



Fisheries

Newsletter

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Editorial

Several important meetings were held during this quarter. The Fourth Heads of Fisheries took place in Noumea, New Caledonia, from 30 August to 3 September 2004. This meeting is the sole occasion when the people in charge of the fisheries sector in the Pacific Island countries and territories can get together to examine the overall situation and problems with regards to fisheries, share their experiences with their colleagues, and provide invaluable advice and guidance to the staff of the SPC Marine Resources Division. More on the outcomes of this meeting can be found in this newsletter from pages 2 to 6.

The seventeenth meeting of the Standing Committee on Tuna and Billfish (SCTB) was held from 9 to 18 August 2004 in Majuro, Republic of the Marshall Islands. This was the last SCTB as with the coming into force of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean in June 2004, the new Western and Central Pacific Fisheries Commission will take over SCTB's role. The first meeting of the Commission is planned for December 2004.

Jean-Paul Gaudechoux
Fisheries Information Adviser (jeanpaulg@spc.int)



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The Fourth Heads of Fisheries Meeting was held in Noumea from 28 August to 3 September 2004



SECRETARIAT OF THE PACIFIC COMMUNITY

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■ FOURTH HEADS OF FISHERIES MEETING

The fourth SPC Heads of Fisheries (HoF) Meeting took place at SPC Headquarters in Noumea from 28 August to 3 September 2004. It was chaired on behalf of New Zealand by Matthew Hooper.

HoF is a regional meeting of Pacific Island countries and territories that covers the entire range of interests under the purview of national and territorial fisheries services. As such it plays a unique role in promoting dialogue and experience-sharing between island nations and territories, as well as guiding the work of the SPC's fisheries programmes. It complements the more sectorally focused, political role of the Forum Fisheries Committee, which has a primary emphasis on tuna fisheries management, whilst HoF covers aquaculture, coastal fisheries management and development and living marine resource science, and has a broad-ranging and relatively informal remit for discussion that can cover any arising issue of interest or significance to participants.

The following paragraphs constitute the points of consensus agreement of SPC member country and territory fisheries service heads on issues that

arose during the meeting, and which the meeting felt necessary to document, either to help in the management of the SPC work programme, to draw to the attention of a wider audience, or to signal agreement on issues that require attention by members themselves.

Output 1. *Bilateral coordination of monitoring* – The meeting requested regional assistance for countries in organising and implementing bilateral understandings between members to facilitate inter-zone observer activity coordination, particularly in the case of urgent needs not yet covered by the Niue Treaty.

Output 2. *PROCFISH/O extension* – Recognising the time that is likely to elapse before the Western and Central Pacific Highly Migratory Fish Stocks Commission reaches full functionality, and the likelihood that the initial membership will consist almost entirely of Pacific Island states, Heads of Fisheries urged SPC to request the European Union to consider extension of the Oceanic component of the PROCFISH project (which currently ends in 2004). As well as a no-cost extension to the current project, based primarily on savings and

contingencies, the meeting also strongly urged SPC to request an expansion of the project to also include the Pacific Island countries joining the ACP group under the Cotonou Agreement, and suggested that this could be accomplished by adding an oceanic component to COFISH in the same way as oceanic and coastal components were combined under PROCFISH.

Output 3. *Coastal fisheries data confidentiality/sharing policy* – The meeting approved a set of data access guidelines for the Reef Fisheries Observatory (RFO) as Annex 1, based on the discussion by member country representatives within the PROCFISH Advisory Committee meeting.

Output 4. *Fisheries science capacity-building and regional assessments* – Heads of Fisheries recognised the analogies between the Reef Fisheries Observatory and the Oceanic Fisheries Programme, and the need for both units to maintain a strong focus on capacity-building and capacity-supplementation according to the capability of each country. The meeting also commended the strategy of promoting the domestication of fishery monitoring and fishery data systems,



Participants at the Fourth Heads of Fisheries Meeting

and the production of increasingly rigorous fishery assessments by the Secretariat based on the best currently available information. It endorsed the aim of the RFO to activate and build on existing national reef fisheries monitoring and assessment systems rather than replacing them.

Output 5. *Progressing PROC-FISH/C* – Heads of Fisheries welcomed the outputs that are starting to emerge from the coastal components of the European Union-funded fisheries assessment projects and look forward to receiving advice useful for national coastal fishery management as well as future capacity-building activities.

Output 6. *Fisheries MPA review* – The meeting requested SPC to coordinate a review of the effectiveness, in terms of fisheries management, of marine protected areas with fisheries management objectives, for discussion at HoF5 and for the information of member countries and territories. This review would also make clear the definition of the term “marine protected area” itself.

Output 7. *Export commodity pricing information* – Recognising that the promotion of sustainability of fisheries requires the optimisation of usage as well as management of resources, the meeting noted the strong outstanding need for an “INFOFISH-style” service to assist countries in improving transparency of export pricing information to ensure that maximum value is obtained from coastal export fisheries by Pacific Island fishers.

Output 8. *HOE TORs* – The meeting approved terms of reference for HoF expressed in Annex 2 as amended by the meeting from the proposal in Working Paper 2.

Output 9. *Move towards functional integrated island/coastal management* – The meeting recognised that coastal fisheries management is not just about counting fish, assessing coral cover and consulting fishers, but also has to take account of other impacts and effects on nearshore fisheries, such as sewage contamination and ciguatera, and urged SPC to find ways of helping countries to integrate coastal fisheries issues into effective whole-island or coastal zone management systems.

Output 10. *Far western Pacific tuna fishery impacts* – The meeting noted that quantifying the impact of tuna fisheries in the far west of the Western and Central Pacific area, particularly Indonesian and Philippines waters, is critical to the assessment of bigeye and yellowfin tuna across the whole region. The multi-donor initiative that SPC has been coordinating to try and improve the quantity and quality of information coming out of this region was commended, and the results already starting to emerge were noted. Members also noted that the integration of the management of fisheries in this part of the region into the management of the entire range of stocks would be a major hurdle for the WCP Commission to tackle.

Output 11. *National capacity-building in OFP work* – SPC members looked forward to further capacity-building assistance through the OFP, particularly in understanding and incorporating scientific advice on region-wide stocks into management at the national level. The meeting recognised the role of the new GEF International Waters project proposal in supporting member country capacity to take effective part in WCP HMFS Commission processes. The meeting also recognised the role of the PROCFISH project in developing capacity for man-

agement of national fisheries within individual EEZs.

Output 12. *Stock assessment capacity* – The meeting noted that OFP did not have capacity to produce full assessments of all four main tuna stocks on an annual basis and asked the secretariat to continue seeking funding to improve regional capacity for stock assessments within the OFP. The need to produce assessments for other species, such as striped marlin and swordfish, as well as the assessment of risk to critical bycatch species from fisheries and other impacts, was also highlighted.

Output 13. *Artisanal, subsistence and recreational oceanic fisheries* – The meeting recognised that, whilst information on artisanal, subsistence and recreational oceanic fisheries is currently not particularly significant in producing overall assessments of oceanic species regional stock status, information on such fisheries is essential for national fishery management purposes and determining potential interactions between industrial and small-scale fisheries, and urged members to seize all opportunities, including those offered by SPC, to improve the availability of information on smaller-scale fisheries for oceanic species.

Output 14. *Aquaculture development* – HoF pointed out that aquaculture will be becoming an increasingly important component of food security for many SPC members. Small scale aquaculture and domestication of indigenous species, particularly those which can be integrated with traditional practices, has widespread applicability. The meeting acknowledged the practical utility of the aquaculture components of the FAO Code of Conduct for Responsible Fishing and suggested that SPC should assist members to put this into prac-

tice through the development, with the involvement of national stakeholders, of national codes of good aquaculture practice, under agreed regional standards.

Output 15. Feed formulation – Feed sourcing is a common bottleneck inhibiting the efficiency of the aquaculture sector. HoF urged SPC to coordinate regional efforts to promote the adoption of local farm-made feeds and facilitate the development of cost-effective formulated feeds, making maximum use of locally available materials.

Output 16. Introduction and movement of aquatic organisms – Heads of Fisheries recognised that the unmanaged introduction and/or translocation of aquatic organisms is a continuing concern, particularly with regard to marine invasive species. The meeting encouraged initiatives by SPC and its collaborators to assist members to address this concern.

Output 17. Coastal fisheries management – The meeting urged SPC to pursue funding to enable all of the coastal fisheries management strategies, as agreed by HoF from year to year, to be effectively pursued. The meeting also pointed out the need to avoid confusion by integrating all Coastal Fisheries Programme sectional goals and activities fully into the overall Coastal Fisheries Strategic Programme Plan.

Output 18. FAD programme management – In response to the specific needs expressed by several countries, the meeting suggested that SPC should produce a guide for the management of national Fish Aggregation Device programmes (monitoring, maintenance, funding options, design improvements including assessment of the efficiency of subsurface FADs etc.), and seek the resources to assist members,

on request, in implementing such programmes.

Output 19. Options paper on maritime security – The meeting asked that SPC collaborate with FFA in producing a joint briefing paper on the implementation of international agreements on heightened port security, suggesting options for implementation and mitigation of impacts upon fisheries. This report should take account of existing security-related measures covering international fishing vessels, including VMS, vessel registration and other compliance procedures already in place, and would provide a series of options based on the level of risk at different levels of fisheries, and taking into account any additional costs, including exploring the prospect of coastal states obtaining assistance in implementing additional fisheries-related security requirements from the leaders of the ISPS initiative. The meeting directed that any measures additionally recommended should not unnecessarily overburden low-risk subsectors, particularly purely domestic vessels.

Output 20. CITES and fisheries – The meeting asked the Secretariat to keep Heads of Fisheries informed about any developments concerning CITES and fisheries, particularly live reef fisheries, and to maintain liaison on these issues with the CITES Secretariat and other relevant implementing agencies.

Output 21. Heads of Fisheries signalled the need for more economic analysis of domestication prospects for individual members in order to implement the directive by Forum leaders to increase the return to Pacific Island countries from the utilisation of the resource within the region. The meeting also directed that the proposed EU/FFA/SPC “DEVFISH” project should

build upon existing national fishery development plans, where available.

Output 22. Guidelines for assessing and handling social and other aspects of tuna industry domestication – Whilst recognising the currently limited capacity of the SPC Marine Resources Division in this area, the meeting requested the secretariat to coordinate the compilation of information and options to assist governments in assessing and handling social and other aspects of tuna industry domestication that are often not fully accounted for in economic development plans, including social and health impacts on populations through associations between HIV/AIDS and STD transmission via the fishing industry. The secretariat was also asked to consider the feasibility of developing regional guidelines, to assist governments in managing these issues, and to pay particular attention to the need to develop methodologies for costing these impacts in development plans.

Output 23. Joint focal points for living and non-living marine resource issues – Heads of Fisheries drew attention to the need for regional agencies working in different ocean sectors to develop a member focal-point contact mechanism that would allow more efficient communication between national stakeholders and regional agencies regardless of the primary focal sector of each regional agency. Linkages that enabled Heads of Fisheries to obtain access to regional oceanographic, and shallow-water mapping, services were particularly encouraged.

Output 24. Fisheries information networking – The meeting welcomed the announcement of the forthcoming EU-funded Programme for Strengthening Fisheries Management in ACP coun-

tries (ACP Fish II). The meeting endorsed the recommendation of the project's feasibility study that the Pacific node of the ACP Fish II Regional Facilitation Unit be based at SPC headquarters. HoF4 also noted that the Secretariat should consult with the European Commission regarding the timeframe for implementation of the project.

Output 25. Preferred options for continuation of SPC In-service Fisheries Officer Training Course – The meeting endorsed the revised course programme that had been implemented from the start of 2004. In considering the financial constraints associated with the withdrawal of the Commonwealth Secretariat, the meeting supported a proposal from the Secretariat to run the course every two years, with an increased number of participants (dependent on funding). The meeting urged SPC to consult with established course donors to ensure the continuation of funding at a level that enables SPC to offer selected private sector focused short courses in the years when the Fisheries Officers course was not offered.

Output 26. USP/SPC Memorandum of Understanding on Fisheries – The meeting approved of the improved collaboration between the two CROP agencies and the prospect of improved linkage and feedback between USP

marine programmes and Pacific Island sustainable fisheries management interests that was signalled by the proposed MOU. The meeting recommended that the “definition of current work areas” should be expanded to include the role of HoF itself in advising USP and SPC on regional fisheries capacity-development priorities.

Output 27. Safety at sea for small fishing vessels – The meeting reviewed and endorsed the outcomes of the recent FAO/SPC regional expert consultation on sea safety in small fishing vessels. While recognising that sea safety is most effectively pursued at the national and local level, the meeting welcomed external assistance, provided that this was very clearly targeted at the practical implementation of national initiatives. The meeting urged SPC to approach FAO and IMO for potential assistance to member countries to facilitate sea-safety strategies and improvements in sea accident data recording and analysis.

The meeting also recommended that SPC establish a Sea-Safety Special Interest Group bulletin and provide information to its members covering electronic location solutions to improve search and rescue operations.

Output 28. International issues – The meeting noted that an SPC member representative, in the person of Glenn Hurry of Australia, will chair the next FAO Committee on Fisheries, and welcomed the enhanced opportunity that this appointment provided to discuss issues of regional concern within the international fisheries agenda. The meeting directed SPC to continue recording and reporting to member countries on issues arising out of international meetings and processes concerning fisheries, and asked for copies of the next draft of the Integrated Strategic Action plan under the Pacific Islands Regional Ocean Policy to be conveyed to Heads of Fisheries as soon as possible.



The meeting was interesting and productive, covered a wide range of topics and provided important guidance for SPC's future work in fisheries

Output 29. General capacity building (carried forward with amendments from HoF3 for continued action)

– It was emphasised that a basic principle of the SPC Marine Resources Division should continue to be to work towards reducing member dependency on regional programmes, and promoting the evolution of competencies at the national level wherever appropriate. It was recommended that the next HoF meeting should include a session on local capacity development in fisheries, including the development of a regional inventory of capacity in a range of issues from oceanic fishery assessment to coastal fisheries development and management, and aquaculture. HoF itself will work towards identifying what capacity should be developed or maintained at the regional level and each country or territory would of course decide what capacity should be a priority for developing at national level in each country and territory. In the meantime, and in the absence of effective national capacity in any area, the Secretariat is encouraged to allow flexibility in its coastal and oceanic fisheries programmes to assist members in addressing these.

Note on progress of above output: Since HoF3, there has been a major initiative by the regional community to review and revamp the whole regional agency system, arising from the review of the Pacific Islands Forum. This is primarily aimed at realigning CROP with member country needs and priorities, and the draft SPC/FFA overview of the fisheries sector for this regional exercise is available to HoF as Background Paper 6. Also FFC decided in May 2004 to strategically develop a new Strategic Plan for the Forum Fisheries Agency, and the new WCP Tuna Commission will open its doors in December. It may be better to wait for these changes to be accomplished and for these reviews to gather their data about national capacity and needs before embarking on a gap-filling HoF inventory through the SPC system.

However, it is proposed that one of the primary tasks of the SPC Director of Marine Resources before HoF5 would then be, with the cooperation of national and territorial fisheries heads, to put together a comprehensive database of SPC member capacity, building on the information that will have

already been collected for the Forum members. A questionnaire will also be circulated after HoF4 to provide some initial guidance.

Note: This list of recommendations is to signal points of consensus agreement of SPC member country and territory fisheries service heads on certain issues raised during the fourth SPC Heads of Fisheries Meeting, and identified by the Chair. These recommendations do not constitute a complete report of the meeting, nor do they constitute a complete work-programme for SPC (the SPC Strategic Programme Plans should be consulted for this) but are intended for the guidance of all with a stake or an interest in Pacific Island fisheries. Some of these recommendations identify gaps in regional support, or identify newly arising problems and priorities, or simply identify agreement on a course of action. Other agencies apart from SPC are invited to note these issues raised by Pacific Island countries and territories, and warmly invited to assist the region in addressing them, either in concert with SPC, or within their own capacity, as appropriate.



SEVENTEENTH MEETING OF THE STANDING COMMITTEE ON TUNA AND BILLFISH

The seventeenth meeting of the Standing Committee on Tuna and Billfish (SCTB 17) was held on 9–18 August 2004 in Majuro, Republic of the Marshall Islands. SCTB 17 was attended by participants from Australia, Canada, Commonwealth of the Northern Marianas, Cook Islands, European Union, Federated States of Micronesia, Fiji Islands, French Polynesia, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Palau, Papua New Guinea, the Peoples

Republic of China, Samoa, Solomon Islands, Taiwan, Tonga, Tuvalu, United States of America and Vanuatu. Participants from various regional and international organisations also attended the meeting. These included the Forum Fisheries Agency (FFA), the Inter-American Tropical Tuna Commission (IATTC), the Secretariat of the Pacific Community (SPC) and the Food and Agricultural Organization of the United Nations (FAO).

The SCTB provides a forum for scientists and others with an interest in the tuna and billfish stocks of the western and central Pacific Ocean (WCPO) to meet to discuss scientific issues related to data, research, and stock assessment. Its aims are to:

- coordinate fisheries data collection, compilation and dissemination according to agreed principles and procedures;

- review research on the biology, ecology, environment and fisheries for tunas and associated species in the WCPO;
- identify research needs and provide a means of coordination, including the fostering of collaborative research, to most efficiently and effectively meet those needs;
- review information pertaining to the status of the stocks of tunas and associated species in the WCPO, and to provide statements on stock status where appropriate, and;
- provide opinions on various scientific issues related to data, research and stock assessment of WCPO tuna fisheries.

The meeting convened as six working groups: Statistics Working Group, Highly Migratory Species (HMS) Biology Working Group, the Ecosystem & Bycatch Working Group, Fishing Technology Working Group, the Methods Working Group and the HMS Stock Assessment Working Group. This “thematic” working group structure differed from the species-based approach used at previous SCTBs.

The SCTB Chairman and Working Group Coordinators for SCTB 17 were as follows:

SCTB Chairman: Dr SungKwon Soh; **Biology WG:** Dr Talbot Murray; **Ecosystem & Bycatch WG:** Mr Paul Dalzell; **Fishing Technology WG:** Mr David Itano; **Methods WG:** Dr John Sibert; **Statistics WG:** Mr Tim Lawson; **Stock Assessment WG:** Dr Naozumi Miyabe and Dr Max Stocker

The initial overview of Western and Central Pacific Ocean (WCPO) tuna fisheries provided details of recent and histori-

cal fishery developments. A summary of this information is presented in the report of the HMS Stock Assessment Working Group. Further details of fisheries at the national level were elaborated in a series of National Fisheries Reports presented by national representatives. Reports on relevant activities of other organisations were received from FAO, IATTC and the Pelagic Fisheries Research Program of the University of Hawai‘i.

SCTB 17 discussed a range of research and fishery statistics needs for the WCPO. The priority needs identified by SCTB 16 and adopted by the second meeting of the Scientific Coordinating Group were again discussed and progress noted (items 1 to 6 below). Also, SCTB 17 suggested two additional issues (Items 7 and 8 below) that it felt needed to be highlighted.

1. Better estimation of current catch and catch composition from Indonesia, Philippines and Viet Nam.

A “Proposal for monitoring the catches of highly migratory species in the Philippines and the Pacific Ocean waters of Indonesia” was presented at PrepCon VI (Bali, April 2004). Under this project, a review of the tuna fisheries and the current statistical system was conducted in the Philippines in July 2004, with funding from Australia. This review highlighted significant problems with the collation of fisheries statistics in the Philippines. One year of port sampling will commence later in 2004, with funding from the United States and another donor. SCTB strongly encouraged potential donors to contribute funds for the balance of the project, namely a second year of port sampling in the Philippines and two years of port sampling in Indonesia. There is also a continuing need to compile informa-

tion on the longline fishery in Viet Nam, including estimates of annual catches.

2. Reconstruction of early catch history (catch, effort, size composition) for all fisheries.

The incorporation of complete time series of significant industrial fishing into stock assessments generally allows a fuller understanding of population abundance variability over a range of environmental regimes. Significant progress has been made, for example the incorporation of pre-1965 Japanese longline size data into bigeye and yellowfin tuna stock assessments. Current work is examining pre-1972 skipjack data for the Japanese pole-and-line fisheries. Further efforts in this area will be important to further reduce uncertainties in the stock assessment.

3. Further development of methods to standardise effort, including the better use of vessel operational details, environmental data and archival tagging data.

This work has been ongoing and improvements in effort standardisation for both longline and purse-seine fisheries were presented to SCTB 17. There is a need for finer scale data on the environment and on habitat preferences, as well as information on vessel, gear and operational details, for example better information to estimate hook depths. Additional variables may be included in the standardisation of effort and more flexible use of standardised effort made in assessment models. There is a forthcoming IATTC meeting on purse-seine effort standardisation and its deliberations will be considered. The use of “Longhurst”-type Large Marine Ecosystems as regions for stock assessments will be explored.

4. *Ongoing efforts to reduce uncertainty in assessments, through improved data inputs, sensitivity analysis and simulations.*

There is a need for better species composition data, especially on improved discrimination between small yellowfin and bigeye. Statistical relations among observer, logbook, and port sampling and landing data need to be established. WPFCC databases should provide for general biological data, particularly for parameters relevant to stock assessment. Assessment models should refine the parameterisation of catchability between regions and explore the estimation of mortality at age. The use of simple production models may also be explored. Bigeye assessments should be compared for the EPO, WCPO, Pacific-wide and with other oceans. Fishing power and effort needs to be characterised and quantified, and there is a broad range of issues related to FADs.

5. *Evaluation of possible regime shifts/changes in productivity and development of improved/alternative estimates of recruitment where possible.*

In response to the SCG 2 recommendations, a project proposal was developed by OFP in collaboration with NRIFS and NIWA. The project has been funded by the Pelagic Fisheries Research Program of the University of Hawai'i and preliminary results were presented at SCTB 17. This work will continue through the collection of empirical data and simulation studies to characterise long-term variability in catch histories and physical/biological time series from the WCPO. Operational metrics to detect changes in productivity and recruitment will be developed. These and other ecosystem indi-

cators may then be used in stock assessments. SCTB 17 also recommends the development of empirical recruitment indicators to compare with model estimations.

6. *Large-scale tagging experiments for the main target tuna species in the WCPO.*

This has been recommended by successive SCTBs as the highest research priority for the region. Such a project will provide better estimates of movement, mortality and other important parameters for stock assessment. Previous work undertaken more than 10 years ago has underpinned stock assessments but there is a need for regular if not continuous tagging studies of all species of interest. This work could be considered analogous to trawl surveys for demersal fisheries as the data provided are quasi-independent of the fisheries themselves. A large-scale tagging experiment would also permit further scientific research relevant to WCPO fisheries, including biology, ecology and oceanography. Various options for conducting tagging of tropical tunas were presented to SCTB 17 and the likely costs of a two-year tag release programme estimated. The meeting agreed to establish a small group to further develop a concept paper that might be made available to the Commission at its December 2004 meeting.

7. *Assessing impacts of fishing and the environment on the pelagic ecosystem.*

The WCPFC Convention (Article 5d) requires members "to assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks". This can be achieved

through studies of forage species by in situ sampling and/or diet analysis, the continued development of modeling methodologies, the definition and identification of habitats of special concern, and the mitigation of bycatch. Biological/ecological studies should be carried out for species of special concern.

8. *Regional Observer Programme.*

Article 28 of the Convention requires the Commission to "develop a regional observer programme to collect verified catch data, other scientific data and additional information related to the fishery from the Convention Area and to monitor the implementation of the conservation and management measures adopted by the Commission". The data needed for scientific purposes includes size and species composition, bycatch and discards. There needs to be coordination with national observer programmes, particularly regarding species of special concern. Additionally, there is a need for sub-regional coordinators for supervision of port samplers and observers. Data collection needs to be expanded to all fleets, in particular distant water longline fleets, and information should be collected on IUU (illegal, unregulated, unreported) fishing activities.

Consideration of issues requested by PrepCon WG-II

PrepCon WG-II recommended several tasks for consideration by SCTB 17 and SCG, among them data standards and advice on analyses of management options respectively. SCTB 17 considered these issues and reviewed the legal basis for data requirements and standards of the new WCPFC as well as existing standards that could be adopted by that Commission. The meeting also discussed

requisites for management options analyses, specifically reference points and decision rules. The meeting concluded that the topic is much too broad to be properly reviewed in the time that was available. It was noted that SCTB 11 held a workshop on the precautionary approach that is relevant to these issues. The meeting further concluded that the topic should be reviewed and discussed in the future at a meeting for that purpose and that fishery managers of the new Commission should also be involved. The meeting also considered the working group structure that was used for SCTB 17. This new structure generally functioned more smoothly; it is recommended that this or a similar structure be adopted for the Specialist Working Groups of the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC) when it is established.

Closing remarks

At the end of SCTB 17, Chairman Sung Kwon Soh (Korea) asked participants to share their personal experiences of the SCTB. Apolosi Turaganivalu (Fiji, on behalf of the Pacific Island countries), John

Hampton (OFP), John Sibert (PFRP, USA), Chung-Hai Kwok (Taiwan), Ziro Suzuki (NRIFSE, Japan), Talbot Murray (New Zealand), Jacek Majkowski (FAO), and Chairman Soh himself all spoke fondly of the achievements of the SCTB throughout the years.

All speakers were in agreement that the SCTB had achieved far more than its original modest goals, that the data collection, compilation and analyses have evolved dramatically, and that the stock assessments are now world class. Notwithstanding the concerns expressed by SCTB 17, stock conditions remain healthier in our region than for other oceans and participants expressed the hope that sustainability of the resources would be ensured by quick and wise management.

One of the most important achievements of SCTB has been to bring together representatives of the distant water fishing nations and the Pacific Island countries and territories on an equal footing. Colleagues have become friends and from friendships grew understanding. This has assisted the development of Pacific Island countries and territories and of

WCPO fisheries. SCTB has provided a unique experience and learning process and participants at SCTB 17 hope that the collegiality and cooperative spirit of SCTB will continue through into the SC.

All speakers highlighted the critical role played by the SPC, and in particular the OFP and its present and previous leaders, in providing support for SCTB meetings and technical assistance to SPC members and other parties. Views were expressed that the critical role of the OFP be retained and its capabilities expanded within the context of the new Commission. Thanks were extended to the Chair, Sung Kwon Soh, to all the Working Group Chairs, to the rapporteurs, and a special thanks to Glen Joseph and all the MIMRA team for hosting this last meeting of SCTB. Glen Joseph thanked the Honourable Minister John M. Silk, all the MIMRA staff, the participants at SCTB17, the staff of OFP and the Marshall Island Resort staff. The Chair then formally closed the last meeting of SCTB, bidding farewell to SCTB and welcome to the SC.



FISHERIES DEVELOPMENT SECTION

Deep-setting techniques for tuna longlining

In July, Fisheries Development Officer Steve Beverly accompanied Oceanic Fisheries Programme's Biological Analyst Bruno Leroy and Fisheries Biologist Pablo Chavance of ZoNéCo on a brief longline trip to Passe de Dumbéa near Noumea on Marine Marchande's vessel, F/V *Dar Mad*. The objective of the trip, on Steve's part, was to further test the new deep-setting technique to mitigate bycatch and enhance target species CPUEs (see *Fisheries Newsletter* # 109). Bruno Leroy's objective was to tag a bigeye tuna with an archival pop-up tag. Pablo Chavance's objective was to continue collecting data on temperature and depth of longline sets for his ongoing ZoNéCo project.

Two long sets were made, one on 28 July and one on 29 July. Each set consisted of 175 hooks in 25-hook baskets using a normal setting configuration and 60 hooks in 30-hook baskets using the deep-setting technique. South African pilchard was used on all hooks and lightsticks were placed on selected branchlines on the second set.

Each branchline in the normal baskets had a hook timer to record bite times, and each basket had a temperature depth recorder (TDR) attached in the middle, or deepest hook, position. These baskets were part of Pablo's research.

Two baskets of 30 hooks each were set each day using the new deep-setting technique. Conditions were a little different than they had been in Mooloolaba as F/V *Dar Mad* is an older boat with less sophisticated gear than is found on the boats fishing out of Mooloolaba. However, the gear was set and retrieved without mishap. TDRs were set on the first and middle hook positions to monitor depth and temperature.

Set details

Set #1 started at 0700 at 22°26.3'S and 166°09.05'E and was completed at 0820 at 22°28.4'S and 166°04.1'E. Hauling started at 1300 and was completed at 1600. The catch was six opah (*Lampris guttatus*) and one mako shark (*Isurus oxyrinchus*). All fish were caught on the normal gear.

Set #2 started at 0450 at 22°25.8'S and 166°13.2'E and was completed at 0610 at 22°24.3'S and 166°08.3'E. Hauling started at 1000 and was completed at 1230. The catch was one thresher shark (*Alopias* spp.) caught on the normal gear and one opah and one bigeye tuna (*Thunnus obesus*), weighing approximately 40 kg, caught on the deep-set gear.

Bruno tagged the bigeye with an archival tag and it was released, apparently fine. The TDR data showed that the bigeye had been captured at 0730 at 388 metres and the temperature was 15.5°C. (Figure 1). The graph is for both days because the recorder could not be stopped and restarted without a laptop at sea. The spike in the line indicated by the vertical marker shows details of the bigeye catch. One outcome of this trip was that it showed another possible use for the deep-setting technique — to enhance catch of target species for fisheries biology research. The TDR data was also useful for Bruno's research.

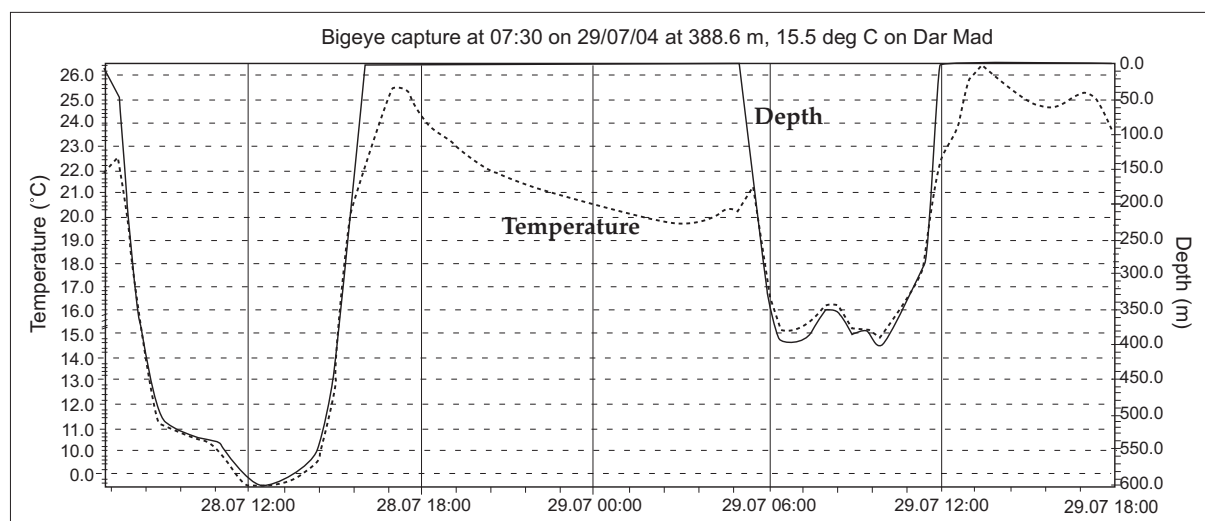


Figure 1: TDR data showing the time and depth the bigeye tuna was hooked

Technical assistance to Tuvalu

During the last week of August, William Sokimi travelled to Fiji to assist the National Fishing Corporation of Tuvalu (NaFICOT) upgrade two secondhand gill-net vessels to tuna longline vessels. These vessels were given to Tuvalu by Korea as part of Korea's aid assistance to Pacific Island countries (see *Fisheries Newsletter* #109). Both vessels (F/V *Taivalu* and F/V *Papuku*, Figure 2) were sent to Fiji in August to undergo outfitting of tuna longline fishing equipment and to reconfigure the deck layout to suit tuna longline operations. The smaller vessel, F/V *Papuku*, was also to be rigged

with four deep-bottom hydraulic fishing reels. William was sent to Fiji to oversee and advise on the work to be done during the conversion of the two vessels.

The main objectives for the project were to work with the skipper, crew and contractors to supervise the installation of the tuna longline machinery on the two fishing vessels; train the skippers and crew in the correct rigging of gear; provide hands-on training for the skippers and crew in all aspects of commercial tuna longline fishing operations using monofilament longline gear; and provide training

in the correct handling, processing and chilling of the catch for export, especially sashimi grade tuna.

While every effort was made to achieve the objectives of the project, circumstances arose that necessitated prioritising the work. Initially it was planned that the two vessels would spend approximately three weeks in Fiji for the conversion stage then the next five weeks conducting training during tuna longline fishing trips. Unfortunately, due to unforeseen circumstances and funding hiccups, the conversion of the two vessels took longer than anticipated and most of the time for the project was spent in Fiji converting the two vessels. Both vessels encountered mechanical problems while on passage to Fiji and these needed to be fixed concurrently with installing the fishing gears. Unfortunately, the additional work was not budgeted for and a major rearrangement of work priorities had to be carried out. In doing this, much of the work for upgrading the vessels to the recommended fishing standards had to be forfeited.

On the F/V *Taivalu* work was concentrated on installing a Seamech mainline reel and shooter; cleaning out and patching holes in the flooring and bulkheads of the fish holds due to diesel contamination from carrying fuel in the fish holds (Figure 3) during the delivery voyage from Korea to Tuvalu; replacing the fuel oil transfer pump; carrying out major electrical work on repairing the generator; replacing the old working



Figure 2 (top): The two Tuvaluan tuna longline vessels

Figure 3 (bottom): Diesel being cleaned out of the fish hold

light fittings with fittings available in the region; reinstalling the Radio Direction Finder antenna and rigging a retractable awning shelter on the forward working deck. The same deck work and installation of fishing gear was done on the F/V *Papuku*, and in addition, four deep-bottom hydraulic fishing rigs were fitted. Work was also carried out to decontaminate the fish holds of diesel but this was less than what was done on the F/V *Taivalu*. However, the engine room defect list required more effort and diverted most of the fishing funds. The engine room repairs were a major contributor to the delays in the project. The additional engine room work on the F/V *Papuku* included replacing the exhaust pipes for the main engine and generator; major repairs to the main engine gear-box including replacing clutch plate, seals and gasket bearings; and overhauling the generator.

The crew of both vessels concentrated on preparing a complete set of branchlines and floatlines (Figure 4) for both vessels. There was only enough gear to construct 2000 branchlines and 250 floatlines. The radio beacons and floats were rigged with attachment ropes and snaps. The mainline was also loaded onto the reel (Figure 5) once the hydraulic system was operational on each vessel. Once the funding and work schedule was sorted out everyone concentrated on putting the vessels together for the fishing trips. Excursions were arranged for the crew of both vessels to visit other vessels with tuna longline gear to observe short demonstrations on how the reel and shooter worked. This was done alongside the wharf. Fortunately, the skippers and crew of the vessels engaged in the Fiji tuna longline industry were more than happy to carry out these demonstrations for the Tuvaluan crew, especially the

skippers and crew of the *Solander 6* and *Solander 7*, Captain Tom Jiare and Captain Aquila.

In the last week of October, the bigger vessel, F/V *Taivalu*, was ready for sea and fishing trials, which would take place enroute to Tuvalu. Delays in acquiring engine parts prevented the F/V *Papuku* from being ready at the same time. Because of time constraints, it was decided that the F/V *Taivalu* would take the lead

and the F/V *Papuku* would follow as soon as it was ready, which was expected to be a week later.

On Saturday 23 October F/V *Taivalu* finally departed Fiji for Tuvalu via the fishing grounds. William accompanied the skipper and crew of the vessel to train them in the use of their newly acquired Seamech longline reel and shooter and to give most of them their first experiences in tuna longline fishing.



Figure 4 (top): Crew making up floatlines

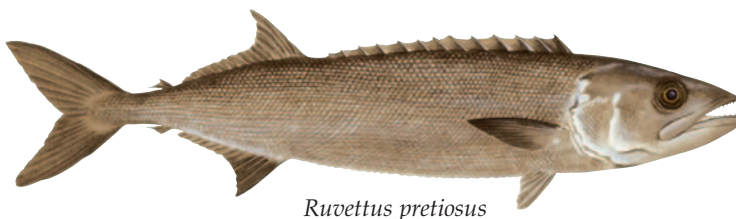
Figure 5 (bottom): Loading mainline onto the reel

There was a full complement of 12 on the vessel, including William. Only two of the crew onboard the vessel had done tuna longlining before. During the first set, 22 nm was covered with only 869 hooks laid. A lot of time and hook space was lost in trying to get the crew to coordinate their efforts and to set up a rhythm when deploying and snapping on the branchlines. The catch results for the first set were only one bigeye tuna (*Thunnus obesus*), one albacore tuna (*Thunnus alalunga*), two yellowfin tuna (*Thunnus albacares*), one blue marlin (*Makaira mazara*), two big-scaled pomfrets (*Taractichthys longipinnis*), one thresher shark (*Alopias superciliosus*), two pelagic rays (*Dasyatis violacea*), one longnose lancet fish (*Alepisaurus ferox*) and one snake mackerel (*Gempylus serpens*). However, the second and third sets saw a marked improvement in the crew's performance and the catch rate improved tremendously.

During the second set 22 nm was again covered but this time 1465 hooks were set. The catch for the second set included 11

bigeye tuna, four albacore, two yellowfin tuna, two blue marlin, three sailfish (*Istiophorus platypterus*), four opah (*Lampris guttatus*), three snake mackerels, three longnose lancetfish, six pomfrets, four oilfish (*Ruvettus pretiosus*), one pelagic ray and two barracuda (*Sphyraena barracuda*). No sharks were caught during this set. In the third set, 1433 hooks were laid over 22 nm resulting in a catch of 15 bigeye tuna, 11 yellowfin tuna, 12 albacore tuna, nine skipjack tuna (*Katsuwonus pelamis*), nine wahoo (*Acanthocybium solandri*), one sailfish, one opah, two barracuda, three pelagic rays, four snake mackerels and two blue sharks (*Prionace glauca*). In total, 3767 hooks were set with a catch of 2043 kg, of which 75 per cent (1535 kg) was tuna (bigeye, yellowfin and albacore).

William only managed to get three sets done to conclude the project and to achieve the "hands-on" training objective. Despite this, the three sets were sufficient to give the crew an understanding of what a tuna longline fishing operation is about. Even though the crew had a shaky start during the first set they managed to get a system going to set up a rhythm for deploying and setting the branchlines and to haul back, process and maintain their catch on ice. Armed with this knowledge the crew of the F/V *Taivalu* should be able to continue with fishing operations to practise and to build up their confidence in tuna longline operations. They will then be able to incorporate and train at least three new crew every trip.



Ruvettus pretiosus

Community surveys conducted in Niue

Fisheries Development Adviser Lindsay Chapman spent the second half of July in Niue conducting the third and final community surveys. The surveys were part of the FAD research project being undertaken by the section in Niue and the Cook Islands. A total of 163 households needed to be located, which was quite difficult in

some cases where families had moved to another village, were on holidays away from home, or even had left the country. Of the 163 households, 124 were located and interviewed, with 111 of these households interviewed on all three occasions.

In addition to the community surveys, Lindsay worked with

the Fisheries Department on the catch and effort logbooks. Each of the fishermen that were providing data was given an identifying number so there was no confusion with the data from each provider. This was needed as several fishermen used the same vessel at different times.



Standing Committee on Tuna and Billfish

In August Steve Beverly attended the last meeting of the Standing Committee on Tuna and Billfish, SCTB 17, which was held in Majuro, Republic of Marshall Islands. Steve and David Itano, Research Associate with the Pelagic Fisheries Research Program at the University of

Hawai'i, did a joint presentation at the Fisheries Technology Working Group (FTWG) session at the meeting on new deep-setting technologies that avoid by-catch and enhance target species catch.

Steve's half of the presentation has already been covered in a separate *Fisheries Newsletter* article (#109). David Itano's presentation was on a new technique being practised by a few hand-line fishermen in Hawaii.



FAD research project update

The FAD research project was scheduled to be completed at the end of June 2004. However, New Zealand granted an extension to the end of 2004 to allow the completion of unfinished components of the project, as well as the complete analysis of the data collected. In July the final community surveys were conducted in Niue. Data entry and analysis commenced in August.

No FAD losses have been reported in the third quarter. Therefore, at the end of September there were two project FADs on station off Rarotonga (one after 30 months and the other after 15.5 months), two project FADs off Aitutaki (one after 29.5 months and the other after 15.5 months), and two project FADs off Niue (one after 31 months and the other after 5 months).

Maintenance of the FADs has been as regular as possible in Niue, although this has been hindered by the lack of availability of the Public Works launch. However, in July, Lindsay Chapman accompanied the Niue Fisheries Department staff to deploy a new offshore FAD (Figure 6) to replace one of those lost as a result of cyclone Heta.

This FAD was rigged with a marker pole with light and radar reflector and an aggregator (Figure 7). The aggregator was made using some fence wire, with four tyres attached at the top and two at the bottom. Four styrofoam floats were attached to the top so the aggregator hung vertically in the water column. Coconut fronds

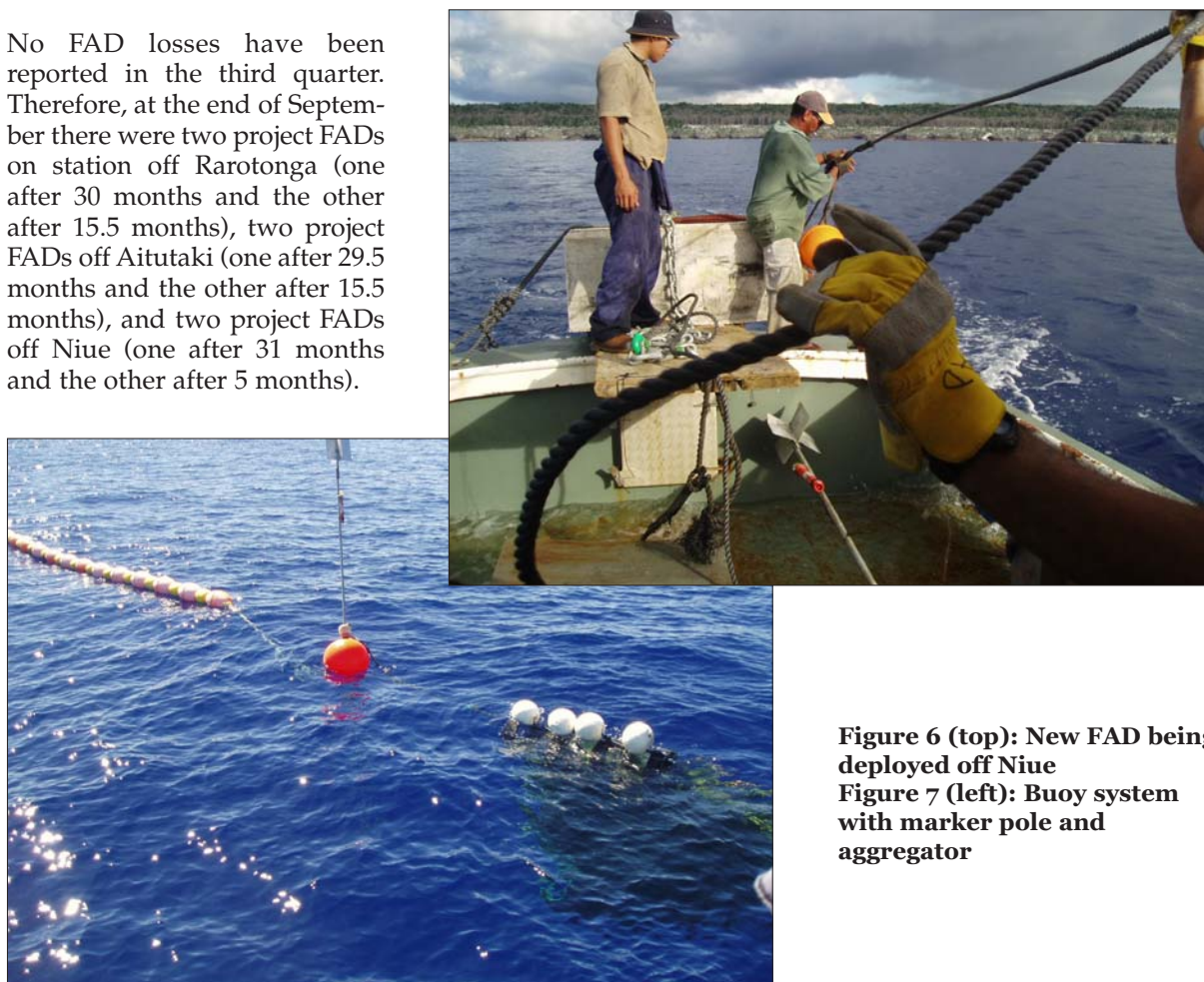


Figure 6 (top): New FAD being deployed off Niue
Figure 7 (left): Buoy system with marker pole and aggregator

were then lashed to the fence wire to complete the aggregator (Figure 8).

Several fishermen continue to provide consistent catch and effort data for the project in Rarotonga and Niue. It is hoped that the logbook system will

continue now that the project has concluded, and the Fisheries Departments are encouraging fishermen to do this.



Figure 8: Aggregator system used

Workshop on the implications of the Western and Central Pacific Fisheries Convention to the private sector Suva, Fiji Islands, 14–16 September 2004

Lindsay Chapman attended this workshop along with several other fisheries staff from SPC. The aims of the workshop were to establish a regional industry association to have an independent accreditation with the Western and Central Pacific Fisheries Commission; develop a website for the use of national and regional industry representatives; establish, revitalise and strengthen national industry associations; identify a viable financing mechanism for the operation and management of the regional tuna industry association; and set up mechanisms

for ongoing public-private sector partnerships in the industry.

The main outcome of the meeting was the establishment of a regional tuna industry association. It was agreed that a steering committee be established, comprising three interested and independent individuals directly involved in the fishing industry. The steering committee was elected and comprised: James Movick (FSM National Offshore Fisheries Association), Maurice Brownjohn (Chairman, PNG Fishing Industry Association (PNG) Inc.) and Robert Stone

(member, Fiji commercial tuna fisheries sector). It was agreed that James Movick would act as Chair of the steering committee. The workshop further agreed that the committee could co-opt to it additional individuals as necessary. The meeting also agreed that the association would be registered in Pohnpei, Federated States of Micronesia. SPC is assisting the association with the setting up of a website (<http://www.spc.int/mrd/pacificuna>), where the outcomes of the meeting can be found.



■ AQUACULTURE SECTION

Australasian Aquaculture Conference, Sydney 2004: Indigenous Aquaculture Session – The Pacific Experience

Background

The workshop *Indigenous Participation in Aquaculture – the Pacific Experience* was held as a day-and-a-half session in the Australasian Aquaculture 2004 conference at the Sydney Convention and Exhibition Centre, Darling Harbour, on 27–28 September 2004. The conference was the first in a biennial series of conferences to be held in different states of Australia to assist in promoting the development of sustainable aquaculture technologies in Australia and the wider Asia-Pacific region. The conference itself was a great success, with over 1300 participants, including a substantial international attendance, and a strong trade show.

A major aspect of the workshop *Indigenous Participation in Aquaculture – the Pacific Experience* was to promote exchange of information and experiences between researchers, government representatives and industry involved in aquaculture development in the Pacific. The SPC Aquaculture Section has formed an informal working group (the Pacific Aquaculture Working Group) in support of this objective, and this workshop was an activity of the Pacific Aquaculture Working Group.

The workshop also recognised the increasing interest in aquaculture as an industry that can provide benefits for rural Indigenous communities in Australia as well as in the Pacific Islands region. The Pacific has a diverse and vibrant tropical aquaculture industry, and has many commodities common to Australia (pearls, shrimp, sea cucumber, etc.). An additional aim of the workshop was to cap-

ture the experience of Pacific Islands aquaculture to develop linkages to support Indigenous aquaculture development in Australia.

Objectives

Prior to the workshop, the main objectives were identified as:

1. Promote the exchange of information and experiences between Pacific Island countries and Australia in support of Indigenous involvement in aquaculture.
2. Promote and support the involvement of Indigenous people in the aquaculture industry in Australia and the Pacific.
3. Assess the potential for adoption of Pacific Island cultured commodities and technologies to assist the development of Indigenous aquaculture in Australia.
4. Support the objectives of the Australian Aquaculture Action Agenda for Indigenous people.

Outcomes

The workshop was very successful and 23 presenters from eleven countries (Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, Kiribati, New Caledonia, New Zealand, Papua New Guinea, Samoa, Solomon Islands, Vanuatu) were well received. The presentations featured many successful aquaculture ventures and highlighted economic, technical and cultural issues faced by communities in the region.

During the workshop, key issues were noted, then raised

for discussion in the final facilitated session. These issues are summarised below, listed in dot point under the relevant desired workshop outcomes (identified prior to the workshop).

Outcome 1: Identify key issues to assist Indigenous aquaculture development in Australia and the Pacific.

The issues discussed were:

- “Western”-style work practices and business frameworks are not always compatible with Indigenous operations. Cultural issues and the history of developments in Indigenous communities (conflicting cultural demands, availability of “sit-down” money) must be considered.
- There is a strong need to consider cultural issues when planning and implementing technical training for Indigenous groups (e.g. consider limited literacy, focus on group-based rather than individual problem solving, “hands-on” training, imaginative solutions to facilitate training and maintain interest).
- There is a need for business (e.g. budgeting) as well as technical training.
- More direct Indigenous involvement in management was recommended. Success and ownership are positive forces and perpetuate success.
- It was noted that small-scale, extensive systems give direct benefits to communities and families (food security, cash income). Larger operations may have to contribute in different ways (employment, scholarships). It must also be

recognised that indirect benefits in the form of employment pride, improved self-esteem, production of species of "cultural" value, etc., are very important.

- There is a need to recognise that cultures are different but that common elements exist and there is potential for collaboration in many areas.
- Consultations, negotiations and business operations must be appropriate to the cultural obligations and sensitivities within communities.
- Complicated ownership systems (both land and sea tenure) must be taken into account in the establishment of aquaculture operations.
- Enhanced income by groups may cause conflict within the community.
- Environmental Scanning needs to take cultural factors/issues into account.
- There is a need to manage expectations within communities and to deliver on promises. Long production timeframes may cause communities to lose interest.
- There is a need to identify social issues regarding Indigenous aquaculture development.
- Full-time employment in an aquaculture industry may not be appropriate or necessary. For example, paid "blocks" of time may be more effective and acceptable.
- There can be delays associated with resolving intellectual property (IP) issues, particularly those associated with traditional knowledge. Many communities and/or individuals don't want traditional knowledge recorded in writing or given to other groups.
- Capacity-building amongst communities should focus on younger people. Consider mentoring from elders;

utilise experience from other aquaculture businesses.

- Collaboration in sponge marketing: develop critical mass to fulfil market demand.
- Focus on interested groups and issues to assist those groups, and not the big picture.
- Environmental issues: understanding of why it is so important to people.

Outcome 2: Develop a collaborative framework to advance Indigenous involvement in aquaculture in Australia and the Pacific.

- There is a need to develop regional centres of research and development (training, extension, advice, support, expertise) and provide institutional support.
- The Pacific/Indigenous Aquaculture session is to be included in Australasian Aquaculture 2006 in Adelaide and in subsequent conferences to maintain interest and focus, report on progress made and promote new ideas.

Output: Commitment to include similar workshop every year.

- Development of a "one-stop" internet shop for Indigenous groups seeking information on how to develop an aquaculture project would be a very useful first step in supporting Indigenous aquaculture. Consider Australian Indigenous and Pacific Islands network. Form links with established websites, e.g. SPC and NACA. One of NAC's objectives is to support the development of a website for information and contacts, enhance communications.

Output: Website to be hosted by NAC.

Outcome 3: Prepare a report on issues identified in a facilitated workshop, reviewing the day's proceedings.

- Write up the outcomes of the meeting and distribute to interested parties (participants, sponsors, government agencies).

Output: This document.

- Develop a basic booklet to outline the strategic requirements, issues and working relationships for establishing Indigenous Aquaculture Ventures. This can be distributed widely to Indigenous communities.

Output: Published booklet.

- "Good news" examples of successful aquaculture ventures that can provide positive stimuli to other ventures.

Output: Publication on successful case studies.

Outcome 4: Utilise these outcomes to assist implementation of aquaculture development in the Pacific Islands region.

- A major outcome from the workshop with regard to implementation of aquaculture development in the Pacific Islands region was the opportunity for workshop participants from PNG, Solomon Islands, Samoa, Fiji Islands, Kiribati, Cook Islands and Vanuatu to interact with each other and with Australian workshop participants, and to participate in a large international technical conference.
- Through providing a forum for Pacific participants to interact, the workshop contributed directly to the aquaculture outputs of the SPC Coastal Fisheries Programme Strategic Plan 2003–2005, particularly Output 1.1: *Establishment and maintenance of a regional network of contacts as a means of exchanging ideas, knowledge and experience on*

Pacific aquaculture issues. This network will be maintained and expanded through the mechanisms identified in this report.

- The workshop also contributed to Output 1.3: *Development of the Pacific Island human resource base for aquaculture.* Participation in an international workshop/conference assisted in building capacity in regard to presentation techniques and networking with other practitioners within and outside the Pacific Islands region, as well as providing exposure to the wider Australasian aquaculture scene.
- The workshop provided opportunity for identification and finalisation of collaborative “miniproject” proposals to be funded under the ACIAR project Sustainable aquaculture development in the Pacific Islands region and northern Australia (FIS/2001/075). These include:
 - Development of commercial and farm-made feeds for tilapia and freshwater prawn in PNG and Fiji.
 - Monoculture of the freshwater prawn *Macrobrachium lar* in Vanuatu and integrated prawn-taro farming in Wallis and Futuna.
 - Training in microalgal culture technology for Samoa.

Output: Two mini-project proposals submitted for funding.

- There was general agreement amongst participants that many of the cultural issues raised by Australian Indigenous participants were also applicable to Pacific Island countries.

Outcome 5: Utilise these outcomes to assist implementation of the National Aquaculture Development Strategy for Indigenous Communities in Australia.

- Continuity of funding or support is very important (CDEP top-up?).
- Recognise the importance of risk analysis. It is important to thoroughly research the proposed operation/species/system before proceeding. Should be appropriate to the cultural group and have high probability of success. Need to recognise that promises must be realistic.
- Maintain the networks established from this conference.
- Strategic planning directions: need to plan “What, How, When”; we know why.
- Develop partnerships with existing industry: Skretting example (Bathurst Island, NT, Tiwi people). May have both positive and negative impacts (e.g. sit-down money from mining companies).

Organisation and sponsorship

The organising committee comprised the following persons:

Dr Mike Rimmer, Department of Primary Industries and Fisheries, Queensland, Australia; Dr Yves Harache, IFREMER, New Caledonia; Mr Ben Ponia, Secretariat of the Pacific Community, New Caledonia; Dr Warwick Nash, WorldFish Center, New Caledonia; Mr Dennis Ah-Kee, National Indigenous Aquaculture Unit, Department of Agriculture, Fisheries and Forestry, Australia; Mr Ian Lyall, Department of Primary Industries, New South Wales, Australia; Ms Cathy Hair, Department of Primary Industries and Fisheries, Queensland, Australia

The workshop was facilitated and chaired by Grant Sarra (Grant Sarra Consultancy Services), assisted by Dennis Ah-Kee as the co-chair.

The workshop was sponsored by the Australian Agency for International Development (AusAID) under the International Seminar Support Scheme (ISSS), the Australian Centre for International Agricultural Research (ACIAR) and the Australian Department of Agriculture, Fisheries and Forestry (DAFF).



SPC seaweed quarantine protocol development undertaken by the Institute of Marine Resources, University of the South Pacific

In 2003 the Secretariat of the Pacific Community (SPC) commissioned the Institute of Marine Resources (IMR) of the University of the South Pacific to: 1) conduct a literature review of the introductions of the seaweed *Kappaphycus alvarezii* to Pacific Islands countries and the current state of seaweed farm-

ing in these countries and 2) to field-test their proposed quarantine protocol for introducing kappaphycus seaweed to new locations. The following is a synopsis of the quarantine protocol report which is now available online on the SPC Aquaculture Portal (<http://www.spc.int/aquaculture/site/publications/>

[documents/Seaweed%20quarantine%20project.pdf](#))

Kappaphycus seaweed is farmed for its carageenan content commonly used in the food processing and pharmaceutical industry. It has been introduced to Pacific Island countries since 1977. The industry has met with

varied success. In Kiribati it has become an important cash crop for both the rural and national economies. In Fiji Islands the progress has been erratic, although the commodity is still recognised as having a potential to be an important income earner in rural areas. In Solomon Islands there has been recently rejuvenated effort leading to rapid increase in farming and export volume. Growth trials have been conducted in other Pacific Island countries although few have led to commercialisation.

These developments have required that whole plants or cuttings of kappaphycus be transplanted from island to island, with most of the material originating in the Philippines, Kiribati or Fiji.

On only one occasion, a shipment from Fiji to the Solomons

in 1988, has there been any documented attempt to quarantine the plants in order to minimise the risk of importing associated species or any diseased plants. Quarantining is important to minimise the risk of accidental introductions, and also to establish if the species being introduced is likely to become a pest itself. The main quarantine problem, however, is that of preventing accidental introductions of associated species; and when volumes exceeding half a tonne are sometimes transplanted this is a real risk.

SPC has therefore developed a protocol for translocating kappaphycus, and commissioned the University of the South Pacific's Institute of Marine Resources (IMR) to field-test their protocols. The protocol is fairly simple and involves washing and cleaning the speci-

mens before they are dispatched and upon arrival, and keeping the plants in quarantine for two weeks during which period there is further cleaning and washing. This protocol is intended to remove most if not all macrobiota, but obviously will not remove the microflora such as diatoms, dinoflagellates and protozoa living on the surface of the seaweed. Nor will it isolate internal parasites such as viruses, fungi or protozoa, although plants that are obviously diseased would be removed.

Accordingly, the IMR obtained shipments of kappaphycus from three Fijian farms to test this protocol. The morphology of kappaphycus is much influenced by environment, especially wave action, and the plants that we received exhibited very different morphologies. We discovered that, compared with many other seaweeds, kappaphycus supports a relatively sparse macrobiota. This is particularly so for laxly branched, long slender plants from Macuata and Savusavu. Compressed, ball-like specimens from sites with relatively high wave action, such as Bua, provided more nooks and crannies for phytal flora and fauna. Hosing and gently scrubbing

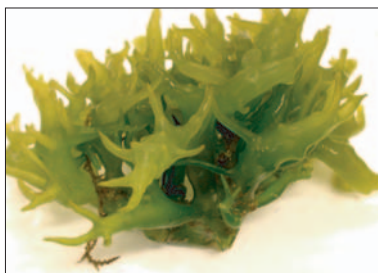


Figure 1 (top): Experimental set-up of seaweed quarantine trials

Figure 2 : Seaweed within Fiji displaying different morphology
Left to right: Bua, Savusavu and Macuata seaweed

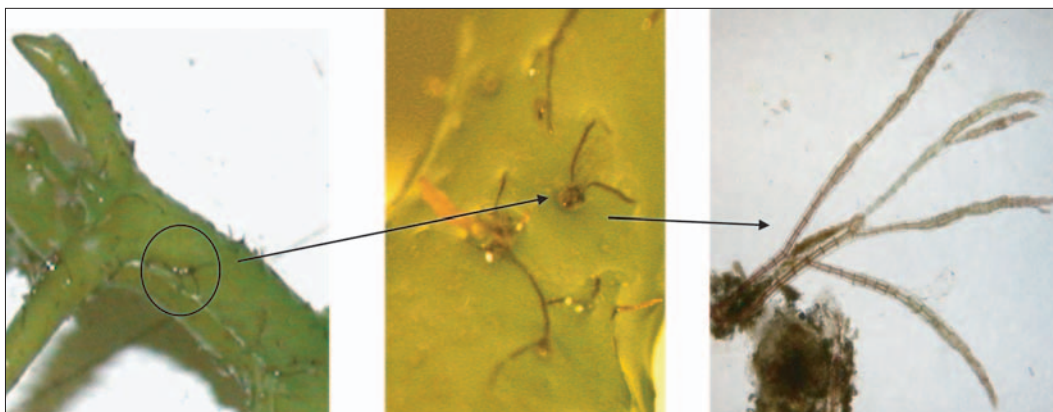
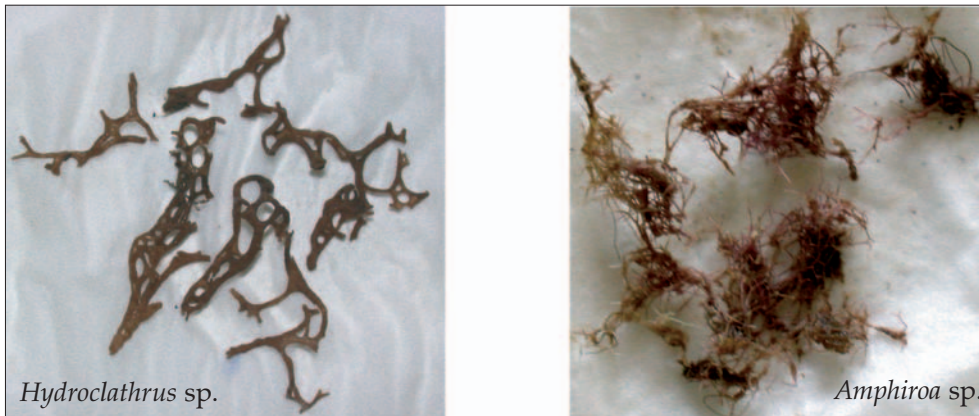
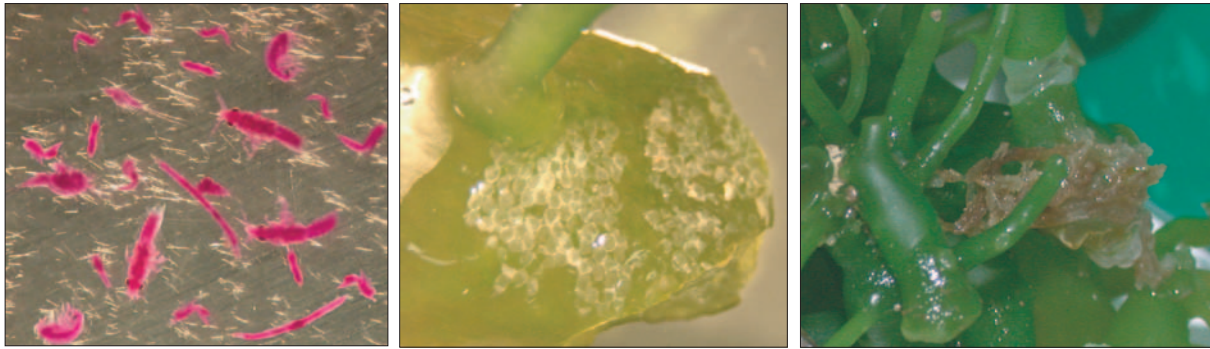


Figure 3: Parasites and other organisms associated with the seaweed host
Top left to right: microfauna, eggs, zoanthids. Middle row: algal fragments
Bottom row epiphytic algae embedded into thallus

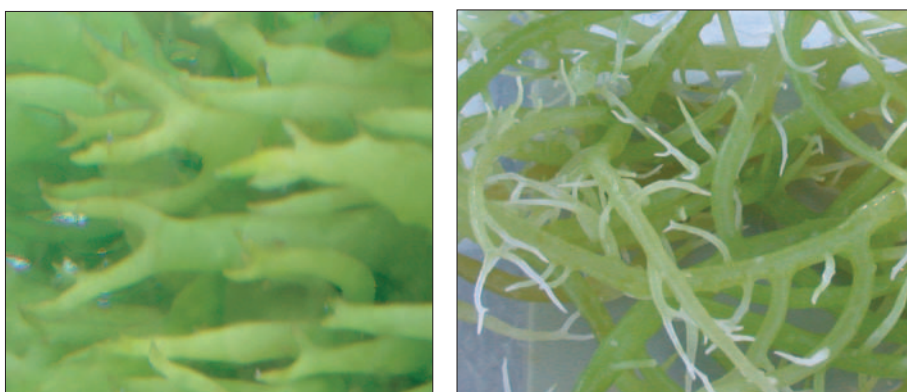


Figure 4:
Kappaphycus algae
under stress.
Left to right,
filamentous algae,
necrotic tips.

the plants with filtered seawater proved to be an effective means of dramatically reducing the epibiota on the specimens.

After two weeks, untreated plants had a much greater diversity and abundance of macrobiota than did the washed plants. Some species were, however, persistent, especially several types of filamentous epiphytic algae, whose bases are embedded in the kappaphycus tissue. Though these epiphytes can be picked or scrubbed off, they quickly regrow. In the absence of any strong water movement in our culture tanks they looked likely to overgrow the specimens unless the cleaning process was maintained. Although washing removed most macrobiota, handling the plants evidently caused stress, which resulted in the treated plants growing more slowly than those untreated. However, all specimens exhibited significant growth over two weeks. Another problem was that after a week, many plants lost colour and became necrotic at their tips. This indicates the problems of a closed tank system where seaweeds are likely to become nutrient limited.

We concluded that the washing and quarantine procedure was effective at removing most large epifauna, but it would not prevent the introduction of some

small epiphytes embedded in the host's tissue. Microscopic examination of periodic washings also showed that washing did not significantly reduce the surface microbiota.

Several simple improvements to this procedure could be made. Perhaps the simplest is to wash the plants in fresh water, which would be more effective at removing the animals, and which is possible because kappaphycus tolerates low salinities for short periods. Second, we would recommend experimenting with surface disinfectants to try to kill epiphytes and epifauna. Brief immersion in copper sulphate may kill epiphytic algae including phytoplankton and even fungi, while Betadine (an iodine based antiseptic) or chlorine would eliminate a wide range of microorganisms. Experiments are needed to test dosage and exposure periods. If successful, then surface disinfection could reduce the quarantine period.

Another stratagem is to minimise the volumes of the seaweed that are transplanted. One method is to minimise the mortality of the transplants at their new location so that there is an opportunity to "bulk up" the specimens to provide the desired biomass needed to supply cuttings; that is, to establish a nurs-

ery for the plant. Otherwise, anticipating high mortality, countries will continue to import very large volumes, and the risk of introducing unwanted species increases with the volume, possibly exponentially. Another method, best adopted, is to transplant only the apical parts of plants, because these are relatively free of epiphytes and animals. Where countries want axenic cultures of kappaphycus, then tissue culture is really the only option. This requires considerable expertise and equipment at source and also at the destination, where the cultures may have to be maintained for as long as four years before there is sufficient material to provide cuttings for an experimental farm.

Reference

Sulu, R., Kumar, L., Hay, C. and Pickering, T. 2004. Kappaphycus seaweed in the Pacific: review of introductions and field testing proposed quarantine protocols. Noumea: Secretariat of the Pacific Community.

For further information on the seaweed quarantine protocol please contact Ben Ponia, SPC Aquaculture Adviser (benp@spc.int).



Fiji Freshwater Aquaculture Census Survey

Introduction

Following a aquaculture study tour in June 2004 (see *Fisheries Newsletter* #109) and meetings with Department of Fisheries officials in Fiji, a request was made by Chief Executive Officer of The Ministry of Fisheries and Forests to SPC and ACIAR to carry out a freshwater aquaculture pond census and to assist in development of

a strategic plan for freshwater culture in Fiji.

Thus a survey of fish farmers with ponds was organised by the SPC Aquaculture Section, with funding support from ACIAR.

The objective of the survey were to:

1. quantify the present status of the industry;

2. identify advantages, constraints and trends within sector; and
3. formulate recommendations of strategic requirements to support freshwater aquaculture development in Fiji.

Survey methodology

A survey questionnaire was developed by SPC to solicit information describing the

farmers' situation. The questionnaire was tested briefly at Naduruloulou aquaculture station on 21 June 2004. The survey was executed in three visits during June–July 2004.

An inventory of fish farmers to update records was conducted by the Department of Fisheries prior to the survey. From the records available the number of fish farmers in the two main islands of Viti Levu and Vanua Levu was estimated to be around 300. It was agreed to attempt to interview all farmers to obtain statistically reliable information as well as update the current records.

Results

The pond census indicates the typical profile of a farmer is of Fijian ethnicity, middle aged and male. The majority of farms are operated by men (92%). A very small percentage of the fish pond operators are women but they share fish farming responsibilities with men. The majority of farmers belong to Methodist denomination.

Most of the farmers had considerable fish farming experience, ranging from 5 to 10 years, and the main economic activity is crop production. There are a total of 110 existing farmers including those with farms under construction. The census reported a further 57 ex-farmers who had become disillusioned with their prospects or cited a lack of government support. There were also a lot of farmers who were intending to start fish farming.

Nile tilapia (*Oreochromis niloticus*) and giant freshwater shrimp (*Macrobrachium rosenbergii*) are the two main commodities. Chinese carps are also cultured but by a small number of farmers only. Thirty tonnes of tilapia valued at FJD 125,000 and 1.7 mt of shrimp worth FJD

30,000 were produced in 2003. Two thirds of the ponds were farming tilapia and 10 per cent shrimp, although one third of the farmers wished to cultivate shrimp if possible. Up to 20 per cent of the farms were integrated with crops or other livestock.

The total area of pond size is slightly over 25 hectares with an average size of 715 square metres. The main source of water for the ponds is mainly streams, followed by springs and rain. Some ponds received water from wells, dams or from irrigation canals. Water is present in ponds throughout the year. However, some ponds did not meet the recommended water depth to culture fish and prawns, namely 0.8 m at the inlet and 1.2 m at outlet side.

Forty per cent of the ponds are located in Naitasiri Province. Half of the farms are on *matagali* owned land with the remaining quarters equally divided between freehold and leased arrangements.

Half of the farmers surveyed indicated that a lack of fingerling and feed supply is the greatest impediment to farming. The majority were unable to get financing, although almost half of the farmers were recipients of government subsidies. Almost all of the farmers would like training in every aspect of aquaculture.

Problems encountered

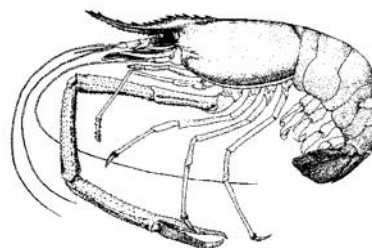
During the interview, the fish farmer (the respondent) was

questioned based on the survey form, which included a set of questions. Attempts were made to obtain all the relevant information from the farmers. However, the farmers were not able to provide all the information and in some cases hardly any information was obtained as they did not keep records. In a few cases the farmers were not present at the time of the interview and their immediate family members were not able to give the information.

Use of the results

The survey established the current situation of freshwater aquaculture, providing the basis for evidence-based advice to the Ministry of Fisheries and Forests and other stakeholders. It is anticipated that the survey results will help policy-makers review and formulate freshwater aquaculture policies and plan aquaculture intervention programmes and projects. Indirectly, the survey results show us how effective are the freshwater aquaculture programmes in Fiji. The results may also assist in determining priorities and channelling resources for intervention programs for better aquaculture extension services for the people.

A final report has been compiled and will be disseminated to Ministry of Fisheries and other stakeholders in Fiji.



Fiji Freshwater Aquaculture Strategic Planning Workshop 4–6 August 2004, Nadi Tanoa Hotel, Nadi

Introduction

Following the Fiji National Aquaculture Census Survey, a planning workshop was held at Nadi Tanoa Hotel on 4–6 August 2004, organised by SPC Aquaculture Section and Fiji's Ministry of Fisheries and Forests (MFF). Funding was provided by ACIAR. The workshop was held at the request of Chief Executive Officer of the MFF.

The objective of the workshop was to formulate a five-year framework to develop the freshwater aquaculture sector in Fiji.

The Fiji government recognises freshwater aquaculture as having a major potential for the rural areas but in the recent past support provided through extension programmes has not been well targeted. Thus, there was a need to consolidate progress and establish clear and valid objectives. The Government of Fiji is the main stakeholder and driver of the aquaculture sector. A strategic plan was therefore required to "sell" the sector in order to raise investor confidence, support government budgetary appropriations and encourage more positive interventions by donor agencies.

Methods used to develop the plan

In order to develop a plan, a national census of the freshwater aquaculture industry was conducted in June–July 2004 to

determine the actual status of the sector, its emerging issues and trends (see report in this issue). The objectives and indicators for the plan were developed through a facilitative process with moderation provided by Amber Davidson (SPC Planning Adviser) and Christine Chung (Moderation Specialist).

SPC Aquaculture Adviser (Ben Ponia) and Filimone Mate of MFF provided an overview of aquaculture in Fiji followed by SPC Aquaculture Officer (Satya Nandlal) presenting the results of the census survey. These presentations on the present status of the aquaculture industry in Fiji provided a basis of information (evidence-based) for the discussions. Participants first focused on identifying challenges for the sector, developing objectives, strategies and performance indicators. The plan was refined after further consultations with MFF staff with the assistance of SPC.

The Minister of Fisheries and Forests and senior officials (Chief Executive Officer, Director of Fisheries), other ministry senior staff and most of the aquaculture staff including three staff from USP attended the workshop. Mr Barney Smith of ACIAR and Dr Peter Mather of Queensland University of Technology, Brisbane, also attended the workshop. There were a total of 25 participants.

The plan

The plan for the development of freshwater aquaculture industry for the period 2005–2010 consists of 7 major objectives or challenges: policy and legislation, research and development, infrastructure development, market research and development, extension support services, human resources development and industry support. Under each of these major objectives, specific objectives and strategies to achieve the objectives with performances indicators are identified, with a list of resources required to achieve the objectives. These include budget estimates for the period 2005–2010, expertise to be developed and acquired, and information on the land resources base (land classification, land use capability and potential sites for aquaculture).

The plan projects a production of about 6500 tonnes of fish and shrimps in a pond surface area of 450 hectares with a value of FJD 60 million. The forecasts could be exceeded provided preconditions to increase the productivity of the farms are adhered to: for example, stock improvement and maintenance of quality stocks, incentive packages and land owner support and participation in the sector. It is anticipated that production could further be increased if research on improving fish growth and productivity is maintained and farm productivity monitored and evaluated on a regular basis.



■ REEF FISHERIES OBSERVATORY

Scientific roundtable discussion

A scientific roundtable discussion took place at SPC headquarters Noumea, New Caledonia 2–4 June 2004. This roundtable marked the closure of the MacArthur Foundation funded DemEcoFish project that has been implemented by SPC's Reef Fisheries Observatory in cooperation with the Institut de la Recherche pour le Développement (IRD). The roundtable constituted a regional platform for an exchange on the experience gained during the implementation of the DemEcoFish project with that of related multidisciplinary and/or interdisciplinary projects in the region, and for discussion on ways to improve the design and implementation of future similar projects, based on these experiences. A major objective was to jointly identify major challenges in the design and implementation of interdisciplinary projects and in the integrated analysis and interpretation of socio economic and ecological data for generating useful information and advise for improved coastal fisheries management. Twenty participants from five regional institutions took part in the discussions and working group sessions: SPC, IRD, SPREP, USP and UPNG.

Selected keynote presentations from the various projects represented by participants provided "food for thought" for the discussions. These were followed by brainstorming sessions covering issues such as:

- improving coastal fisheries management including: funding, partners, mandates, approaches, endpoints, capacity building, continuity, harmonisation and communication;
 - capacity building (in-country) and information delivery, ownership of outputs, measurement of impacts;
 - involvement of each of the project represented by participants in any of the major steps: research, monitoring, policy/government/community and interventions;
 - challenges and requirements for interdisciplinary to multidisciplinary project design; and
 - relevant case studies from current projects.
- The main points and outcomes of these discussions have been captured in a summary paper which encompasses the following:
- Why do we need to bring together user and resource data to achieve improved fisheries management?
 - A conceptual model on how to address the challenge of merging user and resource data.
 - At what level can we achieve integration of various disciplines (resource assessment and socio-economic)?
 - How is data and knowledge to be best integrated?
 - The logistic difficulties associated with multi-disciplinary projects.
 - Dialogue and communication of results: bridging the gap between science management and the community.
 - Regional capacity building.

- Conclusions and recommendations for future project design, implementation and management.

The paper is currently in progress and targeted for publication in the journal *Ambio*. Case studies from the various projects and their components are included to support and highlight major discussion points.

Reference literature to the background of this roundtable discussion includes:

Agardy, T., Cruz, C., Curran, S., Dasgupta, P., Kumar, A., Lutz, W and Williams, M. 2002. Population, consumption, and environment: lessons learned and future research about coastal and marine ecosystems. Roundtable Discussion. *Ambio* 31(4): 377-383.

Johannes, R.E. 1998. The case for data-less marine resource management: examples from tropical nearshore finfisheries. *TREE* 13(6): 243-246.

Visser, T. 2003. Fisheries statistics: a necessary tool for sustainable fisheries? *Fish for the People* 1(3): 2-14.

Belovsky, G.E., Botkin, D.B., Crwol, T.A., Cummins, K.W., Franklin, J.F., Hunter, M.L. jr., Joern, A., Lindenmayer, D.B., MacMahon, J.A., Margules, C.R. and Scott, J.M. 2004. Ten suggestions to strengthen the science of ecology. *BioScience* 54(4): 345-351.



■ TRAINING SECTION

Provision of technical assistance to Maps Tuna Ltd: Kavieng loining operation

Maps Tuna Ltd is a fishing company in Papua New Guinea involved in exporting tuna loins and tropical fish. The company operates a fleet of modern longline vessels. Through the assistance of SPC Fisheries Training Section, the services of Mr Albert Petersen, professional tuna grader and loiner from Fiji Islands, were made available to conduct training at the company's Kavieng plant in early November. The following report is from the company manager, Mr Brett Young.

Maps Tuna, whilst having some four years of experience in exporting fresh chilled tuna, has only recently entered cold smoked tuna processing. The company's recent entry into this field meant that there were very few experienced cutters within the company and even fewer experienced workers within Kavieng (where the company was operating). The need for expertise assistance was vital, urgent and crucial.

Mr Petersen's consultancy period was initially scheduled to be for 7 days (Friday–Thursday). Regrettably the company (due to a reorientation of vessels to service the plant) found itself in the unfortunate position of having limited stock available during this period. As such, and in light of Mr Petersen's professional expertise and conduct, the company undertook to extend his services by an additional seven days.

Thankfully vessel unloads did increase over this period and Albert was able to assist in a multitude of areas, where his knowledge, experience and handling of tuna were of immense benefit to Maps Tuna. Albert injected himself in all areas of the operation, with these areas briefly noted thereafter:

- Correct preparation of slurry bins and handling of fish during unload to minimise bruising, maximise tuna value through correct holding conditions (despite sub-standard holding facilities);
- Quality assurance of the product and explanation of time and temperature control of the product once it is removed from the ice slurries and processing begins;
- Necessity of monitoring the cold chain process to ensure product temperature does not rise over the critical point of 3.3°C;
- Process handling: guidance as to the ideal way to handle fish during the initial cutting stages;
- Cutting: the need for and importance of maintained tools (sharp knives) before, during and after the processing;
- Cutting: the correct format and manner in which to loin tuna so as to minimise handling, maximise product returns and ensure that the process occurs quickly whilst retaining quality assurance;
- Cutting: leaving the skin on till last to permit the loin to hold together naturally;
- Segregation: nomination of specific knives for specific purposes and ensuring that these knives are utilised for their designated process;
- The definition and difference between "cutting/slicing" tuna and "butchering/sawing" tuna and the effects this has on the end product;
- Operational changes to the factory and process layout area to reduce tuna process time to minimal thus reducing the exposure of the tuna loins to excessive handling, temperature and time on the table (i.e. loin chute, reducing the tables used, defined tasks for specified employees);
- Recommended amendments to the process to increase efficiency, decrease handling and improve overall production;
- Grading of tuna and the extensive consultation with the company's grader describing product variances that occur and the causes of such variances;
- Independent representation with an associated vessel that had docked at port without ice, and whose well temperatures far exceeded operational limits. All tuna was graded and tested, and with temperatures showing that the product was "not viable for export" the catch was subsequently rejected

Albert was also able to provide excellent and relevant information on the vessel operations and unloads and, although he was requested by the company not to involve himself heavily in this area due to a preferred focus on loining, some of his comments were implemented immediately, especially the matter of bleeding knives for the vessels, which had been resulting in excessive cuts to the whole fish, which in turn devalued the appearance and quality of the product prior to processing. His comments on general unload and crew conduct were invaluable.

Albert's general conduct, professionalism and ability to communicate with workers and also take a leading role on the floor (operationally and as a supervisor/teacher) were all excellent attributes which definitely improved the quality of han-

dling and net return on the product.

Albert also advised and assisted with dilemmas pertaining to reporting problems and contributed with his practical knowledge in assisting with the

design of new reporting procedures for production and traceability.

Source: Brett Young
[loins.mapstuna@global.net.pg],
Manager, Maps Tuna Ltd, Kavieng,
Papua New Guinea



The effectiveness of the SPC safety awareness initiatives

The following is an interesting extract from FAO Fisheries Circular N° 993 "Aspects of sea safety in the fisheries of Pacific Island countries" by Bob Gillett (Rome, 2003). The SPC sea safety awareness campaign was launched in 1995, with the production and distribution of a series of materials, initially in French and English. This FAO document highlights some weaknesses (notably the difficulty in ensuring effective distribution of materials) but also concludes that sea safety awareness work has contributed to "noticeable improvements" and that "SPC efforts in this subject should continue". Recent efforts by SPC have focused on the promotion of sea safety at high-level regional forums (including the recent Heads of Fisheries meeting in September 2004) and the production of sea safety posters in vernacular languages (PNG, Kiribati, Niue and, more recently, Tokelau). The SPC Fisheries Training Section is also assisting with the planning of an FAO Technical Cooperation Programme on small vessel safety, tentatively scheduled for 2006.

In the course of planning for the present sea safety survey, a meeting was held with staff responsible for SPC's sea safety awareness work. During the discussions it was learned that one important aspect of the project is the difficulty in determining its effectiveness; in other words, whether the various materials distributed by the Fisheries Training Section have saved any lives. Accordingly, some effort was made to investigate this question.

The SPC materials which have been distributed are:

- four posters on safety at sea;
- logo stickers "Think Safety at Sea";
- A4-size stickers "Small Boat Safety Check-list";
- laminated cards "Small Boat Safety Check-List";
- three videos "Better Safe than Sorry", "Survival at Sea", "Rambo Goes Deep-sea";
- 8 TV clips "Boat Safety Tips";
- audio-tape for radio programme on safety at sea.

It is very difficult to directly assess the effectiveness of some of the sea safety work in the Pacific islands. The methodology used to gain some insight during this survey is given in Section 10.2. In short, determining if the target audience is "aware of the awareness programme". Thoughts on what has been the most effective of the SPC materials for each country are given in the country sections of this report (e.g. Section 5.3).

In general, among the various people interviewed in the five countries, the SPC safety videos seem to be the most well-known in situations where people have access to video facilities. This includes urban areas and during visits of extension teams to rural areas. Fisheries officers tended to think the SPC posters are the most effective, possibly because they are often displayed in government fisheries offices. Some heads of fishing companies expressed the opinion that only

limited distribution of the SPC posters occurs by government fisheries agencies.

Judging from comments of people interviewed, radio appears especially effective for sensitizing communities to sea safety issues. It was not often, however, that people interviewed for the present survey identified the radio programme material as being from SPC. This is likely to be due to lack of attribution by the broadcaster rather than greater effectiveness of programmes from other sources. As indicated in Section 11.2, radio appears to be especially appropriate for sensitizing remote villages to sea safety issues. There is also the possibility that language makes the radio broadcasts more effective in remote locations – the radio programmes are in the vernacular whereas most of the other SPC materials are in English or French.

Sea safety awareness work seems to have contributed to noticeable improvements in sea safety in several Pacific Island countries (Section 10.2), and it is likely that the SPC efforts were a major part of this progress. Previous initiatives on sea safety awareness in the region stressed that such work should be a continual process. McCoy (1991) states:

"In planning even modest programmes it must be realized that safety at sea is something which must be taught and continually reinforced. It is recognized that heightened awareness of safety in

industrial societies is due to constant reinforcement. In the island countries, it is the almost total lack of exposure to safety awareness on a recurring basis that results in it being ignored. Programmes should thus emphasize the necessity for their continued, long term existence."

The success of past SPC awareness work together with the ongoing requirements suggests that SPC efforts in this subject should continue. Based on knowledge gained in the present study, the following should be considered for future awareness work:

- greater production of material in local languages;
- expanded use of radio;
- as awareness materials could be one of the few effective tools for improving sea safety in remote areas, more attention be given to those areas;
- use of more than one distribution channel to get materials to target audiences, including that of the Red Cross, disaster awareness teams, churches, and NGOs;
- consultation with stakeholders on the value of new initiatives (e.g. the safety management approach).

Reference

McCoy, M.A. 1991. Survey of safety at sea issues in Pacific Island artisanal fisheries. Field doc. 91/3 (Suva, FAO/UNDP Regional Fishery Support Programme).

The FAO circular can be downloaded from the following URL: http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/006/Y5121E/y5121E00.htm



In brief

- Following a recommendation made at the 4th Heads of Fisheries meeting (September 2004), the Fisheries Training Section is launching a Special Interest Group on sea safety. The first issue of the sea safety SIG bulletin is scheduled for the first quarter of 2005. The aim of this new SIG is to promote sea safety within a large array of sectors, from government ministries to fishermen's association, and to keep readers informed on developments in safety technology, national and regional programmes, training and awareness campaigns, etc. If you wish to be a member of this network, you should contact Section staff or the bulletin coordinator, Hugh Walton (waltonz@paradise.net.nz). Contributions to the first issue will be happily received by the same!
- The popular manual On-board handling of sashimi-grade tuna is being dusted off. A new version will soon be published and distributed to our fisheries contacts. The manual will be printed in a smaller format (A5), on glossy waterproof paper for ease of

use by vessel crew members. The information contained in the manual has been updated, thanks to staff of the Fisheries Development Section.

- Cushla Hogarth, a seafood quality expert from New Zealand travelled to Niue late in September. Cushla's assignment included the delivery of the standard USFDA/HACCP seafood course (7 persons certified) as well as a number of consultations with local authorities. The purpose of this visit was to assist with setting up the Niue Competent Authority responsible for monitoring seafood exports. On completion of her work, Cushla wrote a report for Niue Fisheries, with suggestions on how to best achieve this important step in the development of Niue seafood industry.
- A needs assessment for fishing business planning and management training was carried out in August in Vanuatu and Solomon Islands. In both countries there was a strong call for SPC to run the Start Your Fishing Business programme, which was recently developed

in Papua New Guinea. There was an overall consensus that the establishment of a cadre of confident SYFB trainers in each country would allow for the subsequent development and delivery of a programme targeting fishers. To achieve this, an initial Train-the-Trainer SYFB course, with participants from both countries, will be organised by SPC, with partial funding from the Commonwealth Secretariat. The 3-week course will be hosted by the Vanuatu Maritime College in Santo. In the first instance, the programme will give priority to training those persons associated with the operation and management of the rural fisheries centres. The commercial success of these centres, with either private sector or fishermen's associations/cooperatives management, is viewed as fundamental to having small scale commercial fisheries play a positive role in the rural economy.



■ ASSESSING THE CARRYING CAPACITY OF MPAS: HOW MANY VISITORS CAN YOUR MPA HOLD?

The benefits of tourism to Marine Protected Areas (MPA) can be significant, including the potential for generating revenue to support management (*MPA News* 2:8). Like other human activity in marine protected areas, though, tourism has environmental impacts. Damage to coral reefs from careless divers, as well as pollution and other ecosystem impacts from recreational vessels, are among the range of tourism effects documented in MPAs worldwide. Controlling these impacts can be as important an element of MPA management as any other. A potential key to such management lies in assessing the number of tourists that an MPA can support sustainably — its carrying capacity.

Assessing the carrying capacity of an MPA involves a number of factors, though some scientists suggest there may be general capacity limits for particular habitat types, like coral reefs. However, actual implementation of these hard limits on numbers of tourists can be politically difficult. For this reason, some experts suggest an alternative way to manage tourism impacts: estimating the “limits of acceptable change” for protected sites instead. This month, *MPA News* examines both methods, and how managers are incorporating them to ensure sustainable tourism for their MPAs.

Carrying capacity

The term *carrying capacity* derives from ecological science, where it indicates the number of organisms the resources of a given area can support over a given time period. Adapted to tourism management, it has a similar meaning: the number of people who can use a given area

without an unacceptable alteration in the physical environment. In this case, the concept of an unacceptable alteration has ecological and social aspects. That is, under too much pressure from visitors, a site or ecosystem can degrade, thus making it less attractive as a tourism destination. Delegates to the 2003 World Parks Congress agreed that an action plan for the world’s protected areas should include identification of “the limits of natural systems and their carrying capacity for different activities.”

But how does a manager assess the carrying capacity of an MPA? It is rarely a straightforward process. Carrying capacity can differ from site to site, depending on habitat: a vertical wall of coral reef, in theory, may be able to sustain more divers than a flatter reef, prone to abrasion by divers with buoyancy problems. In addition, a site’s carrying capacity can increase or decrease with visitors’ level of experience and education. Again, the diver with buoyancy problems has a greater impact on habitat than the diver with good buoyancy control. If a park is able to educate visitors to have less impact per person, its carrying capacity increases accordingly.

From guidelines developed in 1992 by the World Tourism Organization and the UN Environment Programme, a basic equation for calculating visitor carrying capacity is:

$$\text{Carrying capacity} = \frac{\text{Area used by tourists}}{\text{Average individual standard}}$$

Here, the *average individual standard* (often measured in square metres per person) is the space a tourist requires for an accept-

able experience in the protected area, which will vary depending on the area, activity, and management. Managers who seek to offer a pristine or wilderness-type environment for visitors, for example, would set a higher average individual standard than managers offering more high-traffic experiences. Despite the objective appearance of the square-metres-per-person figure, its calculation is based on subjective factors (*e.g.*, How many visitors in a given area cause a site to be less wilderness-like?).

Another way of setting carrying capacity limits is by examining in hindsight the impact of visitors on MPAs. In other words, when managers observe a level of use above which degradation ensued, that level becomes the carrying capacity. This was the basis for perhaps the most widely cited research on MPA carrying capacity to date. In 1996, biologists Julie Hawkins and Callum Roberts of the University of York (UK) set out to determine a safe level of carrying capacity for recreational diving. They compared damage levels of protected reefs in three regions (Bonaire in the southeastern Caribbean, Saba in the eastern Caribbean, and Egypt), with each reef subject to known levels of diving intensity. The sites were similar in coral cover and general topography.

Their conclusion: reefs could sustainably support roughly 5000–6000 dives per dive site per year, but greater levels of use caused a rapid rise in diver damage as measured in broken coral. An MPA with multiple dive sites could sustain many times that figure as a whole, as long as no site exceeded the 5000–6000 dive limit. (Incidentally, this figure was similar to

one found by a World Bank-funded research team that had studied the Bonaire site alone.) Hawkins and Roberts acknowledged that this was intended to be a general rule, adaptable to particular circumstances of individual MPAs. Such circumstances could include reef health, number of suitable moorings per site, level of diver experience, and enforcement of regulations, among other factors. (Their paper appears in the *Proceedings of the 8th International Coral Reef Symposium*, 1997, pp. 1923–1928.)

It is unclear how many MPAs have used the 5000–6000 dive figure in setting limits on visitation. In an informal search in July, *MPA News* found relatively few examples of MPAs that had set formal carrying capacity limits at all, whether for diving or other visitor activities. One of the reasons for this is political: it can be difficult for resource managers to limit the number of tourists allowed when local businesses depend on those tourists and, understandably, want to maximise their revenue. Inversely, many less-visited MPAs may not yet be experiencing negative impacts from tourism, so their management is not yet occupied with carrying capacity concerns. Of course, proactive planning can ease management later in cases of growing tourism pressure.

In the case of Cuba's national system of protected areas, such proactive planning is considered key. Located just 90 miles from the US, the nation is nonetheless largely shut off from US tourists by a trade embargo and travel restrictions the US government has applied to Cuba since the 1960s. Cuba's current tourism level of roughly 1.8 million foreign visitors per year consists largely of Europeans and Canadians. If the embargo and travel restrictions were lifted, Cuba would likely

experience a boom in American tourism. Although estimates vary, the number of tourists in Cuba could increase as much as five-fold within a matter of years, according to some experts. This could place a substantial strain on the country's system of coastal and marine protected areas, with 18 sites currently designated and 12 more undergoing final government approval.

In the past decade, the National Center for Protected Areas (CNAP) in Cuba has had that scenario in mind. CNAP has already set general limits on visitor numbers for its "strictly protected" areas — those coastal and marine protected areas in which resource extraction is not

allowed. The general limits apply to the number of bathers per beach (100 m²/bather), maximum group size (10 individuals), and number of groups per day per trail or natural option (2 groups), among other factors. MPA managers can adapt these general limits as needed to their site-level management plans.

Reinaldo Estrada, director of CNAP, notes that current visitation levels to these protected areas are well below the general limits. But he is concerned that a future flood of tourists could overwhelm management. "The greater problem of the national protected areas system, and particularly of its MPAs, is that

Carrying capacity discussions

There are several examples of MPAs in which limits on tourism, though not set, have been discussed by managers or stakeholders:

Florida Keys National Marine Sanctuary (US): This MPA surrounds the Florida Keys, an archipelago that receives millions of tourists each year, including divers, anglers, and recreational boaters. The management plan for the sanctuary calls on managers to assess impacts of recreational activities and estimate user carrying capacities. Although the sanctuary has not yet conducted these assessments, it does have four research-only areas that were designated partly to serve as control sites for such studies. (Notably, a major inter-agency study in the late 1990s sought to measure carrying capacity for the entire Florida Keys ecosystem, both terrestrial and marine; the study is available online at <http://www.sfrpc.com/gis/fkccs.htm>. A critique of the study, provided by the National Research Council, is also online at <http://www.nap.edu/catalog/10316.html>.)

Stellwagen Bank National Marine Sanctuary (US): Off the coast of New England in the US, Stellwagen Bank is home to several species of large whales and a thriving whale watching industry. The sanctuary is now undergoing a management plan review process in which whale watching activity — both by commercial tour vessels and recreational boaters — will be one among many considerations. Federal guidelines for whale watch vessels in the region, including in the sanctuary, allow only one vessel at a time to be within 300 feet (90 metres) of a whale, and only two to be within 600 feet (180 metres).

Svalbard region (Norway): The arctic archipelago of Svalbard features several marine protected areas, totaling roughly 80,000 km². Cruise tourism has increased significantly around Svalbard in recent years. Although Norway has not yet crafted management plans for its Svalbard MPAs, it has restricted access to some landing sites due to impacts from overvisitation.

its limited development and capacity would prevent it from effectively and efficiently enforcing the regulations," says Estrada. The MPAs have practically no boats, land transport, communications technology, or buoy systems. "To face this problem, we are looking for external financing to allow us to strengthen these areas," he says. "For our MPAs, we have had some limited support for this, primarily from WWF-Canada." (The US embargo prevents US organisations from providing direct material assistance of this type.) CNAP is also looking to develop better tools for estimating carrying capacity, and is co-sponsoring a workshop with WWF-Canada and Environmental Defense (an international NGO) in November 2004 to address that issue.

Such pressures, still hypothetical in Cuba, are already real for Banco Chinchorro Biosphere Reserve, a coral reef MPA off the southeastern coast of Mexico. As set in the site's management plan, no more than 150 individuals are allowed to visit Banco Chinchorro each day, where there is a designated zone for diving and snorkeling. But in the past decade, coastal development along the nearby mainland has surged: vacation resorts and cruise tourism infrastructure — including a new cruise ship terminal in the town nearest to Banco Chinchorro — are changing the coastline from small fishing villages to a major international tourism destination. One tourism developer has reportedly purchased a large, high-speed catamaran to take visitors from the mainland to Banco Chinchorro, and is proposing to bring 400 individuals per day.

Tomás Camarena, a policy expert with Environmental Defense and former director of the Banco Chinchorro reserve, says that if that site and other

MPAs in the region are to be protected — potentially through the court system — their defence may rely on their carrying capacity limits. "The carrying capacity component of the management plan is a key to protecting Banco Chinchorro," he says.

Limits of acceptable change

As already noted, setting limits on visitors while also satisfying tourism stakeholders can be a challenge. In the cases from Cuba and Mexico, the limits were instituted in the absence of an active private tourism sector to oppose them. (Banco Chinchorro's limit was set in 2000, before the nearby cruise terminal was completed.) Where tourism is already well-established, the suggestion of a carrying capacity is often interpreted by the private sector as a potential limit on business.

Steve McCool says there is a better way of addressing tourism impacts. A professor of wildland recreation management at the University of Montana (US), McCool says the concept of visitor carrying capacity impels managers to ask the wrong question: How many visitors is too many? He says this treats limits on visitor numbers as an end in themselves, whereas many problems of recreational use are a function not so much of numbers of people, but their behaviour. McCool suggests that managers should ask instead what resource and social conditions are acceptable, and how those conditions may be attained. In other words, management should be based on the limits of acceptable change (LAC) for a protected area.

"LAC is not a carrying capacity but a set of conditions — biophysical and social — that managers have deemed to be appropriate," says McCool. "The limits reflect values, preferences, science, policy, and public

input, and can be maintained through a variety of policies, such as education. In the case of a marine protected area, concerns about damage to coral by divers could lead to a rule or guideline about ensuring proper buoyancy control."

An overview of the LAC framework, authored by McCool, is online at:

http://www.prm.nau.edu/prm300-old/LAC_article.htm

In short, the framework involves four major components:

- Specification of acceptable and achievable resource and social conditions, defined by a series of measurable parameters;
- Analysis of the relationship between existing conditions and those judged to be acceptable;
- Identification of actions necessary to achieve these conditions; and
- A programme of monitoring and evaluation of management effectiveness.

Importantly, the process involves combining the technical expertise of planners and scientists with personal knowledge contributed by public stakeholders. Although the manager retains decisionmaking authority, the public consultation generally leads to greater buy-in from stakeholders and improved chances for successful implementation of management actions. (A carrying capacity approach, in contrast, prioritises science over public values and interests.) McCool acknowledges that as use increases, a manager may decide that the only option left is to implement a limit on visitor numbers. But he describes such a use limit as not a carrying capacity but a

decision that a limit is necessary to prevent any further change. "The strength of the LAC process is that it helps managers work through the process of making such decisions," he says.

The main criticism of the LAC process is that it can be costly in terms of time and staff, due to its requirement for monitoring. In contrast to a carrying capacity — which, once established, entails little monitoring apart from counting visitors — a LAC system requires regular measurements of changes in resource and social conditions. McCool says he has heard of terrestrial protected area managers choosing to implement carrying capacity limits instead of LAC in order to avoid monitoring — a misunderstanding, he says. "Management requires monitoring," he says. "To implement any management regime without monitoring implies that we know with certainty the outcomes of our decisions."

In 1999, McCool participated in developing the first LAC-based management plan for an MPA — the Saba National Marine Park in the eastern Caribbean. (This was the same site featured in the Hawkins/Roberts study mentioned earlier.) The management plan provides standards for multiple factors, including the proportion of damaged branching corals acceptable by zone and the minimum percentage of time that only one dive boat will be present at each dive site. The plan also requires standards for water quality, sedimentation, and fish stocks.

David Kooistra, manager of Saba National Marine Park, says the monitoring requirements, particularly for biophysical data, do pose a challenge for staff. "It is time-consuming," he says. To handle this, the park uses volunteers as much as pos-

sible for the collection of these data. Asked whether LAC has played a role in keeping the park's reefs "pristine", as they are described in the management plan, Kooistra says no — or, at least, not yet. "Low dive numbers, limited fishing activities, and no coastal development are more important contributors," he says. "We expect that LAC will play a more important role once dive numbers increase by at least 50%. With only 20,000 dives made in Saba each year, the highest number of visitors some of the dive sites receive annually is 2500."

In the Western Pacific, the LAC concept is emphasised as part of workshops for dive tourism operators, provided by the Coral Reef Alliance (or CORAL, a US-based NGO). The free-of-charge seminars, titled "Coral Reefs and Sustainable Dive Tourism: Protect Your Business By Protecting Your Reef", are provided upon the invitation of local dive operators, government agencies, or other stakeholders. Combining a general course on sustainable dive tourism with discussions of local issues, each workshop asks dive operators to identify stressors to local reefs (including diving-related stressors), and which of these the participants can address. Through 2003 and 2004, CORAL is conducting eight workshops, in Fiji, Indonesia, Palau, and Pohnpei. Each lasts two days.

Alex Brylske of Project AWARE Foundation — the educational and charitable arm of PADI, an international dive certification

organization — has co-led three of these workshops for CORAL. "Dive operators are small-business folks operating on minimal margins," he says. "When they hear the term 'carrying capacity', they don't like it, even though they may never grow to a size where it would be a limitation on them." He says the buy-in of dive operators for management actions is essential to the success of virtually all MPAs in coral reef regions. "Once they understand that there are alternatives to the idea of 'no more than 6000 divers per reef', they look at the issue very differently. In fact, most become quite supportive of strong management practices once they see the big picture." A workshop in Palau in June 2004 focused significant attention on carrying capacity and LAC, as the Palauan government is encouraging the dive community to self-regulate visitor numbers at dive sites in lieu of government-imposed rules.

Brylske says education, though an important part of managing acceptable change, is not the solution in itself. In some cases, reefs may simply need some rest, he says, such as by moving mooring buoys or even closing sites down for a while. "Businesses are starting to recognise that some attention needs to be paid to the sheer numbers of people diving in some areas," he says. "After all, if the resource declines, divers will take their business elsewhere."

Source: *MPA News*,
Vol 6, No. 2. August 2004;
(<http://www.mpanews.org>).



COASTAL FISHERY MANAGEMENT AND DEVELOPMENT PROJECTS IN PAPUA NEW GUINEA

There are two major domestic coastal fisheries management and development projects being implemented in Papua New Guinea (PNG) at present. These two projects are working together to complement each other's work, and build on the work of previous domestic fishery development projects in the country.

Rural Coastal Fisheries Development Programme

The Rural Coastal Fisheries Development Programme (RCFDP) is an EU-funded project that commenced in PNG in mid-2002. The project is operating in seven provincial locations, Alotau,

*Lindsay Chapman,
Sean Baxter and
Garry Preston*

Buka, Daru, Kavieng, Lae, Madang and Port Moresby (Figure 1) over a five-year period. The main aims of the project are to develop the deep-water snapper fishery, thus relieving fishing pressure on reef fish stocks; link fishermen with private sector partners (PSPs) in the development of small-scale fishing operations; strengthen or develop fish processing facilities to improve fish quality, handling and marketing prac-

tices; establish export markets through the PSPs to raise the financial returns to fishermen; and establish a revolving fund with new boat loans approved, as other loans are paid off.

The RCFDP has developed its own small-scale fishing craft based on the 8.2-m Yamaha fibreglass SPD 27 design. This hull design was used in some locations in PNG in the 1990s with a diesel engine mounted in the centre of the boat, a cabin over the engine, a small icebox and four Samoan handreels, two at the front and two at the back of the vessel (Figure 2).

The new "ELA 82" design vessel is 8.2 m long (Figures 3 and 4), constructed from fibreglass, and is built locally at Samarai Plastics in Milne Bay. It has a standard cabin fitted with a VHF radio and compass. The vessel is powered by a three-

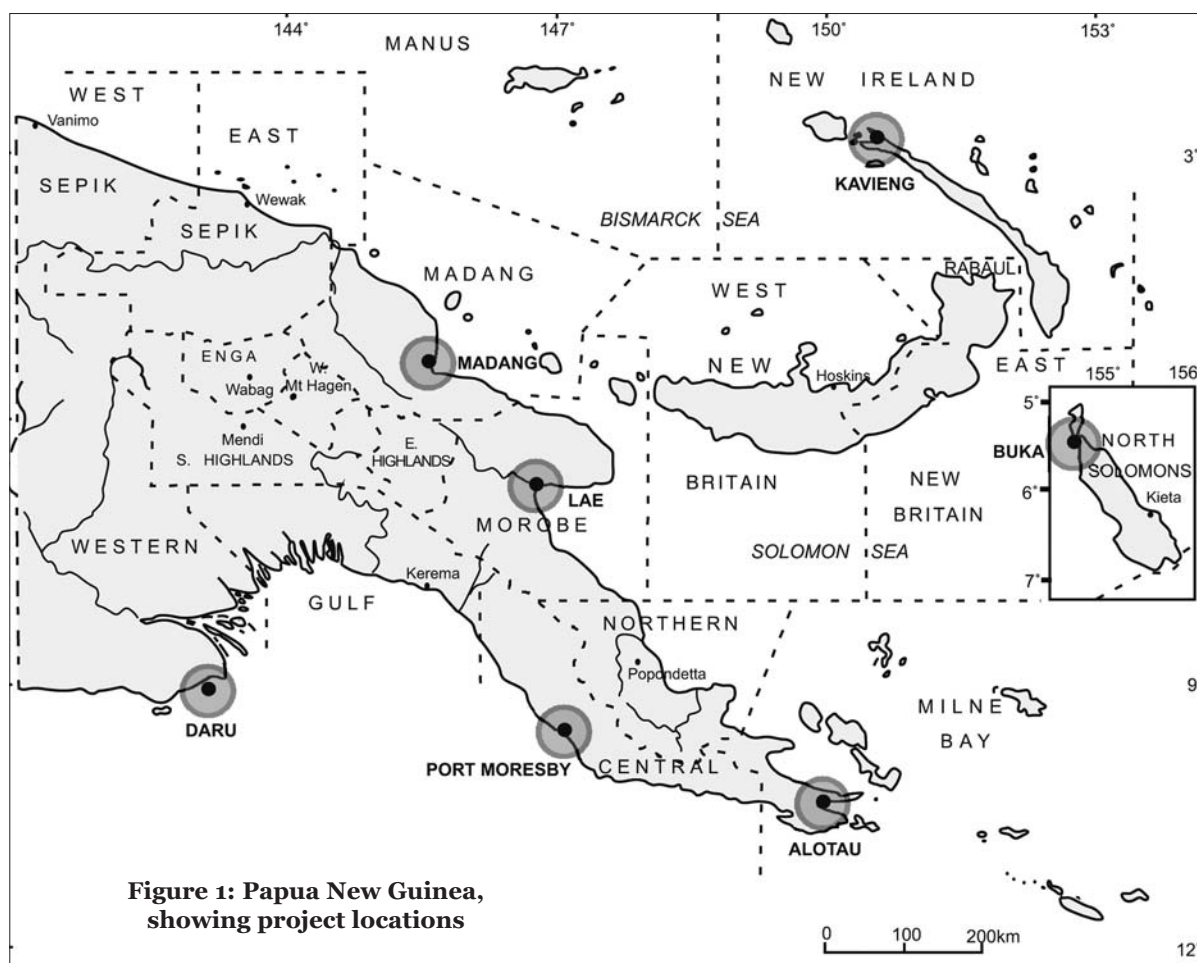


Figure 1: Papua New Guinea, showing project locations

cylinder, 47-HP Yamaha ME200 diesel engine. Between the engine room and the cabin is a fixed fibreglass ice or fish hold with an internal capacity of 1.4 m³. The fish hold has a removable baffle, with the baffle used to reduce movement when fish are packed in an ice slurry. The vessel comes equipped with four Samoan handreels with line and hooks etc, two 500-m droplines, grapnel anchor and 440 m of anchor rope, trolling lines and a full set of sea safety equipment (life jackets, flares etc). The cost of the complete vessel and gear is PGK 133,000 (approx. USD 44,300) and is the "starter package" for fishermen identified and supported under the project.

The project has three loan schemes, one for fishermen who are members of fishing associations (micro credit scheme) for upgrading existing boats and fishing equipment, one for the fish processing sector (major loan scheme), such as private sector partners (PSPs), and the other for fishermen to purchase the project design vessel (starter package loan). The major loan scheme for the PSPs and processing sector is commercial loans provided through a local funding institution at a negotiated interest rate, generally just below the market rate, as the loan is guaranteed by the project. Under this scheme, one processing facility has been built in Madang and two others are to be upgraded in Lae and Kavieng, with others to come as appropriate applicants are identified in other project locations.

The loan scheme for fishermen for the "starter pack" (boat and fishing gear as described above) is free of interest and is given over a three- to five-year period.

A revolving fund has been established under a central fund for this scheme. However, fishermen that qualify for the loan have to put up a PGK 500 bond



Figure 2 (top): Vessel design used in the 1990s for deep-water snapper fishery development

Figure 3 (middle): New ELA 82 design vessels at Kavieng

Figure 4 (bottom): Fishing layout of the new ELA 82 vessel

(this is lost if the boat is repossessed) and need to have at least PGK 1000 operational funding to buy fuel bait and ice for the first trip or two.

The process for fishermen applying and qualifying for a starter package loan in each location is clearly set out by the project. First, suitable PSPs need to be identified in each project location. This is done by the project calling for expressions of interest from the private sector. At the same time, the project establishes a fishing association, or works with and strengthens existing associations in each location. A Provincial Loans Committee is also set up, made up of stakeholders in the area. The National Fisheries College has been contracted by the project to run the Certificate in Small Fishing Operations course and the Start Your Own Business course, at each project location. Fishermen at the courses can then apply for a loan for the starter package, with their applications assessed by their Provincial Loans Committee. The successful applicants are then provided with the starter package (boat and fishing equipment) and work with their PSP. The project then assists with the setting up of the gear and conduction fishing trials or training when needed.

The PSP has many roles to play in the overall management of each fishing operation it works with. The PSP either carries out maintenance using its own resources or identifies the maintenance providers in the area and then assists with organising maintenance when needed. The books and finances for the fishing operation are also managed by the PSP. When fish are landed to the PSP, they are weighed and a receipt docket issued with the weight of fish by species and the value of the catch. The PSP deducts all operating expenses for the fishing operation, makes

the loan repayment to the revolving fund and either holds the balance of funds on behalf of the boat owner or transfers these funds to the boat owner's account.

To date seven starter package loans have been approved and the vessels and gear provided, three in Lae and four in Kavieng. The three Lae vessels have been in operation since mid-2004. One operator is doing very well and is over PGK 10,000 in credit with the PSP after four months of operation. An interesting part of the fishing operation in Lae is that the project fishermen are buying fish from local canoe and banana boat fishermen on the fishing grounds as well as fishing themselves. This has resulted in landed catches of 3–4 t in less than one week's operations.

In Kavieng, the four vessels have only just commenced fish-

ing operations. In their first week of fishing, three of the vessels unloaded a total catch on 1400 kg of which 75 per cent of the catch was deep-water snapper (Figure 5).

The project has been working in Madang as well, although the vessels being used there are modified 7-m (23-ft) banana boats with 30 HP outboards. These vessels have an icebox fitted into a recessed deck area. Nine of these vessels have been provided to fishermen under the loan scheme, with six operating.

In support of the RCFDP projects, 12 fish aggregating devices (FADs) were deployed in February 2004, four off Lae, four off Madang and four off Port Moresby. The FADs in the northern waters are based on the Filipino "payao" design using 16-mm polypropylene rope and a steel buoy, while the FADs off Port Moresby are the



Figure 5: Catch of deep-water snapper unloaded by one project boat in Kavieng

SPC Indian Ocean design. The FADs were deployed at least 10 miles off the coast, and it appears that in Madang they are used more by local sports fishermen than project fishermen at present, whereas in Lae the FADs are used more by the project fishermen. Several of the FAD have been lost.

Future plans for the RCFDP include an additional three vessels being constructed at present, with these to be delivered to successful applicants in Lae. Another ten vessels are planned for construction in 2005 for the project, and from mid-2005 boats will be provided through the credit fund as direct purchases. Local fish markets will be constructed in Kavieng and Buka, and probably extended to Lae and Daru, while processing facilities will be constructed or upgraded in Lae and Madang under the major loan scheme. The deep-water snapper fishing part of the project will also be expanded to take in the other project locations in 2005.

The project is also developing resource-use plans for Madang and Lae, working closely with the Coastal Fisheries Management and Development Project. The RCFDP is concentrating on the management of the deep-water snapper fishery and is looking into Marine Steward-

ship Council certification for the fishery as part of its long-term plan to expand into export markets for high-quality fish.

Coastal Fisheries Management and Development Project

The Coastal Fisheries Management and Development Project (CFMDP) is an Asian Development Bank (ADB)-funded project that commenced in August 2003 and will run until mid-2007. The project will work in four provincial locations, Alotau, Daru, Kavieng and Lae. There are two components to the project, infrastructure development, and fisheries management support and capacity building. Under the infrastructure component, the project is constructing a tuna fishing wharf and small-boat jetty in Lae, a small-boat jetty in Daru, a small-boat jetty and associated on-shore facilities in Alotau, Milne Bay, and a fisheries research facility on Nago Island in New Ireland Province. Infrastructure to support the development of domestic fisheries in Kavieng (Figure 6) is in place as a result of a previous ADB-funded fisheries development project in this area.

The aim of the fisheries management support and capacity building component is to improve the

management of coastal fisheries in order to ensure the sustainability of economic benefits that PNG derives from its fishery resources. The focus is to work in three of the same areas as the RCFDP (Alotau, Kavieng and Lae), to complement the work of this project and maximise the benefits from both projects in these areas. The CFMDP is based at the National Fisheries College (NFC) in Kavieng, with initial work being conducted in the New Ireland Province.

There are four strategic areas in the fisheries management support and capacity building component of the project: institutional strengthening for coastal fisheries management; coastal fisheries assessment and monitoring; strengthening information flows; and community-based fisheries development and management. The activity areas and work undertaken to date come under four headings, as follows:

1. Institutional strengthening for coastal fisheries management

This includes:

- training courses on fishery management for individuals from government, NGO and stakeholder organisations;
- refinement of fishery legislation to support local level fishery management;
- formation of stakeholder associations;
- formation of provincial Fishery Advisory Committees; and
- development of provincial fishery action plans.

A refresher course for New Ireland Provincial Fisheries Officers, Fisheries Observers, Port Samplers and NGOs was conducted at the NFC. This course focused on computer use, fish quality and hygiene, sea safety and small business



Figure 6: Wharf complex in Kavieng funded by ADB in 2002

management. The first training courses on fisheries management will commence in late October 2004, and cover fisheries management theory (biological economic and technical) as well as extension and communication skills, and approaches for working with communities (such as organising and facilitating meetings etc.).

Refinement of fisheries legislation to support local level fishery management will commence in October 2004. This will include a review of the current legislation relating to participation in the fisheries management process by lower levels of government, as well as parallel initiatives in local environmental management. The results will be the development of appropriate legal instruments and approaches that may be needed to support fisheries management interventions at this level.

2. Coastal fisheries assessment and monitoring

This includes:

- preparation of resource inventories;
- habitat mapping;
- conduct of resource surveys; and
- household and socio-economic surveys.

A survey of small-scale fisheries landings and their sale through local markets, roadside stalls and buyers started in May 2004 in New Ireland. Survey work is conducted by the Provincial Fisheries Officers, observers and port samplers who had been trained in the above-mentioned refresher course. Data collection includes the identification of fish species, plus each fish is measured and the length recorded. Several databases have been designed and the data is being entered, with a preliminary analysis of the first

six month's data scheduled for November 2004. Resource surveys are also planned to commence in 2005.

The baseline socio-economic survey for the New Ireland Province was conducted from mid-August to early October 2004, following the completion of a training workshop by the enumerators. There were three groups of three enumerators working for six weeks, with around 800 households surveyed from 21 wards in the northern New Ireland Province.

Databases have been developed and the data entered, with the analysis expected to be completed in November 2004. As part of the socio-economic and market surveys as described above, the geographical distribution of fishing areas, catch, effort and markets is also being collected for analysis. Additionally, published and historical data (purchase and sales records) from selected local fish traders is being reviewed and used where possible.

3. Strengthening information flows

This includes:

- improved availability of information resources;
- preparation of provincial resource profiles;
- preparation of information and awareness materials;
- development of fishery monitoring arrangements; and
- development of NFA fisheries website.

The project is working on a range of awareness-raising information, including radio shows, videos, and publications. Twenty-six 15–20 minute shows are in the process of being scripted in both English and Tokpisin. Four videos are being produced on aspects of fisheries management, and two puppet show

videos are almost complete. A comic book on HIV/AIDS in the fisheries sector has been completed. A comic on sea safety has been commissioned, and a book on reef conservation is nearing completion. In addition, the NFA library and website have been enhanced to increase the availability of information for potential users.

4. Community-based fisheries development and management

This includes:

- awareness-raising on fishery management issues;
- small business promotion;
- women's skills training;
- FAD deployment; and
- peer group education on HIV/AIDS.

The first formal training course in this area will commence in late October 2004, with other courses in the future. The programme itself aims to promote greater awareness of fisheries management issues, assist communities find solutions to local fishery management problems, and support the formation of community associations. An additional goal of the programme is to identify three or four communities where community-based fishery management and monitoring arrangements can be put in place, tested, and used as pilot or demonstration sites to promote the community-based management concept in PNG.

The CFMDP project is proving to be very successful in the work being carried out in the Kavieng area, with strong government, provincial government, and private sector support of both this and the RCFDP project.



A COST-BENEFIT ANALYSIS OF PROJECTS IMPLEMENTED TO ASSIST THE BLACK PEARL INDUSTRY IN MANIHIKI LAGOON, COOK ISLANDS

Objective

The objective of the study was to evaluate the economic net benefits of projects implemented to assist the black pearl industry in Manihiki in the Northern Cook Islands. The intention is that the findings and recommendations of the report will influence the evolution of future project activities in Manihiki and in aquaculture industries elsewhere in the Pacific. It is also intended that the study demonstrate the merits of the cost-benefit analysis approach for assisting resource allocation decisions in the Pacific.

Background

In November 2000 the black pearl industry in Manihiki Lagoon in the Northern Cook Islands was severely affected by an oyster disease, which, along with low international pearl prices, caused a steep decline in

*Emily McKenzie,
Resources Economist,
SOPAC,
Suva, Fiji Islands*

pearl export revenue, from NZD18.4 million in 2000 to NZD2.8 million in 2003.

Overstocking and poor handling of pearl oysters, combined with adverse environmental conditions, were found to be the major causes of the Manihiki disease outbreak in 2000. Scientific research and experience in other pearl farming countries suggest that more sustainable farming practices and lagoon management would have prevented the disease and subsequent decline in the quality and quantity of pearl production.

The Cook Islands Ministry of Marine Resources, with the assistance of other organisations, has implemented various

projects in Manihiki that aim to achieve sustainable development of the black pearl industry and avoid future disease outbreaks. These projects involve diverse activities, including: monitoring the physical and chemical parameters in the lagoon; monitoring pearl oyster health and stocks; mapping the lagoon bathymetry and pearl farms; building local capacity in pearl farming and lagoon management skills, and drawing up a lagoon management plan and code of practice.

The Cook Islands government and supporting organisations have invested considerable resources in the projects in Manihiki. Will the projects reap economic benefits greater than their costs? Farmers can potentially use the project outputs to make their farming practices more sustainable, and thereby gain significant economic returns. The table next page gives some examples of ways in which pearl farmers may adjust their farming practices in response to information produced through four of the project areas.

Methods

The cost-benefit analysis assessed whether the projects implemented in Manihiki to achieve sustainable development of the black pearl industry are worthwhile investments for the Cook Islands. A model of pearl production was developed to estimate the economic benefits that the projects are likely to generate. The technique of cost-benefit analysis was used to compare the estimated benefits over a 15-year time period (2004–2019) with the total project costs. The net economic benefits of the projects were calculated in present value terms as an indication of whether they are good economic investments.

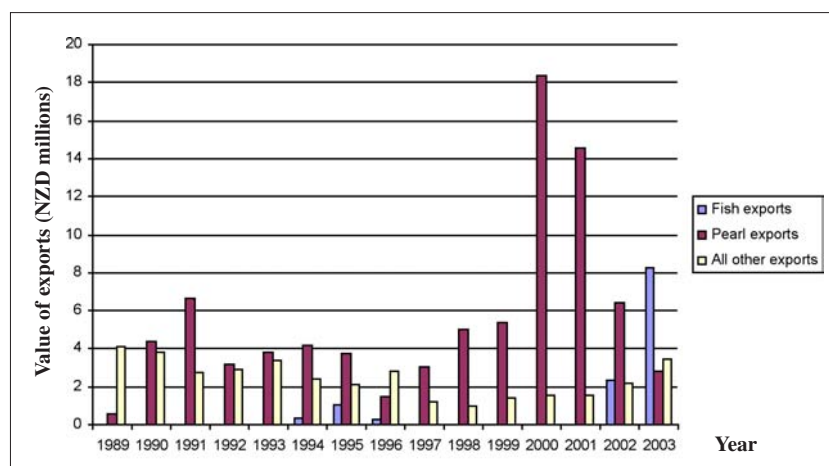


Figure 1: Value of fish, pearl and all other exports from the Cook Islands (Source: Cook Islands Annual Statistics Reports)

Table showing how pearl farmers may adapt their farming practices in response to the projects in Manihiki

Project	Information produced	Use of information by pearl industry
Monitoring buoy	Near real-time data on lagoon parameters e.g. dissolved oxygen, water temperature	If the monitoring buoy shows dangerous environmental conditions in the lagoon that stress the oysters, farmers may adjust farming practices. For example, if dissolved oxygen levels are unusually low, farmers delay cleaning and seeding, because this would further stress the oysters and could lead to high mortality rates.
Oyster health surveys	Statistics on the health of pearl oysters in lagoon	If the oyster health surveys show that oysters are diseased, farmers may adjust farming practices. For example, they may kill sick oysters to prevent the disease from spreading and reduce stock densities to prevent the disease recurring.
Mapping	Maps showing lagoon bathymetry and position of individual pearl farms	Farmers may use the maps to change the location and layout of farms to prevent overstocking of oysters, move to deeper areas of the lagoon, and avoid overlapping with neighbouring farms. For example, the maps are currently being used to plan where <i>haruharu</i> would be optimally located to collect juvenile oysters.
Oyster censuses	Estimates of oyster stocks and densities	If the farm censuses indicate high densities of pearl oysters in certain areas, farmers may change the location and layout of farms to avoid overstocking and disease outbreaks.
Technician training courses	Pearl oyster seeding skills	The course allows Cook Islanders to work as seeding technicians. The ecological and disease risks of high-volume seeding by foreign technicians who are only available to seed for a limited period in the year could be avoided if local technicians were available to seed all year round.

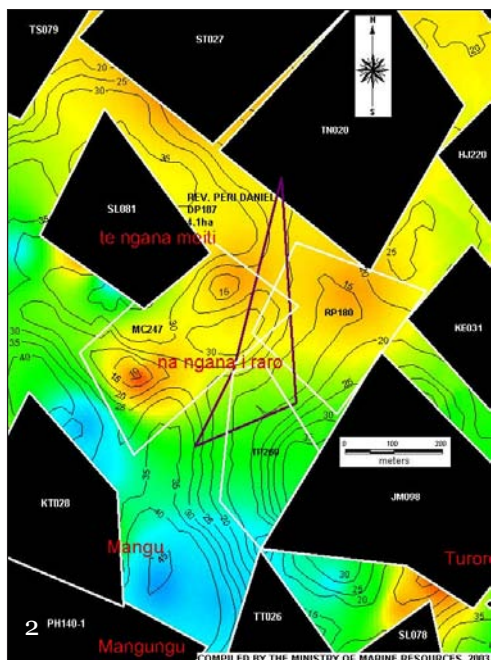


Figure 2: Map of an individual pearl farm in Manihiki Lagoon, showing the lagoon bathymetry and location of overlapping neighbouring farms
Figure 3: Map showing the position of pearl farms (in light grey) in Manihiki Lagoon
Figure 4: The oceanographic monitoring buoy in Manihiki Lagoon supplies near real-time data on physical and chemical lagoon parameters
Figure 5: A student from the Cook Islands learning to seed a pearl oyster at the Manihiki Technician Training Course

Findings

The model of pearl production developed in the study assumes that more sustainable oyster stocking densities and farming practices will improve oyster health, and increase the yield

and quality of pearls harvested. In the first cost-benefit analysis scenario, it is assumed that the projects are supported by the implementation and enforcement of the draft pearl farming management plan, which regulates oyster stocking densities

and farming practices. In this scenario, the net present value of the projects is approximately NZD 39.8 million. That is, the pearl revenue generated by the projects exceeds the total project costs by NZD 39.8 million in 2004 present value terms. The

projects also have additional indirect, secondary and non-monetary benefits.

Sensitivity analysis showed that the projects have a large multi-million dollar net present value under a range of different assumptions about future pearl prices, project costs, discount rates and employment levels.

The exception is the sensitivity analysis scenario in which the management plan is not implemented and enforced, so that incentives remain for resource users to stock the lagoon at unsustainable oyster densities and employ poor farming practices. In this scenario, pearl revenue declines and the projects fail to reap their large potential economic benefits. Under these assumptions, the projects has a negative net present value of approximately (NZD 2.4 million). That is, the project costs exceed the pearl revenue generated by the projects by NZD 2.4 million in 2004 present value terms. Many of the indirect, secondary and non-monetary benefits are also lost.

Recommendations

The following recommendations provide a road map for gaining the large positive net present value of NZD 39.8 million that the original cost-benefit analysis shows the projects could potentially be worth.

1) Projects must be supported by good management structures

The management plan is fundamentally important for the continuation of pearl farming in Manihiki. Without an enforced system of rules and regulations, incentives for individual farmers to overexploit the lagoon will lead to reduced profits for all, repeated disease outbreaks, and could eventually cause the demise of the Manihiki pearl industry. It is strongly recommended that the draft Manihiki pearl farming management plan be implemented as soon as possible, to guarantee that the projects effectively reap their substantial potential economic rewards for the Cook Islands. To be effective, the management plan must include the right to remove the permits of repeat offenders in order to create real incentives for farmers to eliminate unsustainable farming practices.

2) Data from monitoring buoy must arrive promptly and regularly

The information from the monitoring buoy must arrive promptly and regularly to be of direct use to farmers, and make a difference to production decisions. In early 2004 several farmers handled their oysters, either for cleaning or seeding, and subsequently experienced

very high mortality levels among the oysters. A monthly report summarising the monitoring buoy data later indicated that dissolved oxygen levels were unusually low around the time that the oysters were handled. If farmers had received the monitoring buoy information earlier they might have delayed handling the oysters, and the mortalities and subsequent revenue losses could have been avoided.

3) Capacity building needed for interpretation of scientific data

An educational workshop that teaches farmers how to interpret the scientific information from projects such as the monitoring buoy and from maps, oyster censuses and health surveys would help them to apply the information to their farming practices. Such a workshop was suggested by several of the farmers interviewed for the study.

Conclusions

In conclusion, the information and skills generated by the projects in Manihiki have the potential to generate multi-million dollar net benefits in terms of pearl revenue for the Cook Islands, and numerous other indirect, secondary and non-monetary benefits. But these benefits will only materialise if

Table summarising the findings of cost-benefit and sensitivity analyses

Situation	NPV	NPB	NPC	IRR	BCR	Payback period
Original assumptions	\$39.8m	\$44m	\$4.2m	28%	10	Four years
No management plan	-\$2.4m	\$1.8m	\$4.2m	0%	0.4	More than 15 years
Pearl prices recover	\$83.8m	\$88m	\$4.2m	33%	21	Three years
Pearl prices decline	\$17.8m	\$22m	\$4.2m	22%	5	Six years
Project costs increase	\$39.4m	\$44m	\$4.6m	27%	9.5	Four years
Locals not employed	\$26.5m	\$30.8m	\$4.2m	25%	7	Four years

NPV = net present value; NPB = net present benefit; NPC = net present cost; IRR = internal rate of return; BCR = benefit-cost ratio. All \$ values are in New Zealand dollars (NZD).

there is an effective resource management regime to ensure sustainable farming practices, such as the Manihiki pearl farming management plan that is currently in draft form.

Others involved in aquaculture elsewhere in the Pacific region can learn lessons from the Manihiki example. Scientific research and capacity building projects that aim to achieve sustainable management of natural resources need to be supported by effective resource management regimes, to ensure that the information and skills generated

by the projects are channelled in to good management decisions. With the support of good management structures, the economic benefits of capacity building and scientific research projects will be vast; without that support, the benefits will be limited.

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Secretariat of the Pacific Community, Marine Resources Division, Information Section,
BP D5, 98848 Noumea Cedex, New Caledonia
Telephone: +687 262000; Fax: +687 263818; cfpinfo@spc.int; <http://www.spc.int/coastfish>