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Final report

Small research and development activity

project	**Building mariculture capacity in PNG**
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1 Acknowledgments

Our thanks to the National Fisheries Authority (NFA) staff involved in this research, and to staff of the James Cook University (JCU) Marine and Aquaculture Research Facilities Unit (MARFU) aquarium and Aquaculture complex, and the Queensland Department of Employment, Economic Development and Innovation (DEEDI) Northern Fisheries Centre who hosted NFA staff at their research facilities in Townsville and Cairns, respectively.

2 Executive summary

Development of mariculture opportunities in PNG can now be supported by the recently completed National Fisheries Authority (NFA) Nago Island Mariculture Research Facility (NIMRF) at Kavieng, New Ireland. The role of the NIMRF is to develop marine aquaculture-based livelihood opportunities for PNG and to become a training centre for students from the National Fisheries Centre (NFC). However, the current staff of NIMRF have limited experience in maintaining and managing mariculture systems, and in husbandry of marine organisms. For NIMRF to fulfil its desired role, there is an immediate need for capacity building from both technical and husbandry (mariculture) perspectives.

Another priority is identification of commodities with potential to support viable, sustainable mariculture industries for coastal communities in PNG. Some species with such potential were identified in preliminary research conducted during FIS/2006/138 ("Developing aquaculture-based livelihoods in the Pacific islands region and tropical Australia"), but further scoping of appropriate species for mariculture in PNG is required as a basis for greater research investment.

This project developed capacity relating to management of the facility and husbandry of cultured marine organisms at the NIMRF. It involved training of Nago Island facility staff during visits to established mariculture research facilities with similar roles, expectations and support needs. It also included basic culture trials at the Nago Island facility using corals and spiny lobsters to generate baseline information relating to their culture potential and improve husbandry capacity. These activities drew on existing expertise within ACIAR research projects and involved technology transfer. The project also provided contemporary textbooks and background materials for Diploma level training at the NFC to replace those lost in a fire at NFC.

This project was completed in 2013 but a number of the activities it began (i.e. culture of ornamental species) were continued at the NIMRF as part of the larger follow-up project FIS/2010/054 ("Mariculture development in New Ireland, Papua New Guinea") which focussed on developing culture methods for sea cucumber, edible oysters and ornamental species. This project provided an excellent technical basis for FIS/2010/054 and built capacity within NFA staff that will support mariculture research, and the important support role of NIMRF, into the future.

3 Introduction

PNG has a vast coastline, with numerous communities and a large number of people primarily dependent on marine resources for their livelihoods. Coastal waters, reefs and fish stocks are comparatively healthy, but beyond the immediate food resource, communities do not maximise the potential economic and livelihood opportunities provided by this environment. There has been depletion of some fisheries resources. For example, the collapse of the sea cucumber fishery, which was the main village-based fishery generating significant export income, resulted in implementation of a nationwide moratorium by the National Fisheries Authority (NFA). There is an immediate need for social/economic activity as alternative to sea cucumber as a livelihood opportunity for coastal communities in PNG and the NFA is under political pressure in this regard.

There is no tradition of mariculture in the coastal communities of PNG, so awareness of possibilities is low. However, development of mariculture opportunities in PNG can now be supported by the recently completed NFA Nago Island Mariculture Research Facility (NIMRF) at Kavieng, New Ireland. The role of NIMRF is to support research required to develop marine aquaculture-based livelihood opportunities for PNG, and to become a training centre for students from the National Fisheries Centre (NFC). NFC is affiliated with the University of Natural Resources and Environment (UNRE) which has four campuses in PNG. On this basis, mariculture capacity building activities at NIMRF could have much broader impacts in communities throughout PNG.

The NIMRF was recently completed and there are currently two NFA staff members at the facility. However, neither staff member has experience in mariculture systems maintenance or husbandry of marine organisms. For the NIMRF to achieve its desired impacts, there is a need for capacity building relating to both technical and husbandry (mariculture) issues. Another priority is identification of local species which are the ‘best bets’ in terms of their potential to support viable, sustainable mariculture industries for coastal communities in PNG. Some species with such potential were identified in preliminary research conducted during FIS2006/138, but further scoping of appropriate species for mariculture in PNG is required as a basis for greater research investment. This project focused on improving mariculture capacity relating to: (1) management of the new NIMRF facility; and (2) husbandry of cultured marine organisms.

4 Research activities, outputs and application

4.1 Research activities

The overall objective of this project was to support development of the NIMRF in Kavieng, PNG through capacity building activities and scoping the mariculture potential of coral and spiny lobsters. There were two major aims:

(1) Develop capacity at the NIMRF relating to management of the facility and the supply and husbandry of cultured marine organisms.

(2) Undertake basic culture trials with corals and spiny lobsters to determine requirements for their culture and document basic performance characteristics.

Three research activities were undertaken:

NFA staff placement

Staff from NFA Nago Island Facility (Casper Dako and Peter Minimulu) undertook a five-week placement at the James Cook University (JCU) Marine and Aquaculture Research Facilities Unit (MARFU) aquarium and Aquaculture complex in Townsville, Australia. This large aquarium complex is equivalent in size to the Nago Island facility and has similar research deliverables. It is used to culture a variety of marine organisms including seaweeds, giant clams, corals, aquarium fish, crabs, marine fish and bivalves, and it also accommodates a variety of experimental set-ups to allow manipulation of environmental variables. It includes commercial-scale live food facilities and complex water quality treatment equipment.

Coral culture

ACIAR research in Tonga (FIS2006/172) has been successful in identifying coral species suitable for fragging (dividing into small pieces prior to attachment to a base for growing) and culture to commercial size. Newly ‘fragged’ coral pieces are cultured in raceways before transfer to the sea for grow-out. Coral culture is not particularly demanding and village-based coral farms have been established in countries such as Indonesia and Fiji where they generate export income. There is potential for similar development in Kavieng where there are suitable species of coral and an existing export network for marine ornamentals. This project conducted a coral culture trial which included the following components:

- a survey of appropriate culture species based on locally available corals and experience in other countries;
- training of Nago Island staff in the equipment required and methods used for coral collection and fragging;
- maintenance of coral frags in raceway culture;
- on-going maintenance requirements for land-based coral culture and recording of growth rates etc;
- sites selection for ocean-based coral culture; and
- set-up of a trial ocean-based coral farm and its maintenance.

Collection and culture of lobster puerulus

This aspect of the project drew on existing expertise within the ACIAR Fisheries program and links directly with SMAR/2008/021. Training at NIMRF was conducted by Mr. Scott Shanks a DEEDI employee working within SMAR/2008/021. In addition to collection targeting lobsters, a spat collection program commenced in 2010 as part of FIS/2006/172,

targeting edible oysters, pearl oysters and other invertebrates, was continued throughout this project.

4.2 Research Methods

NFA staff placement

NFA staff worked alongside JCU-MARFU staff full-time for four weeks to experience all aspects of the planning, running and maintenance of the JCU-MARFU aquarium complex including: the types of equipment required in such a system, its operation and maintenance; system and water quality maintenance; husbandry requirements for a range of marine organisms; record keeping; ordering and equipment supply; liaison with researchers and students.

An additional week of placement was spent at the DEEDI (now QDAF) Northern Fisheries Centre in Cairns to allow trainees to experience a similarly sized system with slightly different research priorities and greater emphasis on larger-scale fish culture including broodstock maintenance, hatchery culture and live food production.

Coral culture

Training was conducted by Mr. Scott Mactier a JCU employee previously engaged in Tonga as part of FIS/2006/172. He was actively involved in a coral culture project in Tonga conducted as part of FIS/2006/138 in collaboration with a private sector partner (Walt Smith International). This project was successful in identifying appropriate genera of coral for culture and the conditions required for both land and ocean based coral culture. Scott Mactier spent 2 weeks at the Nago Island facility where he trained NFA staff subsequent to their placements in Australia.

Collection and culture of lobster puerulus

Training at NIMRF was conducted by Mr. Scott Shanks a DEEDI employee working within SMAR/2008/021. Mr Shanks spent 10 days at NIMRF instructing staff in methods for making and deploying collectors. He made a second visit to NIMRF to assess recruitment to the collectors and establish protocols and experimental set-ups for growth trials with any resulting juveniles. Staff were instructed in the maintenance of lobsters in culture and in record taking (growth rates, survival, water quality) and husbandry techniques. Juveniles were used to begin basic culture/husbandry experiments in aquaria and tanks at the NIMRF with husbandry and monitoring of growth rates undertaken by NIMRF staff.

5 Major Outputs

- Two NFA staff members from NIMRF undertook a five-week placement at the JCU-MARFU aquarium and Aquaculture complex in Townsville and the DEEDI Northern Fisheries Centre in Cairns, providing experience with management of large marine aquarium/aquaculture facilities and, in particular, with equipment maintenance and servicing. As well as technical aspects, NIMRF staff were also trained in resource allocation, ethics and permitting, animal welfare, dealing with research staff and students, and other aspects relating to the running of a multi-user research facility.

- A spat collection program targeting edible oysters, pearl oysters and other invertebrates, was continued throughout this project to provide ongoing field-based training to NIMRF staff. It provided routine sampling and husbandry activities for staff and contributed information on recruitment of invertebrates with commercial potential in the Kavieng region.

- Staff from the DEEDI Northern Fisheries Centre in Cairns visited the NIMRF to determine whether spiny rock lobster juveniles (puerulus) can be collected using established collecting methods at different sites around Kavieng. Tripod collectors were constructed with equipment sourced locally, apart from the net light which was transported from Australia. This type of collector is used in Indonesia under ACIAR SMAR 2008/021. A single tripod collector was deployed at Nago Island under instruction from DEEDI staff and two others were subsequently constructed and deployed by NFA staff. Only small numbers of lobster juveniles were seen and collected. Subsequent culture of recruits in field-based and lab-based culture units was unsuccessful but provided valuable husbandry training for NIMRF staff.

- A coral culture trial was conducted at the NIMRF in 2012. It involved surveying appropriate culture species and establishing cultured coral ‘frags’ in land-based and ocean-based systems at NIMRF. Husbandry and monitoring of growth rates of various species of corals under different culture condition is on-going and conducted by NIMRF staff. Field-based coral culture areas were maintained beyond the life of the project and coral culture was established in three Kavieng communities.

- Capacity of NFA staff relating to the operation and management of the new NIMRF will provide a basis for mariculture related research into the future, supporting development of this important sector. Importantly, this improved capacity supported a follow-on ACIAR project (FIS/2010/054) that focused on specific mariculture commodities.

- Research with corals and spiny lobsters provided hands-on experience for NFA staff in both lab-based and field-based research, further enhancing the research capacity of NFA staff and the NIMRF. Focus on lobster recruits and corals provided broad husbandry and handling experiences.

- Text books used to support the Diploma Course in Aquaculture and Fisheries at the National Fisheries College in Kavieng were replaced (following a fire) in time for the course taught in 2011. This provided an opportunity to upgrade, update and enhance teaching materials used at NFC.

6 Conclusions and recommendations

6.1 Conclusions

The NFA completed an excellent facility to host mariculture research, supporting development of a national mariculture sector, and mariculture training. This project provided the first capacity building activities for facility staff and their first engagement in both laboratory- and field-based mariculture research with different commodities. Training at other facilities provided experience in facility operation and management while hands on research involved research planning, use of land-based facilities and deployment of various field-based infrastructure.

This project encompassed the first mariculture research activities at the newly established NIMRF and has demonstrated that it is fit for purpose. The facility will grow in significance relating to:

(1) assessment of the mariculture feasibility of a range of potential marine commodities, resulting in a narrowing of the target species, for research investigation;
(2) hosting of larger research projects to develop mariculture protocols for target species under PNG conditions; and
(3) training of both NFA staff, and both undergraduate and research students in various aspects of mariculture supporting improved national mariculture capacity and increasing awareness of the potential of mariculture.

However, the NIMRF is a new facility and there is likely to be a ‘settling-in’ period where the facility will require fine-tuning to properly support research activities. A key component of facility development will relate to appropriate staffing to support much larger and more broadly focused research activities.

6.2 Recommendations

This project was completed in 2013 but a number of the activities it began (i.e. culture of ornamental species) were continued at the NIMRF as part of the larger follow-up project FIS/2010/054 (“Mariculture development in New Ireland, Papua New Guinea”) which focussed on developing culture methods for sea cucumber, edible oysters and ornamental species. This project provided an excellent technical basis for FIS/2010/054 and built capacity within NFA staff that will support mariculture research, and the important support role of NIMRF, into the future.

7 References

7.1 References cited in report

None

7.2 List of publications produced by project

None

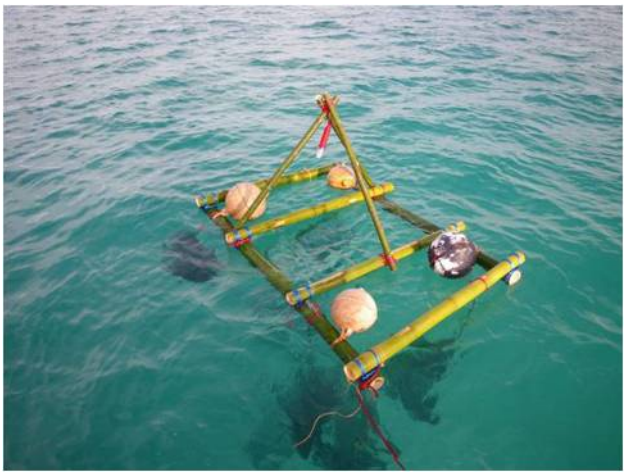
8 Appendixes

8.1 Appendix 1

Project photographs:

- Deploying a long-long near Nago Island, Kavieng for spat collection.

- Tripod collector deployed near Nago Island, Kavieng for collection of lobster juveniles



- Collectors used for lobster puerulus

- Making tripod collector for lobster juveniles at Nago Island

- Raceway culture of corals will be trialled at Nago Island to determine suitable culture species and growth rates