible outputs. Firstly, all available reports on aquaculture and fish stock enhancement in PNG from 1950 to 2005 were collected and scanned. A total of 177 reports in “pdf” format were saved to a master CD and an index was added to make the CD simple to use and quick to search. The master CD, entitled “Aquaculture and inland fisheries in Papua New Guinea: Reports from 1950 to 2005”, was given to PNG’s National Fisheries Authority (NFA) and ACIAR for final approval. After making any modifications, the distribution process will be under the control of NFA and ACIAR.

Second, the project has drafted a manuscript reporting the findings of this project and it will be submitted to ACIAR for publication by the end of September 2005 (see objective 1). This manuscript contains chapters on the findings of the surveys of farms, institutions, markets and hatcheries in the Provinces of PNG as well as the history of the industry and its current status. The study found that there are three types of fish farmers in PNG: 3-5% are “pioneers” or “ol pelas”, 40% have some experience, having harvested one crop (“nu pela liklik”), and 40-50% have not harvested (“nu pela”). Each type of farmer has different needs and constraints. The manuscript summarises the priorities and key researchable issues: improved fingerling production, improvements in fish feed, faster growth rates, and better training and extension of information to smallholder farmers (objective 2). Another important output of the project was the distribution of the findings at regional workshops, which we held in Goroka, Hagen, Kabwun, Aiyura, Erap, Wewak and East New Britain. More than 1,000 farmers and stakeholders participated in these workshops and their views were collected at the workshops and used to prioritise the key researchable issues (objective 3).

Also, the project gathered all existing data on fingerling production from the two main hatcheries in PNG and produced a National Fingerling Distribution database. It will be maintained in the future by NFA and used to monitor national trends in aquaculture – ie the species stocked, fingerling distribution, hatchery outputs, farm sales and productivity.

Anticipated Impacts

The ACIAR survey provided baseline data that can be used to make some projections with regards the economic benefits of fishfarming to local communities. There are 11,000 fish farms in inland PNG and the value of fish production is more than A\$5 million pa. Common carp is farmed in more than 90% of farms, however GIFT tilapia and trout are popular in tropical lowlands and cool highlands, respectively. Unfortunately, the supply of fingerlings (baby fish) has not been able to keep up with demand and many farms are not stocked. The team development a follow-on project in which one of the aims is to improve the productivity of existing farms by increasing the supply of fingerlings from the country’s main hatchery and aquaculture facility, Highland Aquaculture Development Centre (HAQDEC), from the current average of 50,000 pa to 1 million pa. This will represent a substantial increase in production for the industry. Also, through the high interest of villagers in constructing fish ponds, the project should increase the productivity of existing ponds as well as increase the number of fish ponds and small-scale hatcheries in PNG. This will generate income and production for small holder farmers throughout PNG. As farmers are made aware of the benefits of farming GIFT tilapia, it is likely that productivity will increase further. The National Fingerling Distribution database that we developed (see above) will be used to estimate the economic impacts of this project as well as the follow-on project. Also, inputs to the National Fingerling Distribution database from Provincial DAL Officers from their field surveys of fish farmers will provide direct data on farm productivity in the years to come.

One of the main benefits of fish farming in PNG is the improved diet for village people and in some cases alleviation of malnutrition. We found that 40% of farmers used the fish to supplement the family's diet, while the other farmers also sold a proportion of the harvest. The inclusion of fresh fish in the diet is likely to lead to better health and socio-economic status of villagers in PNG. Benefits should flow from training, capacity building, improved nutrition, increased income and job satisfaction. Women and children have a major involvement in fish farming and they will share in the benefits. More precise information on the social benefits can be found in the ACIAR publication of findings.

This project also attempted to raise the awareness of farmers and officers with regards minimising negative environmental outcomes from pond-based aquaculture. The project revealed that few fish farms were integrated (<2%) and most farms used a flow-through system (79%). The findings indicate that fertilisers are not appropriately applied and that nutrients are unnecessarily lost to streams and water bodies. Experience in other countries shows that loss of nutrients to waterways can lead to eutrophication and cyanobacterial blooms. So, by improving the integration of fertilisers and minimising water exchange, farmers will minimize the impacts on the environment while gaining improved fish growth and benefits from improved productivity.

Current Status/Progress

The ACIAR project (FIS/2001/034) was due to finish in September 2004, however it continued until the follow-on project started in June 2005. The project team carried out a number of activities in order to achieve a smooth transition and prepare for the new project (see Objectives 4 & 5). These included a) refurbishing accommodation for 4 Technical Officers (2 residences at Erap and 2 at Aiyura), and b) purchase of a new 20 Horsepower tractor with accessories (hoe, slasher, back-hoe, water pump and front-loader). Also, in September 2004 the remaining funds were used to purchase feed and fertiliser for broodstock conditioning and fingerling production at HAQDEC.

2 Objectives

- To determine the status of inland pond aquaculture in PNG
- To identify and prioritise the key researchable issues
- To distribute the findings to the aquaculture industry
- To improve the infrastructure in key areas
- To provide continuity for a follow-on project

3 Achievements against activities and outputs/milestones

3.1 Communication and dissemination activities

Project Workshops:

- 1) Stakeholders Workshop. October 2001. Held at NARI (National Agriculture Research Institute) in Aiyura, EHP (attended by 25 key stakeholders).
- 2) Final Project Workshop. May 2003. Held at National Sports Institute in Goroka, EHP (attended by 105 stakeholders, including 60 farmers from throughout PNG).
- 3) Kabwun Regional Workshop. September 2003. Held at Kabwun, Morobe Highlands (attended by 120 farmers with representatives from 19 tribes).
- 4) Hagen Regional Workshop. February 2004. Held at Highland Agriculture Training Institute (attended by 100 farmers and officers).
- 5) Goroka Regional Workshop. March 2004. Held at Goroka (attended by 50 farmers).
- 6) Lae Regional Workshop. April 2004. Held at Erap, Morobe Province (attended by 100 farmers).
- 7) Rabaul Regional Workshop. June 2004. Held at OISCA, Rabaul, ENB (attended by 100 farmers).
- 8) Wewak Regional Workshop. August 2004. Held at the Divine Word University (formerly Kaindi Teacher's College) attended by 50 farmers and officers.
- 9) Aiyura Women's Regional Workshop. October 2004. Held at HAQDEC, Aiyura EHP (attended by 50 women from various provinces in PNG).

Written reports:

Mufuape K, et al. 2003. Status of institutions in aquaculture in PNG. Aquaculture Workshop in Goroka PNG, May 2003.

Kia K, et al. 2003 Marketing of aquaculture products in PNG. Aquaculture Workshop in Goroka PNG, May 2003.

Aranka M, et al. 2003. Aquaculture hatcheries in PNG. Aquaculture Workshop in Goroka PNG, May 2003.

Smith PT et al 2003. Status of inland pond aquaculture in PNG. Aquaculture Workshop in Goroka PNG, May 2003.

Kolkolo U, et al 2003. Summary of researchable issues in aquaculture in PNG. Aquaculture Workshop in Goroka PNG, May 2003.

Smith PT 2003. Project report on the status of aquaculture in PNG. ACIAR Project Leaders Workshop, Cairns QLD, June 2003.

Smith PT 2005. Aquaculture in PNG: What are the priorities and how can we make an impact? SPC-ACIAR Feed Workshop. 18-20 April 2005 Suva, Fiji.

Smith PT 2005. Project report on the status of aquaculture in PNG. ACIAR Project Leaders Workshop, Cleveland, QLD, June 2005.

Master CD:

“Aquaculture and inland fisheries in Papua New Guinea: Reports from 1950 to 2005.” The CD contains 177 documents saved in pdf format.

Video:

A film on aquaculture in PNG has been recorded and the editing is currently in progress. It is to be finished by the end of October 2005 (The purpose of the video is to distribute information and extension material to farmers in regional areas).

ACIAR publication:

“Inland pond aquaculture in Papua New Guinea – Assessment of the industry and evaluation of smallholder research and development needs.” (The draft report was completed in November 2003, the revised draft should be submitted to ACIAR in September 2005).

Publicity/news article:

- 1) Aquaculture a key to improving food security for PNG villages. Article written and published by UWS for media release (June 2005).
- 2) Aquaculture a key to improving food security for PNG villages. August 2005. Media release published by Macarthur Advertiser.

Activities remaining to be completed after submission of this report:

- 1) Publications of status report by ACIAR (see details given above: “Inland pond aquaculture in Papua New Guinea – Assessment of the industry and evaluation of smallholder research and development needs.”).
- 2) Submission of manuscripts to refereed scientific journals.

3.2 Farmer-level, community or policy impacts (economic, social and/or environmental)

The impacts of this small project have been generally beneficial. On the positive side we have produced substantial improvements in the level of communication. For instance, at the start we brought together, for the first time, the key stakeholders, including industry reps, NGOs and officers of Provincial and National Government to talk openly at the same table. Throughout the project we were able to bring together stakeholders on a number of occasions for key discussions. However this is a rocky road and progress can be rapidly undermined, so this is an ongoing area of effort.

Other positive impacts of the project have been in the areas outlined below.

- 1) Firstly, at the Stakeholders Workshop at Aiyura in 2001 the lead agency for inland aquaculture was determined. A national structure was put in place for this and future projects to follow.
- 2) Another positive impact has been the assembling of the National Fingerling Distribution database, for the first time. This will be a useful tool for monitoring as well as planning for the needs of the aquaculture industry.
- 3) Also, the collection of all relevant, unpublished reports in a single CD will be of benefit to R&D in PNG. The CD provides a reference or baseline for stakeholders and research providers. The information can be used to minimise the duplication of studies and ensure funds are spent in areas that will provide the greatest opportunity for positive impacts.

- 4) The project has carried out workshops attended by over 1,000 stakeholders in various regions of PNG. This provided the industry with a venue for expressing their needs as well as raising everyone's awareness of the key issues.
- 5) Finally, other projects have developed as a result of this small but significant pioneering project. Those projects include the SPC-ACIAR feed project in PNG & Fiji, the Native Fish project in Western Province of PNG, and a pipeline project on cage culture in PNG by Worldfish.

However, on the negative side, there have been chronic difficulties with project approval, management problems and safety issues.

3.3 Training and capacity-building

Ms Tripiso Abaise, a member of the HAQDEC staff, attended training by SPC on GIFT tilapia & *Machrobrachium* in 2004.

Mr Jacob Wani and Mr Kine Mufuape attended a managers training session in Lae in 2004 that was funded by ACIAR.

Technical Officers, Mr Micah Aranka, Mr Kaupa Kia, Ms Hopa Simon and Mr Wally Solato, received on-the-job training by the Project Leader.

These training activities have strengthened the understanding of HAQDEC staff and project officers. However, the follow-on project is more likely to provide more opportunity for training and capacity building.

4 Relationship to other activities

The follow-on project (FIS/2001/083) commenced in June 2005 and it is a direct result of the findings of the ACIAR project (FIS/2001/034). The overall goal of the follow-on project is to improve the productivity (and profitability) of smallholder fish farmers in inland PNG. The long-term outcome will be increased dietary protein and better nutrition for farmers, their families and inland communities. In pursuit of this goal, the project will have five separate objectives and activities. The project will develop and extend a "Fish Husbandry Package" which will be a set of clear and simple instructions on the main facets of earthen pond-based aquaculture, including site selection, fertilising and pond preparation, transport of fingerlings, stocking fingerlings, making on-farm feeds, application of feeds, monitoring and adjustment of feed rates, making a Secchi disk, monitoring bloom, adjusting blooms by water exchange and fertilising, monitoring fish growth and health, harvest, post-harvest care, fish processing by smoking & drying, and marketing. The package would be produced in various formats. Development of handouts for each farming activity will be important for extending the Fish Husbandry Package. Handouts will feature comic-book type diagrams with instructive captions in Tok Pisin for distribution to farmers at field workshops during our workshops at demonstration farms to compliment the training and demonstration sessions.

The project will have strong linkages with and will compliment several significant initiatives of NFA and link with new ACIAR projects in the region. There is a new scoping study of QDPIF: "Development of capacity for aquaculture of indigenous fish species in PNG" which is centred in Western Province. The two projects will share information and communicate closely on improvements and developments. There will be an exchange of team members for training and extension purposes.

Also there will be close linkages with the new ACIAR/SPC Miniproject, "Development of commercial and farm-made feeds for tilapia and *Machrobrachium* in PNG and Fiji" under FIS2001/075). As an example, the desktop studies of both projects will complement each other and minimise overlap. The principle aim of our desktop study will be to identify relevant knowledge & skills for the Fish Husbandry Package, including pond management, fingerling care, feeds and fertilising strategies. While the desktop study of the ACIAR/SPC Miniproject will focus on gathering nutritional information on available ingredients and developing a prepared feed. Our project will provide data on raw materials used by fish farmers in PNG to the ACIAR/SPC project for their desktop study - this data was collected in the initial ACIAR project in PNG (FIS2001/034). In return we will use the results of the ACIAR/SPC project to develop formulae for our on-farm feed trials at Aiyura & Erap fisheries stations and Co-operator farms. Also, SPC will be invited to send a representative to all major project meetings and workshops.

5 Budget

The initial work was carried out under a grant from UWS to investigate the key researchable issues for inland aquaculture in PNG. This was carried out in 2000-1. A report was written and submitted to ACIAR and an application for a small project was approved by ACIAR. The project started in September 2001 with the Stakeholder Aquaculture Workshop and the employment of the 2 Technical Officers. These activities were funded by a \$10,000 advance from UWS. This unorthodox start was necessary because we needed to establish the agency in PNG that would take responsibility for signing the Project Document. Funds from ACIAR were then transferred to UWS in January 2002 and funds were released periodically to EHP, via an account set up by Mr Bernard Maladina (ACIAR officer). After 12 months of work, the surveys and data analysis had been completed and in May 2003 we held the Final Workshop to release the results of the study. In the meantime NFA restructured and appointed a manager for inland aquaculture (Mr Jacob Wani) and consequently, NFA started taking a managing role in November 2003. NFA was responsible for managing funds for the next two years.

6 Future project plans to build on project outputs / outcomes

This small project provided three fundamental areas that can be built on. Firstly, the project's greatest legacy will be the construction of a workable platform for developing follow-on projects in inland PNG. Prior to this project there were no ACIAR projects in inland PNG and SPC had taken no role, even though inland PNG contains the largest proportion of citizens in the Island Nations of the South Pacific. Our project has shown how this can be done by providing guidance with customs, travel, accommodation, and key personnel in PNG. A number of projects have been approved or are in the pipeline that build on our pioneering project.

The second key legacy of the project is the collection of quantitative data to enable research providers and stakeholders to assess the status of the industry. This data was collected through surveys and desktop studies and it has been produced in a variety of user-friendly formats. The report to be submitted in September 2005 to ACIAR for publication will contain the findings of our survey work and a thorough assessment of the industry. Also we have established a framework for collecting and storing data in a National Fingerling Distribution database and a CD containing more than 50 years of unpublished reports. These repositories of information will be used and built on by successive agencies and organisations.

Thirdly, the findings of the project have been used by the team to develop a follow-on project that will tackle the key constraints to the development of inland aquaculture in PNG. This follow-on project started with the inception meeting on Wednesday 20th July 2005.