



Fisheries

Newsletter

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Editorial

Several important meetings were held during this quarter. The Third Head of Fisheries Meeting took place in Noumea, New Caledonia, from 18 to 23 August 2003. This meeting is the sole occasion when the people in charge of the fisheries sector in the Pacific Islands can get together to examine the overall situation and problems with regards to fisheries, share their experiences with their colleagues, and provide invaluable advice to the heads of SPC's Marine Resources Division. Among the topics covered during this meeting particularly noteworthy was the presentation of a paper proposing technical solutions to reduce or even end sea bird bycatch during longlining operations.

Of the various resolutions adopted by the meeting, the one concerning the strategic plan for sustainable management of coastal fisheries was the subject of intense interest by participants. As part of this strategy, fisheries services will have to place greater emphasis on management than on development while at the same time assisting local communities with management of their fisheries stocks.

The Sixteenth Standing Committee on Tuna and Billfish took place in Australia in July and, as usual, allowed scientists and other tuna fishing sector stakeholders to discuss issues related to fisheries statistics, research in general, and stock management for tuna and related species.

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



The third Heads of Fisheries Meeting was held in Noumea from 18 to 23 August 2003

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SECRETARIAT OF THE PACIFIC COMMUNITY

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SPC ACTIVITIES

■ THIRD HEADS OF FISHERIES MEETING

The third SPC Heads of Fisheries (HoF) meeting took place at SPC headquarters in Noumea, from 18 to 23 August 2003.

HoF is a regional meeting of Pacific Island countries and territories, covering a 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 SPC's fisheries programmes. It complements the more sectorally focussed, political role of the Forum Fisheries Committee, which has a primary emphasis on tuna fisheries management. HoF covers aquaculture, coastal fisheries management and development, and living marine resource science, and has a broad-ranging and relatively informal structure for discussion that can cover any issue of interest to participants.

The following paragraphs constitute the points of consensus among SPC member heads of fisheries on issues that participants felt necessary to docu-

ment. These issues have been noted in order to help in the management of SPC's work programme, to draw the attention of a wider audience, and/or to signal agreement on issues that require attention by members themselves.

Institutional issues

1) SPC member country and territory representatives at HoF3 agreed that the Chair, with the assistance of the Secretariat and advice from members, should draft Terms of Reference to guide the operation of future SPC Heads of Fisheries meetings. This draft will be finalised for approval by HoF4 and will include:

- *Definition of the scope and purpose of the meeting, but one that will not limit the potential for discussion on any issue under the purview of national and territorial fisheries administrations;*
- *A general guideline to keep most presentations to less than 20 minutes for maximum impact, effectiveness and discussion time;*

- *The authority of each HoF session to approve its own agenda and list of papers to be heard or considered; and*
- *A requirement that working papers should be made available to representatives at least two weeks in advance of each meeting.*

2) HoF3 agreed that the Chair should provide a brief report on the main outcomes of the meeting, as expressed by this document, to the Chair of the next SPC governing council meeting.

3) The Marine Resources Division should inject more rigour into the process of handling requests by member governments and administrations. This should include immediate acknowledgement of request, the provision of feedback on the feasibility (particularly economic) of proposed projects, and the negotiation of definite agreements on inputs, outputs and timing of projects. Completed activities should be the subject of a report available (subject to approval of the document by the relevant SPC members) to



Participants at the Third Heads of Fisheries Meeting

an appropriate wider audience, and activities would be occasionally reviewed for long-term sustainability and lessons learned.

4) The Marine Resources Division should report to the next HoF on the progress made towards implementing the recommendations of SPC institutional reviews, including those of the Coastal Fisheries Programme, Oceanic Fisheries Programme and Fisheries Training Course;

5) HoF valued the progress reports on the various long-term multiagency initiatives, and asked that progress on these be formally and briefly reported on at future HoF meetings. Existing initiatives in which SPC plays a focal role include the regional Aquaculture, Live Reef Fish and the new Coastal Fisheries Management initiatives.

6) The meeting welcomed the cooperation between the SPC's Marine Resources Division and other CROP¹ agencies, and in particular welcomed the intention of SPC and USP to develop a more formal understanding for facilitating cooperation on fisheries and aquaculture training, and issues of national support.

7) It was emphasised that a basic principle of SPC's Marine Resources Division should be to continue working towards reducing member dependency on regional programmes, and promoting the devolution of competencies to 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 will work towards identifying what capacity should be developed or maintained at the regional level and what should be a priority for development at national level in each country and territory.

Strategic plans

8) The lack of specific mention of gender, or women in fisheries, in the objectives of the Coastal Fisheries Programme Strategic Plan was noted by the meeting. Although gender is included at the fundamental cross-cutting level of "basic principles and specific policies" in the annex to the plan, the meeting felt the issue should also be expressed as a specific strategy or objective at a high level within the plan the next time this "living document" was published.

Oceanic Fisheries Programme review

9) The meeting noted the very positive independent review of the Oceanic Fisheries Programme, and commended the Secretariat's work in this particular area. The meeting endorsed the Secretariat's response to the review's recommendations, particularly the processes that had been set in motion to further develop national capacity in oceanic fishery science and monitoring.

10) HoF3 emphasised the positive benefits that would accrue to the region from the comprehensive management regime implicit in the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and

Central Pacific Ocean, and strongly encouraged potential parties to accede to the Convention and to bring it into force as soon as possible.

Coastal Fisheries Programme review

11) The meeting endorsed the main thrust of the review's report and its principal recommendations. The Secretariat's response to the Coastal Fisheries Programme review recommendations was generally commended. It was noted that a mechanism would need to be developed for prioritising proposed actions to implement any recommendations with financial implications. This would occur through consultative processes involving Heads of Fisheries, for the benefit of decision-makers and donors. The meeting recognised that there would be an opportunity for further comments from the membership after HoF3 before the Secretariat's response was finalised and there would be another opportunity for member country comments at CRGA in November 2003.

12) The meeting particularly highlighted its agreement with major recommendation #4 of the review, which indicated that the re-establishment of the Coastal Fisheries Programme Manager post, unfunded since 1995, would likely lead to considerable improvement in CFP's organisation, including project accountability, reporting, and the efficiency of services provided to member countries. The meeting urged the Director of SPC's Marine Resources Division to seek means of re-establishing this position, and suggested that, if SPC core funding were unavailable, that external funds be allocated, either from a

¹ Council of Regional Organisations in the Pacific

levy on existing projects, through a new project, or through the realignment of the duty statement of an existing post or vacancy.

Coastal Fisheries Management Strategy

13) HoF3 recognised the problems faced at all levels in ensuring the continued sustainability of many Pacific Island coastal fisheries given the pressures of commercialisation and population, and in rehabilitating or protecting already overexploited or otherwise overimpacted coastal fisheries. Delegates recognised SPC's efforts over the past 15 years to assist individual members in addressing these problems. The meeting welcomed the more comprehensive regional strategic approach now being proposed, and endorsed the goals of the Coastal Fisheries Management Strategy as a multiagency regional initiative, provided that capacity-building in analysis of information under goal #2 was clearly emphasised. The meeting recognised that the strategy would be a major long-term initiative that would benefit all SPC members. The meeting asked SPC to move ahead with the strategy, that is to: maintain an inventory of capacity for coastal fishery management in each country, identify existing regional and international capacity for participating in the framework of assistance to PICTs, and develop action plans to implement priority areas of the strategy with timeframes and progress review mechanisms clearly identified.

14) The meeting asserted that SPC should be clearly identified as the regional "lead agency in coastal fisheries". SPC should move forward on the priority task of assisting members in the sustainable development and management of fisheries, and

making sure that sustainable fisheries management issues are included in broader coastal zone management initiatives.

Fisheries Training Course review

15) After discussing the recommendations of an independent review, the meeting endorsed the value of the six-month SPC fisheries training course as an intensive training programme in practical topical fisheries issues for serving Pacific Island fisheries officers. It endorsed the review's findings and SPC's response, particularly the realignment of the curriculum, and asked SPC to investigate ways of establishing more formal certification of the course.

16) The meeting suggested that, given the uncertainty of funding and the need to maintain momentum, SPC should urgently investigate, with the New Zealand School of Fisheries (NZSF), ways of ensuring delivery of the SPC Fisheries Officer training course for a further cycle. The meeting also suggested that SPC investigate — with NZSF, USP and other institutions — mechanisms for articulating the components of the short course into longer-term diploma and degree courses, and promoting capacity within the region to provide fisheries training.

Tuna fishery-associated bycatch

17) HoF3 noted that bycatch is a growing concern of oceanic fisheries managers in Pacific Island countries and territories. Participants agreed to be proactive in finding ways to mitigate the negative impacts of bycatch on the development of Pacific Island tuna fisheries. The meeting noted the assessment work being carried out under the Standing Committee on

Tuna and Billfish (SCTB) on the issue, and the discussions taking place at other regional fora. The meeting requested SCTB and others to keep Heads of Fisheries informed on the progress made towards addressing these issues at the regional level.

18) HoF3 commended the work of SPC's Coastal Fisheries Programme in developing bycatch awareness materials and mitigation techniques as part of its practical fisheries training, information, and enterprise development activities.

19) The meeting noted that it is the responsibility of national and territorial Heads of Fisheries to ensure that no species becomes endangered because of fishing. While it is recognised that SPC is not the lead regional agency for endangered species conservation, the meeting encouraged SPC's Marine Resources Division to continue to take account of the interaction between fisheries and endangered species, and to develop capacity in assessing, and assisting in the rehabilitation of, populations of endangered species significantly affected by fishing.

(Coastal fixed) Fish aggregation devices

20) HoF3 appreciated the information emerging from FAD experiments carried out in Niue and Cook Islands with SPC's assistance and New Zealand funding. The meeting also noted that the information was valuable for future decision-making concerning cost versus benefits of national artisanal FAD programmes. The meeting suggested that the FAD experiments should continue over a reasonable and sufficient time frame to produce statistically robust results. Promising results concerning improving the longevity of the devices, and

reducing costs were emerging, however the experiments needed to be extended to cover the average lifetime of FADs while the economic and environmental benefits required a longer time frame to take account of changing fishery economic conditions at both sites. Changes in fishing patterns as a result of FADs, particularly relating to sportfishing and tourism, will probably be significant.

21) The meeting urged the Secretariat to continue to document mechanisms by which FAD user groups could be encouraged to play an active and sustainable role in the deployment, maintenance and management of FADs.

Aquaculture

22) HoF3 welcomed the preliminary review of aquaculture policy and legislation in the region, and endorsed the future plan of action outlined in the review. The meeting suggested that more detailed analysis would be extremely useful in assisting many members in making progress towards pro-active sustainable aquaculture management frameworks. It was recognised that a better knowledge of basic principles could be applied across the region

would be useful to all. Several countries invited SPC to examine their legislation for guidance on the commonalities that might be included in a possible regional set of principles.

23) The meeting welcomed and endorsed the ACIAR Queensland Department of Primary Industries/WorldFish Center/SPC Aquaculture Project, "Sustainable aquaculture development in the Pacific Islands region", and encouraged its timely commencement. With regard to developing techniques for culturing of postlarval fish, it was recognised that techniques for reducing natural mortality of pre-recruits could potentially have great benefits, both for culture and for rehabilitating wild stocks. The meeting noted that the project would need to clearly demonstrate the sustainability of the technique, in terms of its effect on natural recruitment, in order to address potential

public concerns. The meeting also noted that pro-active mechanisms should be considered for managing any future postlarval "fishery" that might develop.

Introduced species

24) HoF3 endorsed the draft regional guiding principles for introduction by the SPC/WorldFish Center/Papua New Guinea working group, and proposed several followup actions including:

- ensuring that the guiding principles could be applicable to within-country and inter-island translocation as well as international translocation;
- identifying and making available to SPC members the capacity for quantifying the economic costs versus benefits of historical and potential translocations, through the aquaculture initiative;



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

- *establishing a web or email-based discussion group (if no other such group exists) under SPC's aquaculture portal, to provide linkages to quick and informal advice on different commonly introduced species;*
- *developing basic guidelines on the control or eradication of undesirable historical aquatic introductions, or invasive aquatic species, making these available to Pacific Island governments;*
- *developing basic guidelines, similar to those of the giant clam guidelines approved by HoF/Regional Technical Meeting on Fisheries in the past, to cover several commonly translocated species;*
- *developing a training programme in aquatic quarantine issues for agricultural quarantine officers, and working towards building specialist aquatic quarantine capacity;*
- *establishing a regional network and early-warning system, based on SPC's experience of agricultural and human epidemiological networks, to promote the exchange of information among Pacific Islands about outbreaks of aquatic diseases and parasites.*

25) While discussing the "regional guiding principles for introduction and translocation of aquatic organisms for aquaculture and fisheries" the meeting noted the region's urgent need to more effectively address vessel ballast water discharges and shipwrecks/groundings, which are potential ways of introducing undesirable exotic species. The roles of SPREP's Pacific Pollution (PACPOL) and Invasive Species Programmes, SPC's Regional Maritime Programme and the International Maritime Organization in this area were recognised. SPC's

Marine Resources Division was asked to consider more assistance to members on these subjects, in view of the potential impact on coastal fisheries and aquaculture.

Live reef fisheries

26) HoF3 noted with approval the progress made by the regional Live Reef Fish Trade Initiative since it was launched by Heads of Fisheries in 1999, and acknowledged the contributions made by several agencies, NGOs and organisations towards the joint goals of the initiative. HoF3 looked forward to implementing promising new avenues for achieving or maintaining sustainable management of, and maximum local benefit from, these fisheries, particularly trade certification mechanisms for marine ornamental fisheries, and industry "best practices" for the food fish trade.

27) The meeting welcomed the update on the current status of these fisheries, and took note of the current stagnation of the market and the changing patterns of trade, resulting from these.

Fisheries assessment

28) Heads of Fisheries collectively endorsed the executive report of the Standing Committee on Tuna and Billfish (SCTB), and drew particular attention to SCTB's opinions concerning the status of yellowfin and bigeye tuna resources.

29) HoF expressed pride in the level of international respect given to SPC's scientific work on fisheries, but urged the Secretariat to further improve the interface between science and the public, as well as the existing attention given to high-level, decision-makers. The meeting endorsed the Secre-

tariat's intention to produce easily-understood and widely-distributed, yet scientifically rigorous, explanations of the status of fisheries as soon as possible, particularly regional tuna fisheries. HoF strongly wished to redress the potential distorting effect on public perceptions resulting from certain recent, high-profile publications that had not yet had the benefit of scientific debate, or the opportunity for comment.

30) The meeting was appreciative of the scientific tools being developed by the oceanic component of the SPC/EU PROCFish project for better understanding and predicting the broad distribution and prospects of regional tuna stocks and fisheries in relation to the ocean environment. The meeting urged the Secretariat to work towards the adaptation of these methodologies and computer software for use in oceanic fishery management decision-making at the national level, as appropriate.

31) The meeting pointed out the vital role of the coastal component of PROCFish in developing a rigorous, scientific information-base for improving national and local management of reef fisheries. Several countries expressed great interest in obtaining the collaborative services of the project as soon as possible. The integration of social/economic features with resource assessment, was particularly commended. From the experience of countries and territories that had already taken part in the project, and while it was clearly recognised that the project was still a "work-in-progress" that had not yet developed its final products, the following issues were raised:

- *SPC should make known to the European Union HoF's opinion, which is that the expansion*

of the coastal component of PROCFish to six new ACP/EU partner countries be strongly endorsed for implementation as soon as possible. HoF further hoped that rapid and efficient implementation of the new projects under the 9th EDF Pacific Regional Strategy fisheries focal sector (COFish and DEVFish, the latter jointly implemented between SPC and FFA) would strengthen the case for implementing another Oceanic Fisheries scientific project under the reserved funding that will become available after the 9th EDF mid-term review by the European Union. The regional work of the oceanic component of PROCFish was beginning to show exciting results, particularly with regards to the establishment and operation of ecosystem-based management of oceanic fisheries, which would need to be increasingly implemented at the national level.

- The US territories and Tokelau, the only remaining SPC members not directly eligible for PROCFish assistance, appreciated the opportunity to be included in the discussion of the project, and hoped that SPC's attempts to include them in the project in the future would receive favourable attention from potential funding sources, or from potential collaborators willing to use the same regionally standard methodologies.
- The meeting felt that, as with all regional agency scientific and technical projects, the need to express applied research findings in ways that are comprehensible to the general public, as well as to decision-makers, can never be under-emphasised. HoF3 commended SPC's recent efforts to better address this area, and urged yet further efforts;
 - The meeting noted, however, that SPC staff should be careful in discussing and clearing national sub-project outputs with the relevant national or territorial fisheries head before publication or public presentation, particularly where these involve recommendations or express opinions.
 - The meeting urged the coastal component of the PROCFish project to push forward its plans (through the regional coastal fisheries data repository) to integrate all existing relevant information available from previous work into the comparative assessments, including any available environmental and socioeconomic survey data. Heads of Fisheries recognised the potential value of both the ecosystem approach and the co-management approach to reef fisheries management, and the need for the firmest possible information base on which to develop workable approaches. Heads of Fisheries also noted the need for an accessible central repository to avoid potential duplication of effort by various other agencies and NGOs collecting data in this field.
 - The meeting remarked that a small but significant gap in scientific fishery assessment services remained between the shallow reef fisheries and the oceanic fisheries work of SPC, in particular the assessment of slope and coastal seamount resources, such as deepwater snapper. HoF urged SPC to bring this gap to wider attention at the forthcoming artisanal fisheries meeting associated with the Deepsea 2003 Conference in New Zealand in November.
- The meeting expressed its desire for the coastal component of PROCFish to produce a short, clear, written explanation of project aims and activities for the general public. This would help make clear that the different services previously provided on a small scale by the former CFP Resource Assessment and Management Section, are now separated and expanded into the Reef Fisheries Observatory and the Coastal Fisheries Management Section. HoF recognised that PROCFish/Coastal, under the SPC Reef Fisheries Observatory, is not intended to provide direct advice to governments on coastal fishery management mechanisms like the SPC Coastal Fisheries Management Section does, and is not intended to carry out in-depth trials of community-based sustainable fishery management systems at pilot sites like SPREP's (coastal component) GEF International Waters Project does, but will provide objective, scientifically based information for use by decision-makers in reef fishery management processes.

Other issues

32) Improving the value and quality of fisheries sector exports remains a major and growing need for support at the regional level. SPC should work with the Forum Fisheries Agency, the Pacific Islands Forum Secretariat, the University of the South Pacific and others in developing more comprehensive regional support services in this area.

33) Electronic (CD-ROM-based) libraries of information useful to Pacific Island fisheries departments should be developed and made available.



34) Heads of Fisheries requested that the next HoF meeting be provided with a report on safety at sea for artisanal fishers, based on the recommendations of the forthcoming FAO/SPC regional expert consultation.

35) The meeting appreciated the briefing on forthcoming meetings and asked the Secretariat to expand its calendar of events and meetings of interest to HoF (www.spc.int/coastfish/meetings.htm). The calendar should provide more comprehensive coverage, include short briefing notes on each event, and be distributed to HoF representatives as well as being maintained on the website.

In closing, a spokesman for the meeting highly commended the HoF Chair from Nauru, Anton Jimwereiy, assisted by Peter

Jacob, for managing the deliberations and the outputs of the meeting so effectively. The Secretariat was thanked both for the presentations, and in providing an opportunity to freely and collectively discuss fisheries issues of wide-ranging interest and relevance. SPC's Marine Resources Division was leading the region in "doing what it is supposed to do" within its area of competence, with foresight, dedication, and "a perspective on the real needs of the region". Finally, it was strongly felt by everyone present that HoF needed to meet more frequently, and hoped that the Secretariat would be able to gather enough resources to enable HoF4 to be held in 2004, particularly given the number of "burning issues" that had already been placed on the agenda.

Note: This list of recommendations signals points of consensus of SPC member country and territory fisheries service heads on certain issues raised during the 3rd 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 emerging 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.



■ SIXTEENTH MEETING OF THE STANDING COMMITTEE ON TUNA AND BILLFISH

The 16th meeting of the Standing Committee on Tuna and Billfish (SCTB 16) was held from 9 to 16 July 2003 in Mooloolaba, Australia at the invitation of the Chairman. The meeting was hosted by the Commonwealth Scientific and Industrial Research Organisation and Agriculture, Forestry, Fisheries—Australia. SCTB 16 was attended by participants from Australia, Canada, Cook Islands, the European Union, the Federated States of Micronesia, Fiji Islands, France, Indonesia, Japan, Korea, Marshall Islands, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, the Peoples Republic of China, Philippines, Taiwan, Tonga, United States of America, Vanuatu and Vietnam. Representatives from various regional and international organisations also attended the meeting. These included the Forum Fisheries Agency (FFA),

the Inter-American Tropical Tuna Commission (IATTC) and the Secretariat of the Pacific Community (SPC).

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

1. coordinate fisheries data collection, compilation and dissemination according to agreed principles and procedures;
2. review research on the biology, ecology, environment and fisheries for tunas and associated species in the WCPO;
3. identify research needs and provide a means of coordination, including the foster-

ing of collaborative research, to most efficiently and effectively meet those needs;

4. 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
5. provide opinion on various scientific issues related to data, research and stock assessment of WCPO tuna fisheries.

The meeting convened as eight Working and Research Groups:

- Statistics (SWG),
- Fishing Technology (FTWG),
- Methods (MWG),
- Skipjack (SRG),
- Albacore (ARG),
- Yellowfin (YRG),
- Bigeye (BRG), and
- Billfish and Bycatch (BBRG).

SCTB16 Chairman and Working Group (WG) and Research Group (RG) Co-ordinators were as follows: SCTB Chairman: Dr SungKwon Soh; FTWG: Mr David Itano; MWG: Dr John Sibert; SWG: Mr Tim Lawson; ARG: Mr Régis Etaix-Bonnin; BRG: Dr Naozumi Miyabe; SRG: Dr Gary Sakagawa; YRG: Dr Robert Campbell; BBRG: Mr Paul Dalzell.

The initial overview of western and central Pacific Ocean (WCPO) tuna fisheries noted that the estimated total catch for 2002 for the four main tuna species was 1,982,000 mt, the second highest annual catch on record after 1998 (2,037,600 mt). The 2002 WCPO skipjack catch (1,321,900 mt) was the highest ever, eclipsing the previous record catch attained in 1998 (1,314,200 mt), and as usual dominated the total catch. The WCPO yellowfin catch (438,000 mt; 22%) was the lowest for six years and about 65,000 mt lower than the record catch in 1998 (503,000 mt). The WCPO bigeye catch for 2002 (107,600 mt; 5%) was slightly higher than in 2001, while the WCPO albacore catch (114,500 mt; 6%) was slightly down from that in 2001. The record catches for these species are 111,000 mt and 148,000 mt, respectively and were taken during 1999. In contrast to WCPO, Eastern Pacific Ocean (EPO) yellowfin catch for 2002 was the highest ever (427,700 mt), but the EPO bigeye catch was the lowest since 1984.

Reports on relevant activities of other organisations were received from the Inter-American Tropical Tuna Commission (IATTC) and the Pelagic Fisheries Research Programme (PFRP), University of Hawaii. The three Working Groups (Statistics, Methods and Fishing Technology) held a series of meeting in the two days prior to SCTB16 and con-

sidered a range of issues relevant to their respective terms of reference.

Summaries of these meetings were presented to SCTB16 and summary statements for each working group are provided.

The five Research Groups considered regional fishery developments, advances in research, stock assessment, research coordination and planning for those species or groups of species. Summary statements on these matters are provided for each research group.

Cross-cutting issues arising from the Working Group and Research Group discussions were considered in a separate session of SCTB for the first time. The discussion, which considered issues relating to estimating catch, catch rates and size/species composition, biology and ecology, stock assessment and emerging management issues, identified certain research issues as priorities with time frames for implementation. Those issues that were identified as being of a high priority included:

- Better estimates of current catch from Indonesia, Philippines and Vietnam, noting that some progress had been achieved in this area;
- Reconstruction of early catch history (catch, effort, size composition) for all fisheries;
- Further development of methods to standardise effort, including the better use of vessel operational details, environmental data and archival tagging data;
- General efforts to reduce uncertainty in assessments, through improved data inputs, sensitivity analysis and simulations;

- Evaluation of possible regime shifts/changes in productivity and development of improved/alternative estimates of recruitment where possible;
- Development of appropriate formats to frame advice for managers.

The session also reaffirmed the recommendation from previous SCTB meetings that large-scale tagging experiments for the main target tuna species in the WCPO be carried out, and in coordination with tagging experiments in the eastern Pacific Ocean (EPO). Such an experiment was seen as crucial in helping to estimate of movement and fishing mortality rates in the assessment models, and providing an independent means of validating models results. As such, it should be regarded as the appropriate regular monitoring approach for highly migratory species in the WCPO. Finally, the session reaffirmed the value of directed fisheries research, and its central role in the quality of management advice provided and in reducing uncertainty in the advice provided. The session also noted the likely negative consequences to both the management of the fishery and the status of stock (mainly bigeye and yellowfin tuna) if such research is delayed.

The meeting held initial discussions on defining and measuring "fishing capacity" in WCPO tuna fisheries, and determining SCTB's role given other regional and international initiatives. The meeting noted that the primary focus of SCTB was stock assessment and in this regard participants were interested in measures of effective fishing effort. SCTB was unable to agree on a definition of fishing capacity.

While it remained unclear what SCTB could do in relation to measuring fishing capacity it was noted that SCTB could contribute in improving data availability, fishing effort standardisation, and possibly others. Noting that other agencies continued to grapple with how to address the issue after several years of consideration, it was recognised that fishing capacity issues were broader than what could be resolved in this initial discussion. SCTB members were encouraged to consider this issue over the coming year, and to consider discussing fishing capacity again at SCTB17.

The meeting also considered proposals for improving the organisation of future SCTB meetings. A number of options were discussed and adopted. In acknowledgement of the time required to undertake the assessments, a recommendation to hold the SCTB meeting at a later date (possibly in August) was also adopted.

Statistics Working Group – summary statement

The objective of the Statistics Working Group (SWG) is to coordinate the collection, compilation and dissemination of tuna fishery data. Highlights of the current status of data collection, compilation and dissemination include the following.

- In recent years, estimates of the annual catches of the target tuna species (albacore, bigeye, skipjack and yellowfin) have been provided within six months following the end of the calendar year for all fleets, except those covering the longline and pole-and-line fleets of Japan; however, most of these estimates do not include discards. Estimates of annual catches of billfish are less
- complete. The availability of data (primarily observer data) to estimate the annual catches of other highly migratory species covered by the Western and Central Pacific Fisheries (WCPF) Convention, and species of special interest (marine turtles, seabirds and marine mammals), will be reviewed by SPC's Oceanic Fisheries Programme.
- For 2001, the most recent year for which all or most data have been compiled, OFP holds catch and effort log sheet data covering 44.3% of the catch of target species in the WCPO. These data cover catches taken by the domestic fleets of SPC member countries and territories, catches by distant-water fleets fishing within the EEZs of SPC members, and catches of certain distant-water fleets on the high seas (such as the purse-seine fleets of Korea and Taiwan, but not Korean and Taiwanese distant-water longline fleets or any Japanese fleets). Excluding the domestic fisheries of Indonesia and the Philippines, for which no catch and effort data have been provided, and the coastal fisheries of Japan, the log sheet coverage is 64.3%.
 - Coverage by catch and effort data aggregated by time and area (5° latitude by 5° longitude by month for longline, and 1° by 1° by month for pole-and-line and purse-seine), which are derived from data held by OFP or provided by distant-water fishing nations, is complete for 1950–2001, except for those covering certain fleets in the early part of the time series. The National Research Institute of Far Seas Fisheries of Japan recently provided historical longline catch and effort data, aggregated by 5° by 5° and month, for 1952–1961. Aggregated catch data covering the domestic fleets of Indonesia and the Philippines are based on estimates of annual catches that are highly uncertain, and effort data for these fleets have not been collected.
 - The coverage by length or weight data is currently sufficient for all gear types, except for the domestic fleets of Indonesia, and the Philippines, and the coastal fleets of Japan. Size sampling should be established for these fleets.
 - Information regarding the coverage by catch and effort logsheet data and size data that are not held by OFP — primarily data held by Japan, Korea and Taiwan — has not been provided in most cases.
 - Estimates of annual catches for the domestic fleets of Indonesia and the Philippines have been provided on a timely basis; however, annual catch estimates in recent years (1992–2002 for Indonesia and 1997–2002 for the Philippines) have not been broken down by gear type, and estimates of annual bigeye and yellowfin catches for all years have been reported as a combined catch. Catch data at a higher resolution and effort data have not been provided. Species composition and size data have been collected in the Philippines since 1997, but this programme was interrupted in 2002 due to funding constraints. No sampling is being conducted in the Pacific Ocean waters of Indonesia. SWG, in collaboration with the relevant national authorities, will continue to develop project

proposals and seek sources of funding to establish sampling programmes in the Pacific Ocean waters of Indonesia, and to provide support for ongoing sampling programmes in the Philippines.

- Uncertainties remain regarding the past and present species composition of small tropical tunas caught by purse seiners in association with floating objects, particularly in regard to bigeye.

A one-day meeting of SWG on standards for the design of national and regional observer programmes was held immediately prior to SCTB16. Guidelines were established for coverage rates relating to research objectives for observer programmes covering the offshore longline fleets targeting South Pacific albacore (American Samoa, Cook Islands, Fiji Islands, French Polynesia, New Caledonia, Samoa, Tonga). Further analyses will be conducted to establish guidelines for the offshore longline fleet targeting bigeye and yellowfin and the purse-seine fleets fishing in tropical waters on the basis of observer data held by SPC's Oceanic Fisheries Programme; however, observer data are not available to conduct similar analyses for the distant-water longline fleets.

Recent developments in port sampling and observer programmes were discussed. Port sampling programmes are currently being conducted in Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, Japan, Kiribati, Korea, Marshall Islands, New Caledonia, New Zealand, Palau, Papua New Guinea, Solomon Islands and Taiwan. Observer programmes have been developing slowly in regional and national organisations through-

out the WCPO, but in recent years have expanded more rapidly in response to the need for detailed information on fishing effort, discards, and catch statistics for non-target species. Observer programmes are being conducted in Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, French Polynesia, Kiribati, New Caledonia, New Zealand, Papua New Guinea, Solomon Islands and the United States (Hawaii). The Forum Fisheries Agency manages the observer programmes covering the United States and FSM Arrangement purse seiners. Observer programmes are being developed in American Samoa, Japan, Korea and Taiwan.

The problem of misidentifying bigeye as yellowfin on purse-seine logsheets was addressed. In particular, an analysis of the proportion of bigeye in the combined catch of yellowfin and bigeye, based on purse-seine observer data held by OFP for 1998–2001, was presented. Several data sets that can be used as input data for the MULTIFAN-CL assessment of bigeye were produced. These were based on varying assumptions regarding the statistical relatedness of the proportion of bigeye in the combined catch of yellowfin, and bigeye with variables such as school association, year, quarter, area, flag and size group. A report reviewing the accuracy of species identification by port samplers in American Samoa was also presented; it was verified that the accuracy of the two

samplers was 100% over the size range of fish that were examined (41 cm yellowfin, 45 cm bigeye). It was recommended that similar work be conducted to verify port sampling throughout the region, preferably when yellowfin and bigeye of smaller sizes are available.

Skipjack Research Group – summary statement

Key attributes

Skipjack tuna is found year-round to be concentrated in the tropical waters of the WCPO. Its distributional range expands seasonally into subtropical waters to the north and south. It is a species characterised by large stock size, fast growth, early maturing, high fecundity, year-round spawning over a wide area, relatively short life span (maximum age of four or five years old) and variable recruitment.

A single stock is assumed to reside in the WCPO. Currently, skipjack stock assessment is largely undertaken with the MULTIFAN-CL model. The Methods Working Group noted concerns about the model's ability to produce accurate estimates for some parameters. Consequently, the Skipjack Research Group (SRG) has taken into account these concerns, and has largely relied on trends and ratios instead of point estimates from the model in assessing current stock status.



Recent developments in the fishery

Skipjack tuna catches exceed those of any other tuna species, and a majority of the catch is taken by purse seine. Catches from purse-seine sets consist of a mixture of skipjack, yellowfin, and bigeye tuna, with the proportions varying depending on whether sets are made on free swimming schools or floating objects.

Over the past four to five years, the catch has been at record-high levels exceeding 1.2 M mt annually (Fig. 1) and accounting for more than 60% of the annual catch of principal tuna species landed from the region. Along with the record catches, the price for skipjack tuna has fallen to levels not seen since the 1970s. Since about 1996, increased use of fish aggregating devices (FADs) by purse-seiners has contributed to the record catches. Typically, the bulk of the catch consists of two age groups (size range 40–70 cm FL).

In 2002, an estimated catch of 1.3 M mt tuna was landed, the highest on record. Seventy-three per cent (962,700 mt) was taken by purse-seine gear, 21% (280,600 mt) by pole-and-line gear and 6% (70,000 mt) by other gears.

CPUE trends

Nominal CPUE for all purse-seine fleets, except the US fleet, continues to show an upward trend, reaching a record high average rate of approximately 30 mt/day fished in 2002. This rise is due to increased efficiency associated with setting on floating objects. Standardised CPUE for the Japanese pole-and-line fleet, on the other hand, shows no trend.

Sizes of fish trend

Sizes of fish in the catch (based on weight) have largely been constant with a dominant mode at about 50–60 cm FL and a significantly smaller mode at about 30 cm FL. The larger mode consists of fish mainly caught by purse-seine and pole-and-line gears and the smaller mode, by various gears of the Philippines and Indonesia domestic fisheries.

Recruitment trend

Estimated recruitment has varied (about threefold) since 1972 and the trend has been upward. Estimated current recruitment, although less precise than estimates for earlier year classes, is among the highest in the time series. This high recruitment appears to be related to El Niño events.

Biomass trend

The level of biomass of skipjack tuna is largely dictated by the level of incoming recruitment to the population. Since 1972, the trend in estimated biomass has been upwards, following an apparent step-wise increase in recruitment. Current biomass is well above the biomass that would produce a maximum sustainable yield (MSY).

Fishing mortality trend

The trend in estimated fishing mortality rate has been upwards since 1972, with the current overall fishing mortality rate (F) at a modest level of approximately 0.20–0.25 per year.

Stock status

Estimated biological reference points, particularly B-current/B-MSY and F-current/FMSY, indicate that the WCPO's skipjack tuna stock is not overfished owing to recent high levels of recruitment and a modest level of exploitation relative to the stock's biological potential. Continued catches at the 1.2 M mt level is sustainable with continued high levels of recruitment, which are believed to be determined by principally environmental factors and not owing to a strong spawner-recruit relationship.

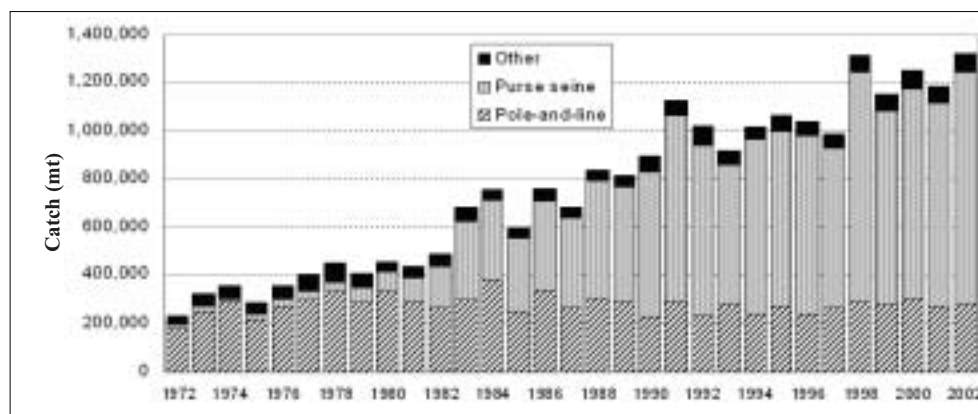


Figure 1: Annual WCPO skipjack catch (mt) by gear

Yellowfin Research Group – summary statement

Key attributes

Yellowfin tuna are fast growing — maturing at about two years of age — and are highly fecund. Yellowfin can grow to 180 cm in length and weigh over 100 kg when they are about six years of age or older. The majority of the catch is taken from the equatorial region where they are harvested with a range of gear types, predominantly purse seine and longline. Yellowfin tuna catches represent the second largest component (21–27% since 1990) of the total annual catch of the four main target tuna species in the WCPO. For stock assessment purposes, yellowfin tuna are believed to constitute a single stock in the WCPO.

Recent developments in the fishery

Since 1990, there have been large increases juvenile yellowfin tuna catches by the purse-seine FAD fishery, though in recent years catches in the purse-seine fishery overall have declined from the record catch taken in 1998. The catches of juvenile yellowfin in the Philippine and Indonesian domestic fisheries have also increased significantly since 1990, with these increases continuing to 2002.

Trends

Catch and effort

Longline fisheries developed in the early 1950s with yellowfin tuna being the principal target species. A major change took place, however, after the mid-1970s with the increased targeting of bigeye tuna. Large-scale industrial purse-seine fisheries developed in the early 1980s,

principally targeting skipjack tuna but also taking large catches of yellowfin tuna. This development, together with increased catches by Indonesian and the Philippines vessels, resulted in the doubling of WCPO yellowfin catches from 200,000 to 400,000 mt between 1980 and 1990. Over the past decade, around 40–60% of the total yellowfin catch in any year has come from the purse-seine fishery.

In 2002, the total yellowfin tuna catch in the WCPO is estimated to have been 437,984 mt, the lowest since 1996 and down from the peak catch of 502,960 mt taken in 1998 (Fig. 2). The relatively low total catch during 2002 was largely due to a decrease in the purse-seine catch, which for 2002 was 171,767 mt (39% of the total). This catch was the lowest since 1996. In contrast, the EPO yellowfin purse-seine catch for 2002 (417,472 mt) was an all-time record. Nominal CPUE for purse-seine fleets generally show no overall trend but high inter-annual variability that is believed to be due to environmental variation that affects recruitment and catchability. The low catch rates observed during 2002 are considered unusual for an El Niño event.

The longline catches since 1990 (60,000–80,000 mt) have been well below catches taken in the late 1970s to early 1980s (87,000–

117,000 mt). The 2002 catch is estimated to be 77,177 mt, or 18% of the catch by all gears. Time-series of nominal catch rates for the Japanese longline fleet display high interannual variability and regional differences, with an overall decline since the early 1950s in the equatorial WCPO but little or no overall trend in more temperate regions. Time-series of standardised catch rates for this fleet also display regional differences, with large differences also seen between the different indices within several regions. The general linear model (GLM) based index displays similar (if sometimes smaller) trends to the nominal catch rates, while the indices based on the statistical habitat based method (SHBS) generally indicate smaller changes in biomass over time.

During 2002, the pole-and-line fisheries took 17,770 mt (4% of the total) while “other” fisheries (largely taken by Philippine and Indonesian fisheries) accounted for 171,270 mt (38% of the total).

Size of fish caught

The domestic surface fisheries of the Philippines and Indonesia take large quantities of small yellowfin in the range 20–50 cm. Purse-seine sets on floating objects (i.e. associated schools) generally take smaller fish than sets on unassociated or free-swimming schools, which

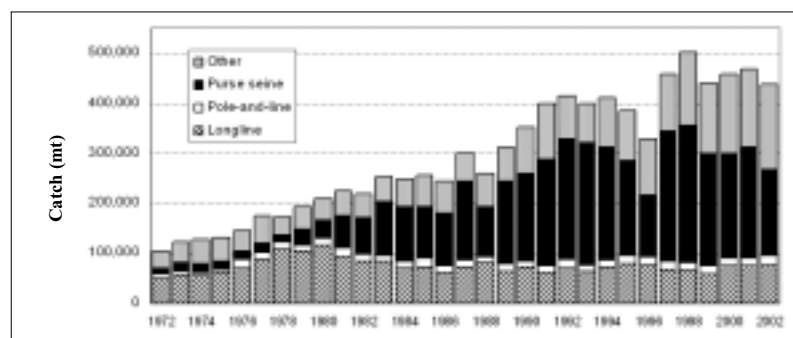


Figure 2: Annual WCPO yellowfin catch (mt) by gear

are often “pure” schools of large yellowfin. However, the size ranges of the yellowfin taken in associated and unassociated purse-seine sets vary from year to year. Yellowfin taken in unassociated purse-seine sets are of a similar size range to fish taken in the longline fishery and the handline fishery in the Philippines (both gears target adults in the range 80–160 cm). The purse-seine catch of adult yellowfin tuna is in fact higher than the longline catch in most years. There was a relative absence of medium-sized (60–100 cm) yellowfin in the catches from both the longline and purse-seine fisheries during most quarters of 2000 and 2001, although a “pulse” in this size range appears by the fourth quarter 2001.

Recruitment

For the GLM index, recruitment displays no overall trend since the early 1950s, while under the SHBS index, recruitment is estimated to have increased between the mid-1970s and the mid-1980s, with overall recruitment levels since that time being around twice the levels before this transition. The SHBS index also indicates that recruitment variability may have increased in recent years. Whether this change in stock productivity is real, and if so, whether it reflects a change (or a “regime” shift) in oceanographic conditions or is an artifact of the increased catch of juvenile fish taken in the surface fisheries over this period remains unclear.

Biomass

For the GLM index there is an overall declining trend in total biomass over time. The pattern

for the SHBS index is somewhat different, however, declining until the mid-1970s, increasing until 1990, after which time it decreased before increasing back to 1990 levels in recent years. Estimates of the current level of depletion of yellowfin in the WCPO indicate that the current biomass is 20–35% less than the level that would have occurred in the absence of fishing. However, depletion is greater for some regions,



notably the equatorial regions where recent depletion levels are near 50%.

Fishing mortality

Fishing mortality for both juveniles and adults is estimated to have increased continuously since the beginning of industrial tuna fishing, with significantly more rapid increases since the early 1990s. These increases are attributable to increased catches of juvenile yellowfin in purse-seine fisheries and catches in the domestic Indonesian and Philippine fisheries, together with the declines in overall biomass over the past decade.

Stock status

The assessment reviewed by SCTB16 reaffirms the result of the previous assessment that stated the WCPO yellowfin stock is presently not being overfished ($F_t/F_{MSY} < 1$) and that it is not in an overfished

state ($B_t/B_{MSY} > 1$). However, the stock is likely to be nearing full exploitation and any future increases in fishing mortality would not result in any long-term increase in yield and may move the yellowfin stock to an overfished state. While biomass-based reference points indicate that the long-term average biomass should remain above that capable of producing MSY if present catches are maintained, yield estimates indicate there may be limited potential to expand long-term

catches from the fishery at the current pattern of age-specific selectivity. The assessment also indicates that the equatorial regions are likely to be fully exploited, while the temperate regions are likely to be underexploited. While these spatial patterns of exploitation remain uncertain, if true, this may indicate the potential need for different management in different regions. Furthermore, the attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian fishery has the greatest impact, particularly in its home region. The purse-seine fishery also has high impact, particularly in the equatorial regions.

While recognising continuing uncertainties associated with the present stock assessment, the SCTB reiterates the previous recommendation that there be no further increases in fishing mortality (particularly on juvenile yellowfin) in the WCPO. If future evidence supports a shift to a lower productivity regime, a decrease in total catch would be anticipated in order to maintain the stock at sustainable levels.

Bigeye Research Group – summary statement

Key attributes

Bigeye tuna are a relatively slow growing species that mature at approximately three to four years of age. Bigeye are known to grow to about 200 cm and over 180 kg when eight years or older. They have a wide distribution: between 40°N and 40°S, and vertically between the surface and 500 m depth (occasionally to 1000 m) due to their tolerance of low oxygen levels and low temperatures. These and other characteristics make them less resilient to exploitation than skipjack and yellowfin tunas. There is no clear evidence of plural stocks in the Pacific and geographical distribution is known to be continuous throughout the ocean. On this basis, and considering the existence of two major surface fishing areas in the western and central Pacific and eastern Pacific, stock assessment has been carried out on two different stock hypotheses (i.e. atwo-stock hypothesis (western and central Pacific and eastern Pacific) and a Pacific-wide stock hypothesis allowing the extent of basin-scale mixing to be estimated. Large fish are caught mainly by longline, and these longline-caught bigeye are the most valuable among the tropical tunas. Juvenile fish tend to form mixed schools with skipjack and yellowfin, which results in catches by the surface fishery, particularly in association with floating objects. Natural mortality is estimated to be relatively low compared with other tropical species.

Recent developments in the fishery

The number of purse-seine vessels has exceeded 200 since the early 1990s. In more recent years, there has been an increase in the number of vessels flagged

by the Pacific Island countries while the number of purse-seiners in other nationalities has reduced slightly. There had been an increase in purse-seine catches of juvenile bigeye tuna associated with the increased use of the drifting FADs during the late 1990s. However, recent catches have fallen to some extent mostly due to a reduced use of drifting FADs since 1999.

Overall longline fleet size has been stable. The number of foreign vessels based in Pacific Island countries fell during the past six years, while the number of Pacific Island domestic vessels has increased since the early 1990s. The distant-water longline fleet has decreased to some extent, since some countries have reduced their number of distant-water longline vessels. The catch composition in the longline fishery has changed from bigeye, 25%; yellowfin, 55%; albacore, 20% in 1980, to bigeye, 30%; yellowfin, 35%; albacore, 35% in 2002, suggesting increased targeting of bigeye as well as albacore.

Trends in catch and effort

The total WCPO bigeye tuna catch in the 2002 was 108,000 mt, similar to 2001 and representing 62% of the total Pacific catch in the same year. Available

statistics (Fig. 3) indicate that 60% of the WCPO catch was taken by longline, and most of the remainder by purse-seine (21%) and by the domestic fisheries of Indonesia, Philippines and others (18%). The total catch of small bigeye tuna by the purse-seine fishery is uncertain, as they are not systematically separated from yellowfin at the unloading sites, nor recorded separately on fishing logs. The purse-seine catch in 2002, estimated through the statistical analysis of sampling data, continued to decline since the 1999 record high of 34,568 mt due to a decreased use of drifting FADs. There is also considerable uncertainty in the estimation of the Indonesian and Philippines catches due to the lack of (or limitations in) systematic sampling programmes. Nominal (unadjusted) CPUE for WCPO bigeye tuna derived from longline data indicated a sharp decline during the early stages of the fishery but has been fairly stable over recent years.

Stock assessment

Stock assessment was conducted using the statistical model MULTIFAN-CL applied to data for the WCPO as has been done in recent years. However, there are a number of differences in

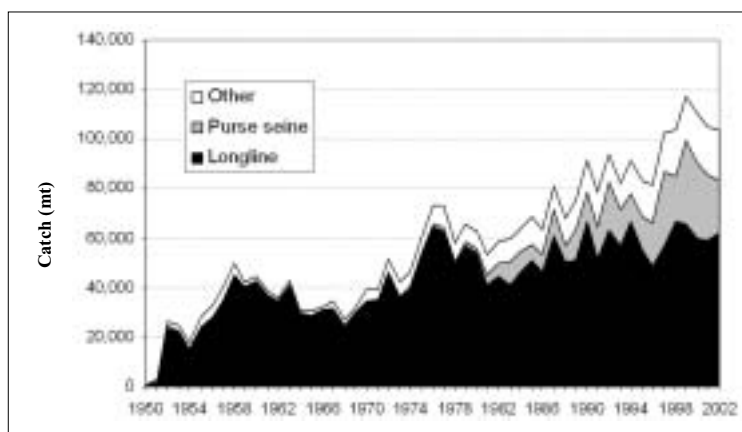


Figure 3: Annual WCPO bigeye catch (mt) by gear

methods and data used in the 2003 analysis from the previous years. Most important of these are the extension of data to 1950, including:

- the additional longline catch and effort data,
- disaggregation of size data into length and weight,
- definition of separate longline fisheries for the Taiwan fleet and mainland China fleet in the tropical regions,
- application of different methods in standardising longline effort,
- the incorporation of equilibrium yield projections, and
- the computation of a wide range of reference points useful for management purposes.

This year's assessment results were qualitatively different from last year's, although the trend of biomass was similar for the comparative period analysed last year. The largest difference, that was common in all runs made this year, was a sharp increase in recruitment from 1990. This appears to be directly related to increasing catches of small fish over the same period. It is not clear that the model, as formulated for bigeye, can distinguish changes in catchability from changes in recruitment. Consequently, this model behaviour raises questions regarding low recruitment estimates in the early years when catches were also low. The summary results of this year's analysis were given below, however, the Bigeye Research Group (BRG) considers these results should be viewed with caution because of this problem. The BRG decided not to select a single model to estimate standardised effort for the longline

fisheries. This is because the present application of habitat models relies on the assumption of a spatially and temporally invariant habitat preference. There is some evidence that this assumption may not hold, and further work on habitat-based standardisations is required. Therefore, the BRG decided to continue considering a range of standardisation methods until this issue was resolved. Also, the BRG considered that it is not appropriate to quote the absolute numbers of population estimates, and that qualitative statements on stock status and relative benchmarks should be provided.

Fishing mortality

There has been a consistent increase in fishing mortality (F) on juvenile and on adult age classes since the beginning of the fishery. The adult F increased very quickly from the beginning of the fishery and has been higher than juvenile F by 25–50% up until 1990. Fishing mortality for adult bigeye peaked in the mid-1990s. Juvenile F continued to increase and is at a similar level to the adult F in the most recent years. The impact of the fisheries on the stock is much higher in the tropical regions than in the subtropical regions, which is consistent with the distribution of the catch.

Biomass

Total estimated bigeye tuna biomass in the WCPO indicated a decline during the 1950s and 1960s of about 30%. Thereafter it has been fairly stable. Biomass then recovered during the 1970s and 1980s before entering a sharp decline in the 1990s

Recruitment

Generally, estimated recruitment indicates some fluctuation

but with an increasing trend since the early 1980s, reaching the highest level in 1999, which is about 2.5–3 times higher than in 1980. However, as noted above, this pattern may be an artifact related to surface fishery development and/or the lack of early size data. This issue requires further investigation.

Stock status

Bigeye assessment results for 2003 are both uncertain, and for key management benchmarks, inconsistent with the bigeye assessment presented at SCTB15. In particular, the SCTB15 assessment concluded that overfishing was not occurring ($F_{\text{current}} < F_{\text{MSY}}$), while 2003's assessment concluded that overfishing is occurring ($F_{\text{current}} > F_{\text{MSY}}$). Given that it is unlikely the true status of the bigeye stock has changed so dramatically, BRG cannot discount last year's assessment. Consequently, caution should be exercised in using the bigeye assessment results for management purposes until such time as these issues can be resolved.

The current stock status was assessed by the yield curve and a range of reference points. The analyses indicated that the current F is larger than FMSY. However, the current biomass remains higher than BMSY. In other words, overfishing is occurring, but the stock is not yet overfished because of the recent above-average recruitment.

Overall, the longline fishery has had the largest impact on the stock, and later development of the purse-seine fishery and increases in the Philippine and Indonesian catch have also had high impact on the stock. In this regard, the assessment results are consistent with those from a Pacific-wide assessment as well as the current status of the stock in the eastern Pacific. The cur-

rent level of exploitation appears not to be sustainable in the long term, unless the high recent recruitment is continued in the future.

Therefore, BRG believes that there should be no further increase in the fishing mortality rate for bigeye tuna, until the results are further confirmed.

BRG noted, however — while recognising the current uncertainty in the stock assessments — that all the stock assessment results conducted this year were more pessimistic than last year's. If further assessments confirm the concern derived from this year's results, the managers should consider practical management action to prevent further decline of stock.

Albacore Research Group – summary statement

Key attributes

Albacore tuna comprise a discrete stock in the South Pacific Ocean. Mature albacore (age at first maturity, 4–5 yr; ~ 90 cm FL) spawn in tropical and sub-tropical waters between about 10°S and 25°S during the austral summer, with juveniles recruiting to surface fisheries in New Zealand coastal waters and in the vicinity of the sub-tropical convergence zone (STCZ — about 40°S) in the central Pacific about two years later, at a size of 45–50 cm in fork length. From this region, albacore appear to gradually disperse to the north, but may make seasonal migrations between tropical and sub-tropical waters.

Albacore are relatively slow growing, and have a maximum fork length of about 120 cm. Natural mortality is low compared to tropical tunas, with significant numbers of fish

reaching an age of 10 years or more.

Recent developments in the fishery

Catch in 2002 reached 51,000 mt, which is the second highest in the post-drift net period. Since drift netting ceased in 1992, catches have predominantly come from troll fleets of New Zealand and the US south of 30°S, and by longliners which fish mainly between 10°S and 50°S.

Catches from Pacific Island countries' (PIC) longline fleets have increased in recent years (Fig. 4). In 2002 these fleets accounted for 50% of the total longline catch. The Taiwanese fleet, which has traditionally targeted albacore and has accounted for the majority of the historical longline catch, recently moved some of its activities to target seasonally northern albacore or bigeye in the equatorial waters of the WCPO. The albacore catch by this fleet has therefore fallen in recent years.

Trends

Catch and effort

CPUE has been fairly stable in the central zone (10°–30°S),

where catch rates from PIC fleets have tended to converge in recent years. The current CPUE in several PIC longline fleets is significantly less than the levels attained in the early years of these fisheries. In some cases, high CPUE has been maintained by expanding the area of fishing to the extremes of the EEZs and beyond. There has been a gradual decline in the catch rates in a number of fisheries. This decline has been gradual in some fisheries and stronger in other areas, particularly Samoa and American Samoa. However, the CPUE for the Samoan and American Samoan fleets remains higher than other fleets despite these declines. Some degree of convergence in CPUE is also noted for the New Zealand and US troll fleets, although CPUE for US vessels has generally been higher and more variable.

Sizes of fish

Longliners catch larger albacore, with the size distribution typically comprising a single multi-age-class mode with a modal length of 90–100 cm. Troll catches consist of smaller albacore, typically 50–85 cm in length. Size composition varies from year to year, but no trends are evident over the past five years.

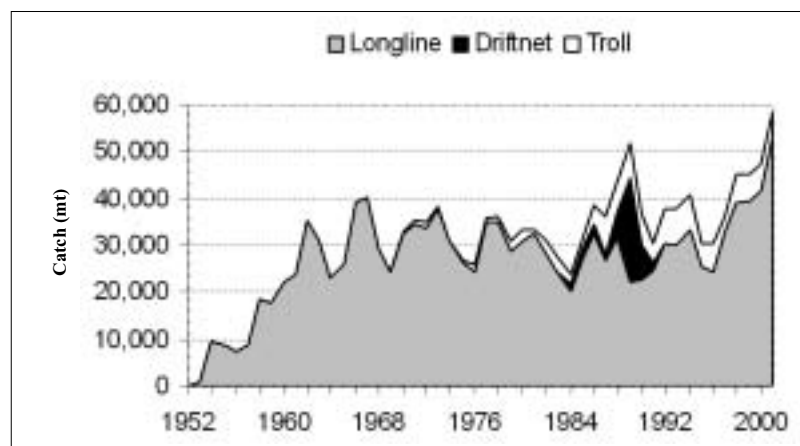


Figure 4: Annual WCPO South Pacific albacore catch (mt) by gear

Recruitment

Recent application of a high resolution environmental and population dynamics simulation model (SEPODYM) to South Pacific albacore has provided some preliminary results on the possible mechanisms for recruitment variability. Recruitment, as estimated by MULTIFAN-CL, appears to be negatively correlated with El Niño events, which may explain low recruitment rates in the 1980s and 90s.

Biomass

Biomass levels have largely reflected the variation in estimated recruitment, peaking in the late 1950s and late 1970s. Current biomass is estimated to be about half of the maximum estimated levels and about 60% of the estimated biomass in the early 1950s. Biomass is concentrated in the area south of 10°S.

Fishing mortality

Fishing mortality is higher for adult albacore than for juveniles, reflecting the predominantly longline exploitation. Total fishing mortality appears to be considerably lower than natural mortality. The impact of the fisheries on total biomass is estimated to have increased over time, but is likely to be low to moderate across a plausible range of model assumptions.

Stock status

The current stock assessment was conducted with MULTIFAN-CL. The fishery for albacore is unique in that it has exhibited no significant trend in catches over the period of 1960–1995. Due to the problems faced by all assessments conducted with limited stock data, which have been apparently exploited at only low exploitation rates over the period of the

fishery, the results obtained provide little information on the biomass of the stock. Improved results from this model would be expected if there were better return rates of tags placed on albacore. An analysis based on a Schaefer production model provided an estimate of MSY, but ARF believed that this methodology requires further review before it can be used to provide advice on stock status.

The assessment gave similar results to last year's assessment, with a low impact of fishing on biomass, and indicated that the current biomass is at about 60% of unfished levels. It is therefore unlikely that the stock is being overfished or is in an overfished state.

Billfish and Bycatch Research Group – summary statement

During SCTB16, BBRG discussed billfish catches and catches of other species, with a focus on mahimahi and wahoo.

Billfish

BBRG has a more varied perspective than the single species research groups. Issues include non-targeted catches in pelagic fisheries, protected species interactions and billfish catch by commercial and recreational fisheries. SPC's Oceanic Fisheries Programme (OFP) generates annual estimates of commercial billfish catches, but currently not on recreational billfish catches. A system for reporting catches by recreational fishing clubs in the WCPO was established by OFP. Ensuring that such data are collected and provided to OFP, however, requires considerable work, and it has not been possible to adequately cover this activity (for most countries) over the past year.

There were several papers and presentations on the biology and management of swordfish fisheries. Research by CSIRO has focused on developing an operational model for swordfish management in the Australian east coast longline fishery. It is thought that the swordfish stock is currently not overfished but a better understanding of the sustainable harvest is required. In the absence of a swordfish stock assessment, the operational model provides a framework for the evaluation of alternative harvest strategies.

Other studies by CSIRO have included the investigation of declines in catch per unit of effort (CPUE) of swordfish in the Australian east coast longline fishery, and age and growth studies for swordfish caught by this fishery. The CPUE study, using generalised linear models, investigated a number of different hypotheses for the decline in CPUE, including competition between vessels, fishing down of seamounts, and changes in fishing practices and/or fleet structure. The analyses supported the notion that there has been a sequential spatial depletion of the swordfish resource off the central east coast of Australia. However, the changes in observed CPUE do not appear to be supported by the hypothesis that these changes have been due to changes in fishing strategies adopted by fishers or oceanographic conditions on the fishing grounds.

The ageing study validated annulus formation indirectly in the second anal fin spines of swordfish from eastern Australia. Growth curves fitted to age-at-length data fell within the range of studies conducted elsewhere. A validation study of age-at-length for swordfish is still required. A study of factors affecting swordfish catch in

New Zealand's longline fishery was also presented. Targeting swordfish in this fishery is prohibited but swordfish are caught and retained by vessels targeting bigeye tuna. Various factors such as fleet type, area, season, operational characteristics, and environmental effects were found to have an influence on swordfish CPUE. However, the number of light sticks was found to have the greatest effect, and could increase swordfish CPUE four-fold. A collaborative project to develop an age and sex structured population assessment model for North Pacific swordfish was presented to BBRG. The model will address uncertainties in the current North Pacific swordfish stock assessment resulting from swordfish sexual size dimorphism, where females grow faster and larger than males.

Three presentations were made on marlin catches. The first, from the Australian Bureau of Rural Sciences, concerned interactions between longline and charter sportsfishing vessels taking striped marlin off the southeast coast of Australia. The study concluded that catch rates in both fisheries are likely to be predominantly reliant on the underlying abundance or availability of striped marlin. Some evidence for commercial targeting of this species was presented and a possible link to reduced charter fishery catch was discussed. The second was a study by the Japanese National Research Institute of Far Seas Fisheries (NRIFSF) of the vertical distribution of blue marlin CPUE in the Atlantic. The study showed that the vertical CPUE trends with respect to depth and temperature relative to the surface are not always consistent with the vertical distribution of blue marlin. The final presentation referred to an information paper on the ongoing tagging of recreationally caught billfish and gamefish.

Sharks and other species

There were two presentations on sharks. The first concerned a directed shark longline fishery in Papua New Guinea presented by the PNG National Fisheries Authority. This fishery has grown in importance in PNG and comprises nine freezer-equipped longliners that annually land about 1500 mt of dressed shark, most of which is exported along with the fins. Half of the catch comprises silky shark, and the fishery is managed under a shark longline management plan approved in 2002. NRIFSF presented information on Japanese purse-seine and pole-and-line tuna fisheries that make use of seasonal migrating whale sharks associated with schools of skipjack tuna. Fishing around whale sharks peaks between July and August and is concentrated in an area to the east of Japan.

A regional overview of mahi-mahi catches in various pelagic fisheries in the western and central Pacific was presented jointly by OFP and the Western Pacific Fishery Management Council. The overview also included depth descriptions of CPUEs and mean lengths of mahimahi and wahoo in pelagic longline and troll fisheries in the US flag Pacific Islands. A summary was made of the results from a dietary study of mahimahi, wahoo and lancetfish by OFP. The results showed that mahimahi consumed primarily epipelagic fishes, while wahoo consumed a mix of epipelagic and mesopelagic fish and molluscs. The main dietary items for lancetfish included a pelagic gastropod, epipelagic and mesopelagic fish and molluscs. Lancetfish were also noted to demonstrate a high degree of cannibalism.

OFP also presented a preliminary ECOPATH model of the

western Pacific warm pool ecosystem. A simulation run was shown where the current level of fishing effort was doubled for 25 years and resulted in declines of biomass of sharks, billfish, yellowfin and piscivorous fish, but an increase in the biomass of small scombrids. Little confidence could be placed in these results at present, but they demonstrated the type of simulations that can be conducted with the model. The limitations and weaknesses of the current model were discussed, as was its potential application for generating reference points for ecosystem-based fishery management.

Two studies of longline fishery bycatch were presented by the Australian Fisheries Management Authority (AFMA) and Japan's NRIFSF. The AFMA study evaluated bycatch reporting rates from logbooks versus those from observers. Non-commercial species and regulatory discards such as blue and black marlin appear not to be fully recorded in logbooks. Similarly, seabird and turtle bycatch appear to be under-reported, although for turtles, this conclusion may be confounded by the rarity of interactions. Observer coverage has been set at about 5%, a level sufficient to provide an accurate estimate of catch of most target and bycatch species.

NRIFSF presented a synopsis of its activities concerning shark, seabird and turtle bycatch. The main objectives for sharks include improving data collection, stock assessment and effective utilisation. NRIFSF is continuing an ongoing program of mitigation research to reduce interactions between seabirds and pelagic longline vessels. Apart from tori poles, other methods being tested include blue-dyed bait and weighted hooks. Results to date have been used to require longline

vessels fishing within 20 miles of Torishima Island, the main breeding site of the endangered short-tail albatross, to use two seabird mitigation measures. NRIFSF also has an ongoing research program for longline-turtle mitigation, including the use of circle hooks, and modification of bait and depth of set. Turtle conservation measures also include nesting beach protection and management in Japan for loggerheads, and in Irian Jaya for leatherbacks.

OFFP made a brief presentation concerning the development of an individual-based model for North Pacific loggerhead turtles. The model will be adapted from an existing model developed for skipjack. The model will be used to simulate oceanic foraging and consequent interactions with fisheries.

BBRG made the following recommendations.

1. A strong focus should continue to be maintained on monitoring regional billfish catches, both in commercial pelagic fisheries and from recreational fisheries.
2. Efforts should be made to improve observer coverage in WCPO pelagic fisheries in order to obtain more reliable statistics on bycatch, and to permit risk analysis on bycatch species. Prior to implementation, the objectives for an observer programme and the process by which these objectives can be met should be clearly identified. The risk assessment currently being conducted to set objectives for an observer programme for the Australian east coast swordfish fishery may be a useful paradigm for this process.
3. Participants should strengthen data collection on turtle

interactions in pelagic fisheries in order to refine estimates of the interaction problem, due to concerns regarding the population status of Pacific turtles. BBRG also recommends closer collaboration and liaison by participants with the appropriate government and regional agencies to ensure that turtle nesting sites are inventoried, and non-fishery related impacts on turtle populations are clearly identified and addressed. This will place fishery impacts on turtle populations in context. Some of this broader analysis may be done by other organisations, but SCTB should remain informed of the issues and be able to evaluate information and analyses as they are used to set management policy.

4. A watching brief should be maintained on other bycatch issues as they arise (e.g. future developments under the FAO International Plan of Actions (IPOAs) on seabird-fishery interactions, and on shark fisheries).
5. Additional research should be conducted on stock structure and stock boundaries of species of interest to BBRG.
6. Data collection programmes should be modified to better report bycatch species.

Fishing Technology Working Group – summary statement

The Fishing Technology Working Group's (FTWG) work was presented and discussed during a preparatory meeting and during the SCTB 16 plenary session. Brief summaries emphasising new developments by national and distant water representatives were provided, emphasising new developments in

regional fisheries, expansion/contraction of fishing effort, port sampling and observer programmes and developments in shore-side processing facilities. A common theme throughout the major purse-seine fleets was a continued and self-enforced reduction in FAD-associated sets due to the tendency of these sets to produce smaller, lower value catch compared with unassociated schools. Industry efforts to reduce overall effort and catch by self-enforced, extended port calls and efforts to control illegal, unreported and unregulated (IUU) fishing were also noted.

A review of the Palau Arrangement was provided to FTWG, detailing numbers of agreed and reported purse-seine vessels that may operate within the region in categories of multilateral, bilateral foreign, domestic locally based, new bilateral, and special arrangements. The "new bilateral" category allows access to vessels from China and the EU while "special arrangements" were established to accommodate additional purse-seine vessels from the EU, China and the Philippines. As of April 2003, 194 vessels had been licensed and were operating in the region.

The Palau Arrangement effort cap of 205 vessels was established in 1992 as a per vessel limitation on total purse-seine effort in the WCPO. While efforts to precisely quantify increases in vessel efficiency have not yet been realised, it is widely recognised that effective fishing effort in purse-seine fisheries has been increasing steadily.

In this regard, the work of the FTWG was recognised as essential, and that work toward quantifying increases in effective fishing effort in both long-

line and purse-seine fisheries should be a priority task. The group presented work toward identifying key components of increasing efficiency in fleets and the development of historical timelines of the introduction of key gear and targeting practices by regional purse-seine fleets. Work along these lines will continue with cooperation from regional and distant-water fishing nations (DWFN) agencies.

Additional presentations and inter-sessional work concentrated on training materials for regional and national port sampling and observer programmes to better define advances in fishing power and the accurate reporting of species-specific catch and effort. FTWG presented work that documents and characterises the historical development and current status of the latest technology available to regional purse-seine vessels, and this work will be expanded to include longline gear and fleets. Improved reporting of bigeye landings, especially from mixed catches by purse-seine fleets was recognised as a broad, cross-cutting measure of high priority to the region. FTWG supported these efforts with the development of an identification key for purse-seine caught bigeye and yellowfin for training purposes.

Due to the ecological and resource implications of FAD utilisation, FTWG monitors recent developments in both

large-scale anchored FAD arrays and the use of drifting FADs by regional purse-seine fleets. The large numbers of anchored FADs supporting purse-seine operations in PNG as well as the means to monitor and regulate these FADs were presented and discussed.

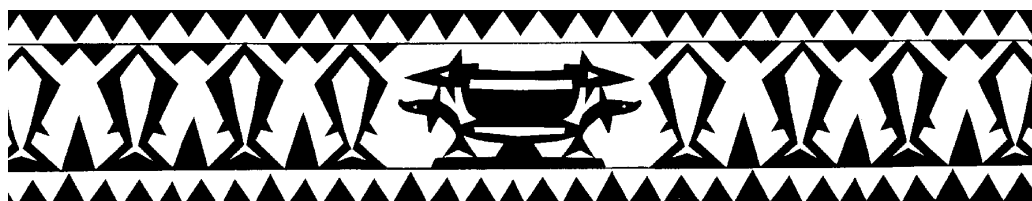
The application of innovative technology and fishing methods to reduce bycatch is a specific FTWG task. FTWG presented information on proposed and ongoing efforts to reduce purse-seine bycatch of undersized tuna and associated finfish bycatch, as well as gear related to bycatch reduction and improved targeting in longline fisheries.

Several critical issues that may be directly addressed by the Terms of Reference of FTWG arose during SCTB16, such as estimating effective effort for catch rate standardisation, potential gear related methods to reduce juvenile bigeye mortality, and technology issues related to estimating harvesting capacity in regional fisheries. FTWG will actively pursue these priority activities and related studies inter-sessionally, with results presented to SCTB.

Methods Working Group – summary statement

The Methods Working Group (MWG) had two major tasks for SCTB16. The first task was to carefully scrutinise the MULTI-

FAN-CL assessments of yellowfin and bigeye tunas. Lack of reliable fisheries data, in particular size-frequency and fishing effort from Indonesia and the Philippines is a continuing concern in both assessments. The influence of different methods of effort standardisation emerged as an additional source of uncertainty in all stock assessments, especially for yellowfin and bigeye. The influence of recently high catches of juvenile bigeye in the purse-seine fishery on high estimates of recruitment is a major uncertainty in the bigeye assessment. The second major task of MWG was a comparison of the performance of different stock assessment methods against “data” from an operational model with known properties. Seven stock assessment methods were tested against 40 different realisations of five different fishery scenarios of increasing complexity. Time did not allow completion of this task (effectively an analysis of 1400 different stock assessments) but preliminary results indicated that the performance of the stock assessment methods varied widely. The MWG also compiled a list of general criteria or principles to assist fishery managers in selecting a stock assessment method. Finally, MWG prepared a table illustrating the general effects of alternative fishery management actions both on stocks and on the industry under different stock conditions.



■ FISHERIES DEVELOPMENT SECTION

The French version of "Horizontal longline fishing, methods and techniques — a manual for fishermen" has been finalised and distributed. The content of the manual was described in Fisheries Newsletter #105. This manual is available in hard copy or on the section's website at <http://www.spc.int/coastfish/publications>.

Deep-water snapper fishing trials and training in Solomon Islands

In mid-July 2003, Fisheries Development Officer, William Sokimi, commenced a new assignment in Solomon Islands. The objective of this project was to conduct workshops in three locations covering:

- the construction and use of deep-water snapper fishing gears and techniques;
- the use of mid-water fishing gears and techniques used in association with FADs;
- sea safety and small boat operations; and
- the correct handling, processing and preservation of the catch, with a focus on export.

William was assigned to work with several of the rural fishing centres (RFCs) under the support of the EU-funded, Rural Fisheries Enterprise Project (RFEP).

The objectives of RFEP were specifically focused on establishing improved access to markets; diversification of RFC activities, and maintaining adequate and sustainable fish supplies to the fish centres. The five main activities pursued by RFEP were to:

- improve management to RFCs;
- establish regular transportation from the RFCs to

Honiara and onto local and overseas markets;

- create a loan fund to enable enterprising locals to purchase boats and fishing related equipment;
- establish a marketing unit to facilitate viable marketing of the fish products; and
- establish improved resource management and fishing technology.

The fishing centres covered under RFEP are Afio (West Marasike) in Malaita Province; Bahana (Kia) and Tatamba in Isabel Province; Seghe (SE New Georgia Island) in Western Province; and Semeghe (Florida Islands) and Yandina (Russell Islands) in Central Province.

Once William arrived in the Solomon Islands, meetings were held with RFEP staff to schedule training at each location based

on staff readiness. Initially, three fisheries centres were to be assisted: Seghe, Afio and Semeghe. As the project progressed, however, it was decided that a fourth fisheries centre, Yandina, would also benefit; this work was carried out in October 2003.

Vessels and equipment used during the project

A standard package for fishing gear and fishing vessel was covered under the RFEP loan scheme. From this package a fisherman could select the items that he wanted to draw a loan for. Most RFC fishermen opted for the whole package, while a few who have their own vessels requested loans for vessel accessories. The type of vessel covered under the RFEP loan scheme is a 6.5-m long (21 ft) round cabin 10 mm thick fibreglassed moulded boat (Fig. 1) built by Auaua Industries of Honiara. The fishermen were



Figure 1: Vessel package most commonly purchased under the RFEP loan scheme

given several choices of outboard engine for their boats. Most loan recipients requested the Yamaha Enduro 15 hp long-shaft outboard engine, while several fishermen chose the Suzuki 15 hp long-shaft, Yamaha 30 hp long-shaft, and the Yamaha 40 hp long-shaft. Each vessel was equipped with a standard fishing gear package consisting of:

- 3 Samoan hand reels with 500 m of 115 kg (250 lb) test monofilament lines;
- 300 m of 7 mm polypropylene anchor rope;
- two grapnel anchors constructed from 10 mm rebar;
- 4 rebar sinkers x 1 kg each;
- 50 hooks (11/0, 12/0 13/0);
- 10 three way swivels;
- 2 raincoats;
- 1 drinking water container;
- 1 container with 1 parachute flare;
- 1 orange smoke signal and 1 hand-held flare;
- 1 kerosene lantern; and
- 1 torch.



The iceboxes used by the fishermen are owned by the RFC at each location. They are made of moulded hard plastic and have a volume of 250 litres. (Fig. 1).

The SPC project colour plotter and sounder (Furuno GP-1610-CF) was mounted in the bow of the fishing vessels at each location using a 12 volt wet cell car battery for power (Fig. 2). The sounder was moved from boat to boat so that all fishermen could be instructed in its use. The transducer was mounted on a pole, and secured in position using monofilament line (Fig. 3).



Figure 2 (top): Mounting and power supply for the project echo sounder

Figure 3 (bottom): Mounting of the echo sounder transducer

Training and fishing activities

In classrooms sessions, William instructed the fishermen on the use of fishing gear and techniques. A display of the gear, including sea safety gear, was set up as part of these sessions (Fig. 4). Following the theory, there were practical sessions on fitting together gear and at-sea fishing trips. The at-sea component of the training was the most important, as the fishermen were able to implement and practice the skills discussed in the classroom.

Many important areas were covered during the training at each location. These included:

- carrying out bottom surveys of the deep-water fishing grounds using an echo sounder and a lead line to determine the potential of fishing grounds and the type of bottom (coral growth, sandy, dead coral, etc.);
- assessing suitable FAD positions and deploy a FAD in Afio;
- training fishermen and their associates who have been issued loans under the RFEP loan scheme to conduct efficient boat operations;
- small fishing business management;
- deep-water fishing methods that focus on “quick turn around” practices;
- suggesting and demonstrating alternative fishing methods such as mid-water fishing techniques (vertical long-line, palu-ahi and ika-shibi) and night fishing methods using light attraction;
- assisting fishermen in setting up their vessels for maximum working efficiency;
- working with fisheries centre managers to suggest and implement improvements to their current shore-side operations that would facilitate the fishermen in their activities as well as contribute to a smoother and more efficient running of the fisheries centres; and
- correcting on board handling, processing and preservation of deep-water snappers and tuna for the export markets.



William's first training location was at the Seghe fisheries centre in Western Province. He spent 31 days at this location, with 30 overnight trips made by the five Seghe fishing vessels. Usually three boats fished together, with William on one of them. He then fished on a different vessel the next trip. Overall the catch from the 30 trips was 1172.5 kg, with a gross income value of SBD 5955.10. The catch consisted of many deep-water snapper species with the odd large ruby snapper (*Etelis carbunculus* — Fig. 5).

Figure 4 (top): Display of fishing and sea safety gear used in classroom sessions

Figure 5 (bottom): A large ruby snapper being landed at Seghe

Eighteen fishermen were trained, five of whom were issued loans under the RFEP loans scheme, eight who served as boat crew, and five local fishermen who used their own vessels on fishing trips. The trips and catch from the fishermen with their own vessels are not included in the above figures for this location.

The second project location was Afio in Malaita Province. William had 14 days in this location with 12 overnight fishing trips made by four of the 12 fishermen issued with RFEP loans. Again, several boats fished together with William making six trips and rotating between the vessels on each trip. This resulted in a catch of

731.8 kg, with a gross income value of SBD 4241.88. Ruby snapper and flame snapper (*Etelis coruscans*) made up nearly half of the catch at this location (Fig. 6). Thirty-two fishermen were trained at this location, included 8 of the 12 fishermen issued with RFEP loans and 24 locals who were selected by the boat owners to be crew.

Semeghe in the Central Province was William's next location. Seven overnight fishing trips were made over 15 days by four of the five RFEP loan fishermen. The boats fished individually, so William went out on all seven trips. The total catch was 404.1 kg, with a gross income value of SBD 2078.9. Fifteen fishermen, of which five were boat owners,

and 10 crew were trained at this location.

Conclusions

Although adverse weather conditions initially affected the results at the start of the project, there were better returns towards the end of the project, which resulted in the fishermen becoming more confident in the management of their vessels and their fishing operations. At the start, when faced with bad weather in open fishing grounds, the fishermen would return to base. When faced with bad weather, towards the end of the project, the fishermen returned to sheltered waters to carry out night fishing using light to attract fish. The target species at night was kingfish (*Scomberomorus commerson*), which fetched Grade 1 price on the market.

There are two other main constraints faced by the fishermen at each location. First, RFCs are still confronted with shipping problems. Irregular shipping schedules make it difficult for the centres to confidently store and export fish to Honiara. Second, the unreliable fuel supply and the exorbitant prices charged by local merchants, increase the cost of operations. In addition, when the fuel sold by the local merchants runs out, fishing operations cease. The fisheries centre management and the fishermen need to develop a solution that assures consistent fuel supplies at competitive and realistic prices.



Figure 6: Catch consisting mainly of ruby snapper at Afio

Advancing domestic tuna fishing in Tokelau

Fisheries Development Adviser, Lindsay Chapman, visited Tokelau for two weeks in September to work with the Forum Fisheries Agency and other SPC sections in the initial stages of a tuna development and management plan for the

country. The main focus of the trip was to meet with different stakeholders, such as the taupulega (Council of Elders) and other groups at each of the three atolls. Travel was by the inter-atoll vessel, M/V Tokelau.

Three or four days were spent at each atoll. After the welcoming ceremonies, meetings commenced with the taupulega and other groups.

In addition to his work on the tuna development and management plan, Lindsay also per-



Figure 7 (top): Longline vessel purchased by local businessman in Tokelau

Figure 8 (middle): Four new aluminium dinghies being delivered to one of the atolls in Tokelau

Figure 9 (bottom): Kim (right) interviewing the head of a household on Atafu with translation assistance from Ms Malia Daleb (left)

formed duties pertaining to a domestic tuna fishery development project that is planned with funding from UNDP. Lindsay worked through the logistics of implementing such a project, and worked with staff of the Natural Resource and Environment Unit in Tokelau to assess the current infrastructure in place for the project.

Tokelau has six alia-type catamarans that are rigged for tuna longlining, although the boats and gear need to be upgraded to bring them into proper fishing condition. Two of the three atolls (Fakaofu and Nukunonu) have commercial freezer complexes, although they have not been used. This equipment will form the basis of the tuna longline component of the project. In addition to the six community-owned vessels, a local businessman has purchased a similar vessel to operate out of Nukunonu (Fig. 7). This vessel and its crew will be included in training activities for this atoll.

Another component of the domestic tuna fishery development project is the implementation of a FAD programme, which will be funded by the Government of Tokelau. FADs will assist subsistence fishermen at each atoll by increasing catch potential while reducing operating costs. It is hoped that the FAD programme will commence in early 2004 as the number of small-scale, outboard-powered craft in Tokelau is steadily increasing (Fig. 8).

In support of the upcoming FAD programme for Tokelau, a baseline household fishing survey was conducted at each atoll to document current fishing practices. Ms Kim Des Rochers from SPC accompanied Lindsay to Tokelau, specifically to assist with the community surveys. The questionnaire was the same as the one used in Niue and Cook Islands. The only differ-

ence was that for Tokelau, the FAD section of the questionnaire was removed, as there are currently no FADs in Tokelau waters. An additional question was also added on the processing and preservation methods used.

The surveys were conducted at each atoll by either Kim or Lindsay with assistance from local staff to translate when language became a problem (Fig. 9). Some of the local staff who had assisted in the surveys, Mr Mose Pelasio and Ms Fenuafala Faafoi conducted some of the surveys by themselves.

Table 1 summarises the data collected from the community surveys. As can be seen, 153 households were surveyed: 46 on Atafu, 58 on Fakaofu, and 49 on Nukunonu. In comparing this with the number of households in the 2001 Tokelau census (83 on Atafu, 80 on Fakaofu and 66 on Nukunonu), the coverage ranged from 55.4% on Atafu to 74.2% on Nukunonu. The actual per cent coverage was probably higher than this, as it was reported that some families had departed Tokelau, while others had joined households.

From the households surveyed, only one family, a retired widow, was not involved in any fishing activity, although extended family kept her supplied with fresh fish. When looking at the ownership of boats and canoes, the surveyors had to distinguish between the owner of each boat and those that fished on or borrowed them from time to time. It was interesting to note the small numbers of canoes at two of the atolls, where the local's purchase imported aluminium dinghies, partly due to the shortage of suitable timber for making canoes, but also because of convenience.



Table 1: Summary of the data collected during the community survey conducted in Tokelau

Atoll	No. of h/holds surveyed	No. of people covered by survey	No. of people per h/hold	No. of h/holds fishing	% of h/holds fishing	No. of canoes	No. of boats	No. of h/holds fishing outside reef	% of h/holds fishing outside reef
Atafu	46	299	6.5	46	100.00%	31	37	32	69.60%
Fakaofu	58	320	5.5	57	98.30%	3	86	47	82.50%
Nukunonu	49	280	5.7	49	100.00%	4	56	30	61.20%
	153	899	5.9	152	99.30%	38	179	109	71.70%

American Samoa training

Lindsay took advantage of travel arrangements on the Tokelau trip, and made a small detour to American Samoa for four days. The Department of Marine and Wildlife Resources (DMWR) had officially requested technical assistance from the Fisheries Development Section to set up a training programme for local fishermen based on their identified needs. This was partly a response to the downturn in the tuna longline fishery in the area, which resulted in many fishermen tying up their alia catamarans (Fig. 10) while they look to other fishing activities.

To identify training needs, DMWR staff arranged a meeting

with local fishermen. During discussions some fishermen mentioned that they were now looking at the deep-water snapper fishing and small-scale mid-water fishing techniques used in

association with FADs. This was mentioned by those fishermen who were displaced from the tuna longline fishery. These methods will be the focus of workshops in early 2004.



Figure 10: Alia tuna longliners tied up in American Samoa

Contribution to Standing Committee on Tuna and Billfish 16

In July, Fisheries Development Officer, Steve Beverly attended SCTB16 in Mooloolaba, Queensland, Australia as part of the Fisheries Technology Working Group (FTWG). During the plenary session and in a working group session, FTWG presented the latest in tuna fishing trends and technology so that the region's fisheries scientists were made aware of technological trends in the fishery. Steve's presentation was on a new, and as yet untried, bycatch mitigation technique for the tuna and

broadbill swordfish longline fisheries. The technique involves setting all the hooks in a longline at a prescribed depth, which is below the depth, where bycatch species, such as turtles, are normally encountered, and down to depths where the most sought-after target species, such as bigeye tuna, are found.

The current setting technique (Fig. 11) sets the hooks at random depths along the catenary curve in each basket of mainline, whereas the new setting

technique uses weights at either end of each basket of mainline to sink the ends down to a prescribed depth. Blank sections of mainline supported by two additional floats will keep the long sections of mainline from tangling. The mainline will actually act as a floatline so no new gear is needed other than lead weights. The Fisheries Development Section is currently seeking funding so that fishing trials can be carried out to test the new approach.

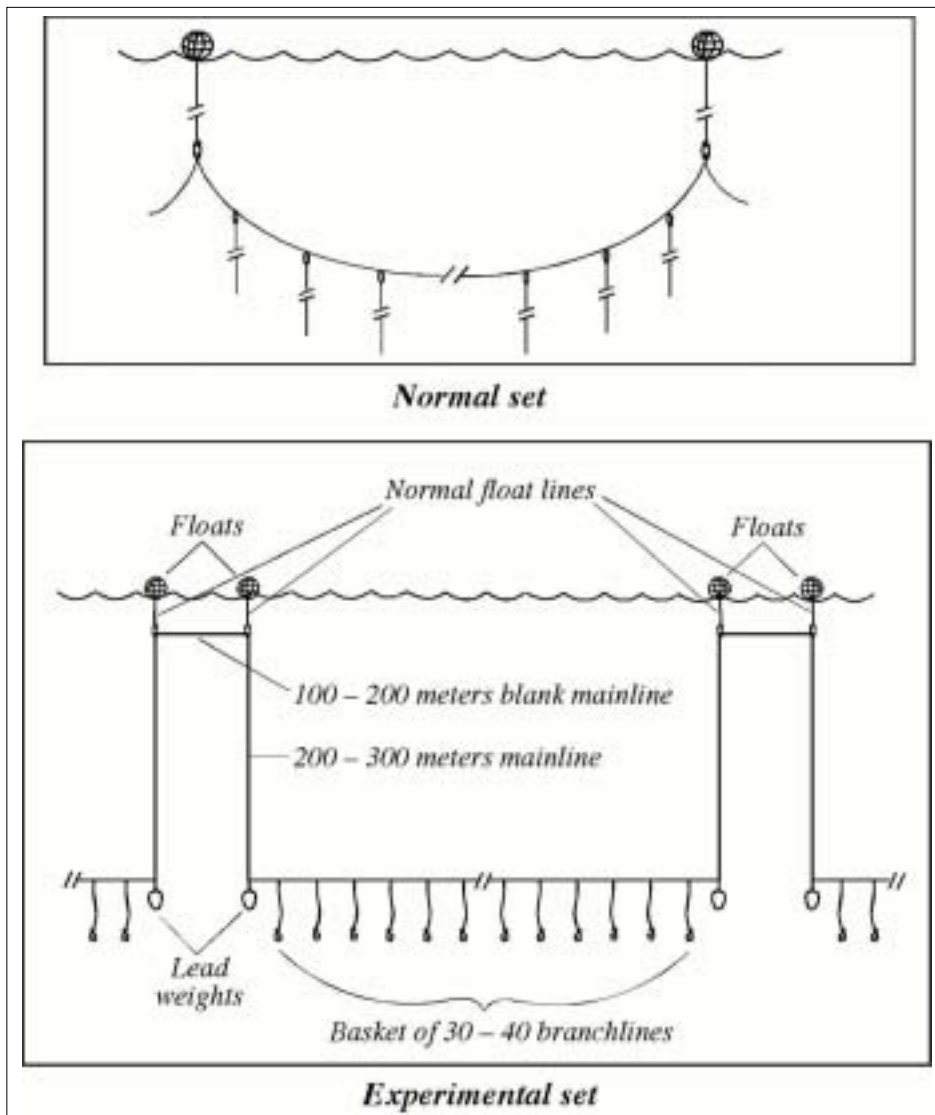


Figure 11: Schematic diagram of a normal set and the experimental set

Assistance provided to New Caledonia longline operation

In September, Steve completed an outstanding request for technical assistance from New Caledonia. Boat construction, repairs and timing had caused this project to be postponed several times. Eventually, one longline fishing trip was carried out on the New Caledonia longline boat, F/V Warren (see *Fisheries Newsletter* 98 and 99).

Before the fishing trip, Steve downloaded sea surface height (SSH) and sea surface temperature (SST) charts for the waters around New Caledonia from the Internet (Fig. 12) for 24/09/03. Steve instructed the vessel's captain on how to look for temperature breaks using these charts as guides. On the second day of fishing a good temperature break (1° C over a ten mile distance) was found, which resulted in a good catch of yellowfin

tuna. The temperature break was about 120 nm south of Noumea, between the high and low spot on the SSH, chart cen-

tred at 24°S and 167°E. Almost 100 fish, mostly yellowfin tuna, were caught on this temperature break during two sets.

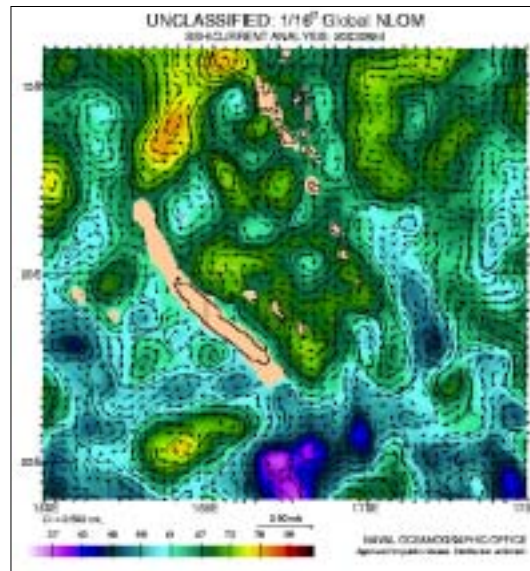


Figure 12: Sea surface height and current analysis for 24/09/03

FAD research project update

Three project FADs were lost during the third quarter of 2003, all of them in July. Two of these were the last of the galvanised wire cable upper mooring FADs, one off Niue after 531 days (17.5 months) and the other off Rarotonga after 463 days (15 months). These two FADs were expected to be lost given the fate of the other four FADs of this design.

The third FAD that was lost had 100 m of nylon rope as the upper mooring, spliced directly onto the polypropylene rope lower mooring line. The FAD was on station for 523 days (17 months) before failure. The nylon rope was badly hockled at a depth of around 90 m (10 m above the connecting splice), which was

the point of mooring failure (Fig. 13). Niuean fishermen noted that in strong currents, the floats on this FAD were pulled under water and the mussel float on the end would stand upright in the water and spin.

There are currently seven of the initial 15 FADs still on station.

As of 1 November 2003, these FADs have been in the water from 20 to 21 months in Niue, and 18 to 19 months in the Cook Islands. In addition, the three replacement FADs that were deployed, one at each of the three locations in May/June 2003, are all on station.



Figure 13: Hockling at around 90 m depth caused mooring line failure

■ COASTAL FISHERIES MANAGEMENT SECTION

Progress on the Regional Fisheries Management Strategy

A significant focus of the Community Fisheries Management (CFM) Section's work over the last few months has been on the Regional Fisheries Management Strategy and the process of familiarising countries with the strategy. Following the regional meeting in Nadi, and the mission to several countries of the region that followed, the strategy received the support of the directors of fisheries agencies at the Heads of Fisheries meeting in Noumea in July 2003. The strategy highlights the main problems faced by various fisheries sectors in the region and identifies urgent priority areas.

The major problem areas identified in the strategy included the depletion of resources due to overexploitation, the lack of relevant legislation and policies, and the associated problems of enforcement. Use of overly efficient fishing gear, the move to

commercial fishing, the inability of fisheries agencies to deal with the problems because of resource constraints, and a lack of data to allow for efficient management were also identified.

Major needs areas identified included:

- management strategies to address overexploitation of resources,
- more relevant and up-to date legislation and policies of coastal resources,
- data or statistics on inshore fisheries to ensure efficient management and development,
- training on acquisition of scientific and socioeconomic data,
- the need for capacity building within countries, and

- the need to address the increasing use of detrimental fishing practices.

The need to include women and other sectors of communities and the need for the exchange of expertise and officers within countries and to SPC were also identified under capacity building initiatives. Training and human resource support in priority areas were clearly identified as urgent work areas to be addressed by the CFM Section.

The identified needs and recommendations from the strategy will direct the work of the CFM Section and will form the basis of collaborative work with other agencies, including NGOs, institutions and regional organisations working on coastal resource management and other related areas, and with other SPC programmes.



CETC Fisheries Module Suva, July 2003

SPC's CFM Officer, in collaboration with staff from the University of the South Pacific, organised and coordinated a one-week fisheries module, that formed part of the CETC course in July. Tony Chamberlain, Johnson Seeto, Jone Maiwelagi and Jese Verebalavu made up the USP resource team for the

module. The CFM Section's contribution to the course focussed on gender participation in fisheries, especially in community-based coastal management initiatives.

The use of participatory learning tools for gathering information and creating awareness and

teaching was also introduced to CETC participants. The 16 women who attended the fisheries module especially enjoyed the field experience out on the reef and later preparing their catch. More time should be devoted to this module given the importance of the fisheries sector to island countries.

Gender in Fisheries Writers Workshop University of the South Pacific, Suva, July 2003

The workshop, held in Suva in July this year, brought together individuals working on gender and fisheries issues in the region. SPC's Coastal Fisheries

Programme provided resource persons and technical advice on the project, which is coordinated by Dr Joeli Veitayaki of USP.

The outcome of this initiative is the documentation of case studies on gender in fisheries participation in the region.



Palau Sub-regional Workshop on Strengthening Coastal Fisheries Legislation in Pacific Island States

The CFM Officer attended the Sub-regional Workshop on Coastal Fisheries Legislation in Koror, Palau from 7-10 October 2003. The workshop focused on aquaculture, fish health management, and fisheries co-management. Countries represented at the meeting included the Marshall

Islands, Nauru and the Federated States of Micronesia. The workshop was the initial step in an FAO project in which coastal legislation and policies will be reviewed and assessed. This acknowledges the importance of legislation in management and development work

within coastal areas. SPC's Coastal Fisheries Management Section is collaborating closely with FAO on this initiative and presented its strategies and planned work on coastal management in the region to workshop participants.



120th Western Pacific Regional Fisheries Management Council Meeting

The 120th Western Pacific Fishery Management Council meeting, held in Honolulu from 20-23 October was attended by the Coastal Fisheries Management Officer who was a keynote

speaker. She discussed SPC's strategic plans for coastal fisheries management in the region, encouraging collaboration and support from the Council. SPC's CFM Section is especially look-

ing at data collection and statistical work, and the areas of regulations and policies as possible areas for collaboration.



Tokelau Country Visit August-September 2003

Both officers of the CFM Section visited Tokelau from 28 August to 12 September. The CFM Adviser conducted a preliminary assessment on the feasibility and needs of community-based management in Tokelau, which was requested from the director of fisheries. The CFM Officer was part of a Forum Fisheries Agency/ SPC team that is developing a Tokelau National Tuna Management and Development Plan. FFA is the lead agency on this initiative, while SPC is providing technical input to the plan.

Both the CFM Adviser and Officer spent three to four days on each atoll, meeting with various sectors of the community, including the taupulega (Council of Elders), and men's, women's and youth groups. Discussions focused on tuna resource development and management, and the possible associated social implications and gender issues.

The Tokelauan community strongly support the Tuna Management and Development Plan, with many realising the importance of economic development

that will result from developing this industry. Tuna represents one of the only potential areas for employment for people and so received support from all sectors of the community.

The various community groups also realised the importance of putting into place some management measures for coastal fisheries. Although there was still an abundance of seafood, especially finfish, there were noted decreases in some species such as giant clams and land crabs.



■ AQUACULTURE SECTION

Kiribati celebrates its first cultured black pearl harvest

SPC's Aquaculture Adviser, Ben Ponia, was present to witness the first harvest of cultured black pearls on Abaiang Atoll in Kiribati. This special event was celebrated by the visit of a delegation of government officials

led by the President and the Australian High Commissioner.

The pearl harvest occurred nearly a decade after government began plans to trial pearl farming. The driving force behind

the pearl harvest has been the Australian Center for International Agricultural Research/ Kiribati Ministry of Natural Resources Development (ACIAR/ MNRD) Pearl Oyster project, a collaborative effort between the

Kiribati and Australian government involving Kiribati Fisheries Department and James Cook University in Australia.

To overcome the lack of wild pearl oyster stocks, the project constructed a pearl oyster hatchery that has produced all of the pearl oysters used for farming. The hatchery is one of the most productive in the Pacific with up to 60 per cent of the oyster larvae developing into juvenile oysters (spat). From the hatchery the spat are shipped to the

lagoon nursery at the project farm on Abaiang atoll. Currently there are about 40,000 pearl oysters being cultivated.

The harvest consisted of 200 grey and gold coloured pearls, which came from 1000 oysters that were seeded two years ago. Several thousand oysters were also seeded during the current harvest, which is a major milestone for Kiribati pearl industry in terms of research and development. Considerable effort is still required, however, because

the next phase — commercialisation — has begun. While in Kiribati, SPC's Aquaculture Adviser met with ACIAR/MRND project leaders and industry stakeholders to determine the types of assistance that SPC can provide. For example, ongoing institutional support, training attachments, awareness raising, and advice such as economic modelling were identified.



Black pearls from Kiribati's first harvest display a interesting array of colours

New SPC Aquaculture Officer recruited

In July 2003, Mr Satya Nandlal joined SPC as the new Aquaculture Officer. At the time of his recruitment, Satya was a PhD fellow at the USP Institute of Marine Resources. Prior to that he was for many years an employee of the Fiji Department of Fisheries.

Satya brings a broad range of skills and experiences to the organisation. During his employment with the Fisheries Department



he oversaw operations at Nandroloulou Aquaculture Research Station, a leading centre for freshwater aquaculture. He also oversaw the operations at Makogai Island mariculture station, which is well known for its giant clam work. A specialist at

tilapia and shrimp farming, at both the artisanal and commercial levels, his efforts have helped establish these commodities as two of the most significant aquaculture species in Fiji Islands.

The recruitment of Satya will enable SPC to be more proactively involved in direct technology transfer to farmers and extension activities.



SPC Aquaculture Officer participates in meeting on ecological risk assessment of genetically improved fish

Genetic improvements in commercially valued cultured fish are yielding results, and strains are being disseminated throughout the Asia-Pacific region. The improved strains are providing significant social and economic benefits, particularly to poor people in rural communities. However, these stocks should be properly managed to minimise the risk to the biodiversity of the aquatic environment. Hence, before introductions are made, the risks should be properly assessed and relevant policies and protocols put in place.

the “Dhaka Declaration on Ecological Risk Assessment of Genetically Improved Fish”.

While in Dhaka, SPC’s Aquaculture Officer, Satya Nandlal, met with senior members of

INGA and the WorldFish Center. One matter under joint consideration is the possibility of SPC joining the INGA network. INGA is a lead facility for aquaculture genetics.



Satya Nandlal, SPC Aquaculture Officer (left) on a tour of fish farms in Bangladesh

The expert consultation meeting, organised by the International Network on Genetics in Aquaculture (INGA) and the WorldFish Center, was held in August in Dhaka, Bangladesh. Fifty-four participants from 20 countries attended the meeting, and represented various national and regional organisations. The main recommendations of the meeting will be published in

SPC attachments provide valuable contributions and expertise

Jacob Wani, Aquaculture Manager at the National Fisheries Authority (NFA) in Papua New Guinea, spent five weeks with SPC’s Aquaculture Section. Jacob helped produce SPC guidelines for the introduction and translocation of aquatic organisms and these guidelines were presented to the SPC Heads of Fisheries meeting.

Jacob was one of the key researchers and author of this policy, and he also played a role in presenting the guidelines to HoF delegates.

Papua New Guinea has grappled with the problems caused by new species introductions. Jacob’s attachment will prove useful in putting into place

national policies for his country’s aquaculture industry.

Mataora Masters, pearl oyster hatchery manager for the Cook Islands Ministry of Marine Resources, oversees the Tongareva Marine Research Centre in Penrhyn Atoll, Northern Cook Islands. Mataora spent four weeks with the ACIAR/

MNRD pearl project on Abaiang Atoll. Mataora's attachment came about as a request to SPC to provide technical advice on pearl farming matters for the project. Mataora shared his experience in pearl hatchery operations and pearl farming at research and commercial levels.

A large portion of Mataora's work was in the field, assisting with the layout of the pearl farm, suggesting research projects, and preparing for the upcoming pearl seeding operation that would follow on from the project's first pearl harvest.

According to project staff in Kiribati, Mataora's input and hands-on style was well received. Project staff requested more regular exchanges of this nature.



USP report on the Review of Aquaculture Policy and Legislation in the Pacific Islands region

The current legal and policy framework for aquaculture in 21 Pacific Island countries and territories has been analysed in a report by N. Evans, J. Raj and D. Williams of the University of the South Pacific. This report was funded by a grant from SPC. The main author, Dr Evans, presented an abridged version to the 3rd SPC HoF meeting held in Noumea in August 2003.

Overview of legislation and policy

- Aquaculture in the Pacific was found to be a rapidly evolving activity although legislation tends to lag behind development.
- Some countries had regulations and/or legislation that did not correspond to the level of development. For example some countries with little activity had more elaborate regulations than others with more substantial interests.
- The majority of countries surveyed had few specific laws on aquaculture. In most PICTs, provisions relating to aquaculture are usually addressed under Fisheries or Marine Resource Acts.
- Several incidents highlight the need to establish policy and legal frameworks to

exercise controls over development. These include: introductions of pest species, the lack of an enabling environment for sustainable development, and the lack of clarity over the jurisdiction of various regulatory authorities.

Considerations for aquaculture law and policy

- "Aquaculture" tends to be poorly defined. For example should the collection of broodstock for aquaculture be managed as "fishing" or "aquaculture"?
- In some PICTs, the task of obtaining permits is rigorous but once operations commence, monitoring or enforcement is often inadequate. Attention should focus not only on enacting legislation but also on the capacity to implement policies and enforce legislation.
- The system of demerit points is worth considering. Under this approach demerit points would accrue according to the severity of a breach of conditions. An advantage of this system is that it would not stifle development by imposing heavy penalties, but would encourage operators to meet performance standards.
- Because the purpose and scale of subsistence, small scale and industrial aquaculture differ, a regulatory regime could provide several classes of licenses. Artisanal activities that are being encouraged in order to reduce fishing pressure and raise the standard of living may have reduced regulatory requirements.
- Regarding the regional trend toward the drafting stand-alone aquaculture bills: the immediate enactment of new legislation may be difficult and resource intensive. The legal requirements for development may be better integrated into existing statutes rather than through the enactment of dedicated legislation.
- The fact that aquaculture and fishing activities use the same resource base suggests that some aquaculture measures could be integrated within existing fisheries legislation.
- Although each country's circumstances are unique, commonalities do exist. A set of minimum considerations that should be prescribed in PICTs legislation, include: providing for an efficient means of allocation of space; providing statutory rights for taking cultured fish for

sale and collection of broodstock and spat; establishing renewable licensing for environmental effects; devolution of monitoring and enforcement of controls; and addressing the issue of seafood safety.

- Given the common issues shared by many PICTs, and the constraints to the development of legal frameworks, a regional approach may be the most efficient method of establishing certain regulatory frameworks. Common issues include: translocations of live aquatic organisms into and within the region; customary, private and investor rights and responsibilities; transfer of technology; information collection and record keeping; responsible aquaculture research or trials.

Future work

- The legislative environment can either stimulate or constrain aquaculture. It is therefore important that PICTs enact suitable legislation that will promote sustainable development of aquaculture.

- Important factors that need attention include the role of traditional management practices in aquaculture, traditional tenure systems, native land rights, and traditional or community-based aquaculture. These issues are likely to be unique to different PICTs and require that national solutions be incorporated into a regional template.
- The absence of legislative standards specifying acceptable limits for output of contaminated or polluted wastewater and ambient water quality needs to be addressed. This should be done either through aquaculture legislation or through generic environmental legislation. Standards for quarantine, genetic and resource ownership, and protection of intellectual property rights should be considered.
- Land leases for aquaculture often do not describe any clear process for lease allocation, and this may act as a disincentive for development and investment. The importance of long-term

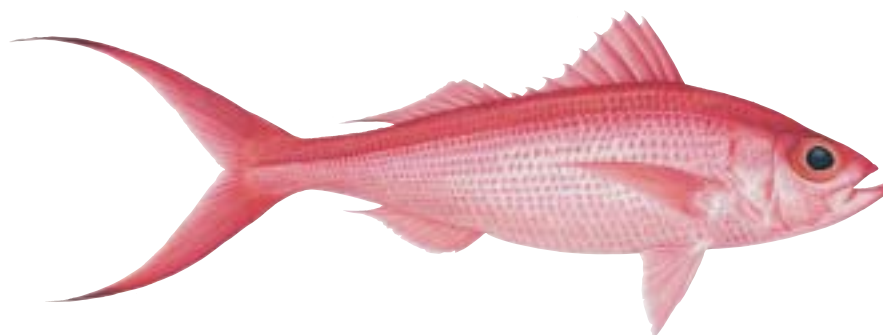
leases for aquaculture, in order to allow investments to be recovered, should be considered.

- In-country studies building upon this preliminary review would allow for a more complete understanding of the practical implementation of existing legislation in each of the PICTs. Such studies would provide guidance as to the commonalities for possible regional policy approaches. A country-specific survey would ultimately establish a potential model approach for the control and management of aquaculture in the PICTs.

A copy of this report can be downloaded in pdf format (680 kb) at the following URL:

http://www.spc.int/coastfish/Sections/Aquaculture/publications/Aquaculture_policy.pdf

For further information on this report, contact Ben Ponia (benp@spc.int) or Dr Nathan Evans (evans_n@usp.ac.fj).



■ SIDE SETTING TO AVOID SEABIRD BYCATCH PROVES SUCCESSFUL IN PRELIMINARY TESTS IN HAWAII

A team comprising representatives from the Hawaii Longline Association, National Audubon Society, Western Pacific Regional Fishery Management Council, National Marine Fisheries Service, and an Australian consultant, released the preliminary results of a unique cooperative research project. Their findings: using a new technology called side setting, longline fishing vessels can catch tuna and swordfish with minimal risk of accidentally killing seabirds.

Mortality in longline fisheries is the most critical global threat to certain seabirds, which get caught on baited hooks and drown. Hundreds of thousands of birds, including tens of thousands of albatrosses, are caught annually in longline fisheries worldwide. Longline mortality is the most significant component in the decline of several albatross species.

The team's research was conducted in Hawaii on longline vessel, F/V *Katy Mary*, during April and May 2003. Three seabird deterrent methods were tested in the longline fishery: side setting, deep setting chute, and blue-dyed bait. The team assessed each method's effectiveness at avoiding seabird interactions, practicability, effect on fishing efficiency, cost to employ, and enforceability. A commercial demonstration was made to prove the viability of each deterrent. During the trials, one method emerged as the most promising: side setting.

In side setting, the line setter, or shooter, is moved from the stern

to the side of the boat and well forward of the usual position. During setting, baited hooks are set close to the side of the vessel's hull where seabirds are unable or unwilling to attempt to pursue the hooks. The wash from the propeller pushes the baited hooks down and off to the side, away from the pro-

PELLER AND RUDDER SO THERE ARE NO PROBLEMS WITH TANGLES. By the time bait reaches the stern, it has sunk to a depth where seabirds cannot locate it or dive deep enough to reach it. This method had the lowest average seabird contact and capture rates of all the seabird deterrent treatments tested. It was used



Side setting uses the side of the boat to shield the fishing gear from the seabirds until the bait sinks

with both tuna gear and swordfish gear.

Side setting, as opposed to traditional stern setting, provides a large operational benefit for certain types of vessels, and was practicable and convenient for use by crew. In fact, work was actually made easier, according to the vessel's crew because branchline bins, bait, floats, radio buoys, etc. did not have to be hauled fore and aft each day. All work was carried out on the same area on deck.

In other tests, the underwater setting chute, a promising device designed to release baited hooks underwater, out of sight and reach of diving seabirds, was relatively effective at reducing bird interactions but performed inconsistently and was inconvenient due to design problems. A third deterrent — thawing and dyeing dark blue bait to reduce seabirds' ability to see it — was less effective at avoiding bird interactions. It was also found to be relatively impractical and does not facilitate effective enforcement.

"Fixing the global longline seabird mortality problem means not only identifying the deterrents that nearly eliminate bird deaths, but also making

them practical and convenient, providing fishing crews with an incentive to employ them consistently and effectively," said Eric Gilman, National Audubon Society's Pacific representative. "Results from this trial significantly contribute towards this end."

"To successfully abate the problem of albatross mortality in global longline fisheries, there is a need to mainstream seabird deterrent best practices for longline fisheries. Side setting combined with adequate line weighting, holds much promise to significantly reduce seabird mortality in both pelagic and demersal longline fisheries worldwide," said Nigel Brothers, the consultant seabird expert on the project.

"The next step towards mainstreaming best practices is to promote broad industry trials in Hawaii and abroad. Instituting a formal incentives program will help encourage the fleet to change longstanding practices and try side setting," said Jim Cook, of the Hawaii Longline Association. According to Sean Martin, President of the Hawaii Longline Association, "Broad trials must precede widespread advocacy for longline fleets to side set to confirm several expect-

tations of the mitigation method's effectiveness and suitability for fleet-wide use." To this end, the group is planning more experiments over a longer time period, combined with other bycatch mitigation techniques.

The team has produced a final report for the Western Pacific Regional Fishery Management Council titled, "Performance Assessment of Underwater Setting Chutes, Side Setting, and Blue-dyed Bait to Minimize Seabird Mortality in Hawaii Longline Tuna and Swordfish Fisheries", by Eric Gilman, et al. 2003.

(adapted from National Audubon Society press release July 2003)



■ TURTLE BYCATCH AND COMMERCIAL FISHING OPERATIONS

Bycatch, the catch of non-target species, is a significant issue in many of the world's fisheries. Sea turtles are of particular concern given their endangered status and the considerable numbers caught, and occasionally killed, worldwide in commercial fishery operations. Trawl fisheries, in particular, are recognised as discarding the greatest amount of bycatch compared with other commercial fishing methods. In addition,

trawling operations have been held responsible for more sea turtle deaths than any other human-related factor (Bisong 2000).

TEDs — turtle exclusion devices — have been hailed as the solution. Designed to allow prawn trawling to continue while protecting sea turtles, TEDs are sewn into trawl nets to separate large unwanted animals from the smaller target species, gen-

erally prawns or fish. They enable large animals to exit the net before reaching the cod-end. There are many designs, although most commonly they consist of a grid (grating) that directs the turtle towards a hole in the net.

Following many years of domestic discord in the United States — regulations, challenges, lawsuits and court cases, amendments, public hearings, injunctions and delays (Oravetz 1988

and 1992) — in 1996 the US placed an import embargo on wild-caught prawns from fisheries that did not have a sea turtle conservation program in place, and which involved the use of TEDs. Even though the US embargo continues to be debated, it has resulted in TEDs being used in trawl fisheries in many countries, including Australia, Belize, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Indonesia, Mexico, Nicaragua, Nigeria, Pakistan, Panama, Suriname, Thailand, Trinidad, Tobago and Venezuela (Brewer et al. 1998; Anon. 2001).

The Australian Northern Prawn Fishery (NPF) was a trawl fishery with sea turtle bycatch problems. Poiner and Harris (1996) estimated that between 5000 and 6000 sea turtles were caught incidentally by NPF trawlers from August to November each year. Of these, almost 40% may have died as a result of capture. In 2000, following many years of research into the development of TEDs; they were made mandatory in the NPF.

A study conducted by the Bureau of Rural Sciences (BRS) and funded by the Fisheries Research and Development Corporation (FRDC) evaluated the effectiveness of TEDs in reducing sea turtle bycatch in this fishery (Robins et al. 2002). The study, based on data collected by volunteer fishers, demonstrated that TEDs substantially reduced capture of sea turtles during trawling activities. Since TEDs were installed the catch of sea turtles is estimated to have fallen as much as 96%, which is fewer than 200 turtles per year. In addition, turtle mortality is estimated to have decreased from close to 40% in earlier years to negligible rates today. This may be attributed to the improvement in turtle handling techniques adopted by the fishers

and also due to the turtles generally being captured at a later stage of the fishing operation. These sea turtles are presumed to survive due to the short time they are in the trawl. Consequently, since the introduction of TEDs only a few turtles are expected to die as a result of capture in trawl nets in the NPF.

Over the last couple of years, trawl fisheries have been the focus of sea turtle conservation concerns. This method of operation, however, is not the only cause of sea turtle mortality by commercial fisheries. Substantial numbers of deaths also occur as a result of other commercial fishing operations: longline, pound nets, gill-nets, purse-seine, hook and line, and pot trapping operations (Crouse 1984; Hillestad et al. 1981; Oravetz 1999). There is a need to start concentrating on these other sources of mortality resulting from commercial fishing activities, while continuing to monitor trawl fisheries at a lower level to ensure that circumstances do not change. In addition to natural events, there are many diverse anthropogenic events that result in the death of sea turtles that are not related to commercial fisheries. There is the need to minimise, to the greatest extent possible, all of the negative effects of human activities on sea turtles.

As yet there is no gear modification mechanism, such as TEDs, which can be used in many non-trawl commercial fishing operations. Nevertheless, more research funding to support cooperative research with the fishers themselves needs to be provided to find a practical solution to bycatch for all types of commercial fishing operations. There are many benefits of the participatory solution, that is, fishers, scientists and managers working together to address bycatch problems, including the possi-

bility of avoiding conflict (Tucker et al. 1997).

Now and into the future, fishers, with or without the help of others, will continue to refine their gear and fishing techniques in their quest to catch more and/or better quality target species and less bycatch. Adequate funding and assistance will greatly benefit this advancement.

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(Source: *Waves*, Volume 9, Number 3. Autumn 2003)



■ AQUACULTURE ECONOMICS CONSULTATIVE WORKSHOP — FIJI

Ongoing research and funding initiatives into aquaculture by the Fiji Department of Fisheries has resulted in the successful establishment of a number of small-scale, aquaculture-based enterprises. These include farming tilapia (*Oreochromis niloticus*), seaweed (*Kappaphycus* spp.) and giant freshwater prawns (*Macrobrachium rosenbergii*).

Aquaculture as a source of livelihood is relatively new to Fiji. Consequently, farmers who have been involved in other traditional livelihoods such as fishing, copra production or dalo farming, are usually wary of switching to such new enterprises. An important reason for this reluctance to venture into aquaculture can be attributed to farmers' lack of knowledge in aquaculture economics, which prevents them from realising the potential benefits that can be derived.

To overcome this problem, it is imperative that fisheries extension workers, whose roles are to promote aquaculture, provide accurate cost-benefit analyses to farmers on commodities that they are involved in, along with other aquaculture-based livelihoods. With such an information, farmers can make comparisons on the level of benefits

from the different livelihoods. This process could reveal for some farmers that aquaculture-based livelihoods may be the most beneficial for them.

But preparations of accurate cost-benefit analysis are time consuming and are beyond the capability of most extension officers. Being mindful of this problem, the Marine Studies Program seeks to develop computer software that can quickly and accurately undertake such an analysis with the input of relevant data. Fisheries and agriculture extension workers could use such a program to perform economic analysis and then provide relevant advice to farmers.

The four-day consultative workshop from the 29 September to 3 October 2003 at the University of the South Pacific's Laucala campus, was purposely held to gather data from local experts involved in a number of different livelihoods around Fiji. During the workshop a number of discussion groups were set up for each of the different commodities. Discussion in each group focussed on the cost structure and likely outputs for each commodity. Bill Johnson an economics consultant from Southern Cross University will use this information to create

the computer program for the Marine Studies Program. The computer programs were put on compact discs and were expected to be available towards the end of 2003.

The workshop was cosponsored by CSPOD-2 under the auspices of the Marine Studies Program along with the WorldFish Center. Senior aquaculture lecturer from the Marine Studies Program, Dr Timothy Pickering, Warwick Nash from the WorldFish Center and Satya Lal and Ben Ponia from the Secretariat of the Pacific Community helped facilitate the workshop.

Fifteen participants from around Fiji who have been actively involved in various livelihoods (artisanal and commercial fishing and various farming activities, including copra production, dalo, chicken, pearl, rice, cane, tilapia, *Macrobrachium* and seaweed) were invited to the workshop. A number of representatives from Fiji's departments of Fisheries and Agriculture extension services were also invited as observers.

(Contributor: Ferral Lasi, CSPOD training Marine Studies Program USP)



PRINCIPLES FOR THE INTRODUCTION AND TRANSLOCATION OF AQUATIC ORGANISMS FOR AQUACULTURE AND CULTURE-BASED FISHERIES

Delegates to the 3rd SPC Heads of Fisheries meeting in Noumea in August 2003 endorsed a policy guideline regarding the introduction and transfer of aquatic organisms. This guideline is intended to assist both PICTs and regional organisations in making prudent decisions when contemplating species introductions and/or movements.

Background and introduction

The past few decades has been a period of increased introductions of aquatic organisms. A cursory survey of aquatic introductions in PICTs identified 52 per cent of introductions as being for aquaculture purposes and a further 20 per cent for culture fisheries. Common species targeted include giant clams, green snail, penaeid prawn, trochus, tilapia and macrobrachium shrimp.

The potential exists for introductions to have adverse impacts; these may stem not only from the species intentionally introduced but also from unintended "hitch-hikers". In the majority of cases the ecological impact of introductions has been either benign or is unknown. There have been exceptions, however. The Mossambicus tilapia (*Oreochromis mossambicus*) from Africa was widely introduced in Pacific

by Ben Ponia¹, Warwick Nash² and Jacob Wani³

Island countries in the 1950s for both mosquito control and as a candidate for fish farming. It never fulfilled these purposes and is now generally regarded as a pest and competitor with native fauna. The Japanese pond snail (*Viviparus japonicus*) was accidentally introduced to Fiji Islands as larvae in the host water of imported grass carp (family Cyprinidae). This gastropod is now the dominant benthic fauna of prawn and fish ponds and has severely reduced productivity.

There is a strong link between the increased emergence of virulent diseases and the movement of aquatic species. Fortunately, the region has so far not been greatly affected by disease impacts; however the white spot syndrome virus in penaeid prawns and akoya virus in pearl oysters are two pathogens that pose a severe risk to the region.

A number of regional organisations can provide assistance in this area:

- SPC, which functions as a regional focal point for aquaculture and coastal fisheries issues;

- FAO, which provides advice on matters of global policy;
- SPC Regional Animal Health Service and the SPC Plant Protection Service, which provide technical advice on import risk analysis, quarantine and disease management of aquatic animals and plants;
- SPREP, which serves as a regional focal point for biodiversity and invasive species issues;
- The WorldFish Center and USP, which can assist with research in the above areas.

In addition there are relevant policies that can assist PICTs that are contemplating the introduction or movement of aquatic organisms. Examples include the FAO Code of Conduct for Responsible Fisheries, The Nairobi Declaration, AFFA Australia Aquaplan and FAO-NACA Asia Regional Technical Guidelines.

Why is an intervention urgent?

The impacts of introduced organisms may be severe. Native species and the ecosystem as a whole can be affected; rural livelihoods, food security, poverty alleviation and public health may be at risk; and significant economic losses in international trade can occur. Hence the importance of developing and implementing safeguards against these types of impacts.

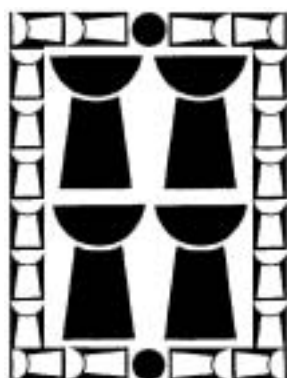
The urgency of this resolution can be highlighted by some of the following considerations:

¹ Aquaculture Adviser, Marine Resources Division, Secretariat of the Pacific Community, PO Box D5, 98848 Noumea Cedex, New Caledonia; BenP@spc.int

² Senior Scientist/Officer-in-Charge, The WorldFish Center, c/o Secretariat of the Pacific Community, PO Box D5, 98848 Noumea Cedex, New Caledonia; WarwickN@spc.int

³ Manager Aquaculture/Inland Fisheries, National Fisheries Authority, PO Box 2016, Port Moresby, Papua New Guinea; jwani@fisheries.gov.pg

- The relative ease with which aquatic species can be moved within the region, particularly by airfreight links;
- The lack of awareness and capacity of the customs/quarantine agencies in terms of the quarantine issues for aquatic organisms;
- A casual attitude observed (in some cases) by fisheries officers regarding the movement of aquatic species;
- The inherent responsibility of recipient countries to adopt minimum standards before assistance related to aquatic species can be expected from donors or development agencies;
- Recent trade agreements such as those imposed by WTO, which require countries to abide by stringent phyto-sanitary and quarantine protocols.
- National work programmes that often do not follow a logical hierarchical process, i.e., policy - risk analysis - introduction - quarantine - monitoring. Regional organisations often find themselves working in a "cart before the horse" situation.



Guiding principles for the introduction and translocation of aquatic organisms for aquaculture and culture-based fisheries

Purpose, benefits and risks

1. The introduction and movement of aquatic organisms should have a clear economic, social or environmental benefit.
2. It should also be shown why similar benefits cannot be attained by utilising indigenous or local strains of species. The use of an indigenous species is preferable to introducing a new species.
3. Introduction and movements of aquatic organisms may lead to new and emerging pests, pathogens and diseases. Therefore, such activities may pose risks to the importing country. Risk arises from both the intended transfer species and also from pathogens, parasites and symbionts associated with this species.

Risk assessment

4. Proposals for introduction and movements must be assessed from a holistic perspective, including a full review of the potential hazards and an assessment of the options for mitigation.
5. The impacts to existing aquaculture operations and culture fisheries and the habitat in which the species will be introduced should be considered. In addition, the risks to natural ecosystems, rural livelihoods, food security, public health and trade should be taken into account.
6. When there is considerable uncertainty about the biolo-

gy of the proposed species or the possible risks associated with the translocation, a precautionary approach should be adopted.

7. The first movement (introduction) of a new species into a new area will require special considerations in light of the risk of introducing new pests, parasites, pathogens and genetic material.

Notification and engagement of stakeholders

8. Formulation of policy and legislation concerning introduction and movements should seek to engage all stakeholders in a participatory process. In addition, governments should establish advisory groups with links to independent and scientifically competent expert bodies.
9. Translocation into regions that are shared zones between two countries should be approved by relevant authorities in both territories concerned. Under such circumstances the proponent country should inform its neighbour of the intended translocation.

Quarantine and release strategies

10. When introducing a new organism, attention should be focused on the prevention of the spread of diseases and pests that might accompany the import through the implementation of an effective quarantine measures.
11. Quarantine measures should be based on scientific principles and should be practical, cost-effective and easy to implement by utilising read-

ily available facilities. Individual countries may need to adopt, modify or vary guidelines to suit their own particular situations and resources.

ments should not be disregarded.

Roles and responsibilities, capacity building and awareness raising

countries with respect to the implementation of quarantine programmes should be taken into account by development agencies and donor institutions.

- 12. Movements of aquatic organisms should be conducted within the provisions given in existing relevant national and international agreements and instruments such as the United Nations FAO Fisheries Code of Conduct and Convention for Biological Diversity.
- 13. All introductions must be treated as open water stocking even if made to aquaria or closed water bodies (dams or ponds). The possibility of species establishment into natural environ-
- 14. National governments have a key responsibility to manage the risks arising from the introduction and movement of aquatic organisms. This includes the responsibility to reject applications for introductions when the risks of the introduced species itself are deemed unacceptably high, and to terminate an introduction if the specimens are found to be carriers of unwanted organisms.
- 15. The varying capacity and special circumstances and requirements of developing
- 16. Collaboration among governments, public institutions, and the private sector, including all stakeholders, is important if management of aquatic organism transfers is to be effective.
- 17. Policy makers, enforcement agencies, stakeholders and the general public need to be made aware of issues related to, and the need for policy on the introduction and movement of aquatic species; this should be a high priority issue on national agendas.



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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>

FAD RESEARCH PROJECT: SUMMARY OF RESULTS AT THE END OF THE SECOND YEAR (JUNE 2003) — PART II

Summary of the community survey activities

Introduction

The three-year SPC FAD research projects commenced in mid-2001 after funding was secured from the New Zealand Pacific Initiative for the Environment (PIE) fund. The project was implemented in three locations: Rarotonga and Aitutaki in Cook Islands, and in Niue.

In the last issue of the SPC *Fisheries Newsletter* (#105), the

by Lindsay Chapman¹, Ian Bertram² and Brendon Pasisi³

objective or outputs of the project were presented along with a summary of project activities and results related to FAD designs and costings. This second article summarises the results of the project to June 2003 (first two years), with respect to community surveys and catch and effort data.

Following the commencement of the project, a coastal community questionnaire was developed by SPC in consultation with the Fisheries Departments in both Niue and the Cook Islands. The first community surveys in Niue were completed in December 2001, and in March 2002 for Cook Islands. These were done with the assistance of Fisheries Department staff in each location. Table 1 summarises the data. This table and the results were reported in the SPC *Fisheries Newsletter* #101 with an explanation of the figures.

Table 1: Summary of data collected during the first community surveys (December 2001 in Niue and March 2002 in the Cook Islands)

Island	Village	No. h/holds surveyed	No. people covered by survey	No. people per h/hold	No. H/holds fishing	% h/holds fishing	No. canoes	No. boats	No. h/holds fishing outside reef	% h/holds fishing outside reef	No. h/holds FAD fishing	% h/holds FAD fishing
Niue	Alofi North	27	100	3.7	23	85.2%	17	15	15	55.6%	15	55.6%
Niue	Avatele	27	106	3.9	21	77.8%	29	13	19	70.4%	8	29.6%
Niue	Hikutavake	12	37	3.1	7	58.3%	6	0	3	25.0%	2	16.7%
Niue	Lakepa	22	84	3.8	15	68.2%	7	2	6	27.3%	3	13.6%
Niue	Makefu	20	75	3.8	15	75.0%	12	2	8	40.0%	2	10.0%
Niue	Namakulu	7	9	1.3	4	57.1%	2	1	2	28.6%	2	28.6%
Niue	Selected fishermen	4	21	5.3	4	100.0%	4	7	4	100.0%	4	100.0%
Niue	Tuapa	24	75	3.1	23	95.8%	18	6	12	50.0%	10	41.7%
Niue	Vaiea	11	60	5.5	10	90.9%	6	3	7	63.6%	6	54.5%
	Sub-total	154	567	3.7	122	79.2%	101	49	76	49.4%	52	33.8%
Aitutaki	Amuri	54	214	4	38	70.4%	28	14	10	18.5%	6	11.1%
Aitutaki	Arutanga and Araura	27	120	4.4	14	51.9%	4	11	4	14.8%	3	11.1%
Aitutaki	Nikaupara	34	143	4.2	26	76.5%	7	21	10	29.4%	8	23.5%
Aitutaki	Reureu	27	125	4.6	15	55.6%	7	7	3	11.1%	2	7.4%
Aitutaki	Ureia	24	95	4	17	70.8%	10	10	8	33.3%	6	25.0%
Aitutaki	Vaipae and Vaipeka	80	375	4.7	53	66.3%	22	26	12	15.0%	11	13.8%
	Sub-total	246	1072	4.4	163	66.3%	78	89	47	19.1%	36	14.7%
Rarotonga	Aroko and Avana	23	76	3.3	14	60.9%	0	2	0	0.0%	0	0.0%
Rarotonga	Matavera	25	93	3.7	10	40.0%	0	4	2	8.0%	2	8.0%
Rarotonga	Pokoinu to Nikao	77	339	4.4	33	42.9%	2	10	6	7.8%	4	5.2%
Rarotonga	Rutaki and Aroa	43	174	4	24	55.8%	2	3	1	2.3%	1	2.3%
Rarotonga	Selected fishermen	19	85	4.5	19	100.0%	5	21	19	100.0%	19	100.0%
Rarotonga	Titikaveka	34	136	4	16	47.1%	8	5	4	11.8%	4	11.8%
	Sub-total	221	903	4.1	116	52.5%	17	45	32	14.5%	30	13.6%
	Total	621	2542	4.1	401	64.6%	196	183	155	25.0%	118	19.0%

¹ SPC Fisheries Development Adviser; Email: LindsayC@spc.int

² Director, Inshore Fisheries, Ministry of Marine Resources, Cook Islands; Email: I.Bertram@mmr.gov.ck

³ Principal Fisheries Officer, Department of Agriculture, Forestry and Fisheries, Niue; Email: fisheries@mail.gov.nu

Table 2: Summary of data collected during the second community surveys (March 2003 in Niue and May 2003 in the Cook Islands)

Island	Village	No. h/holds surveyed	No. people covered by survey	No. people per h/hold	No. h/holds fishing	% h/holds fishing	No. canoes	No. boats	No. h/holds fishing outside reef	% h/holds fishing outside reef	No. h/holds FAD fishing	% h/holds FAD fishing
Niue	Alofi North	26	76	2.9	15	57.7%	10	7	7	26.9%	7	26.9%
Niue	Avatele	28	89	3.2	21	75.0%	24	12	15	53.6%	11	39.3%
Niue	Hikutavake	14	36	2.6	9	64.3%	8	1	4	28.6%	2	14.3%
Niue	Lakepa	22	76	3.5	18	81.8%	7	3	4	18.2%	2	9.1%
Niue	Makefu	21	63	3	16	76.2%	14	2	7	33.3%	4	19.0%
Niue	Namakulu	8	6	0.8	3	37.5%	2	0	1	12.5%	1	12.5%
Niue	Selected fishermen	4	23	5.8	4	100.0%	9	8	4	100.0%	4	100.0%
Niue	Tuapa	28	59	2.1	13	46.4%	8	2	8	28.6%	7	25.0%
Niue	Vaiea	11	55	5	10	90.9%	5	6	7	63.6%	7	63.6%
	Sub-total	162	483	3	109	67.3%	87	41	57	35.2%	45	27.8%
Aitutaki	Amuri	54	175	3.2	37	68.5%	22	19	14	25.9%	9	16.7%
Aitutaki	Arutanga and Araura	27	89	3.3	17	63.0%	8	9	4	14.8%	3	11.1%
Aitutaki	Nikaupara	35	140	4	27	77.1%	8	20	9	25.7%	7	20.0%
Aitutaki	Reureu	27	107	4	19	70.4%	2	8	5	18.5%	2	7.4%
Aitutaki	Ureia	24	95	4	21	87.5%	6	12	11	45.8%	7	29.2%
Aitutaki	Vaipae and Vaiepeka	80	306	3.8	49	61.3%	15	19	11	13.8%	6	7.5%
	Sub-total	247	912	3.7	170	68.8%	61	87	54	21.9%	34	13.8%
Rarotonga	Aroko and Avana	24	63	2.6	8	33.3%	0	0	0	0.0%	0	0.0%
Rarotonga	Matavera	25	73	2.9	10	40.0%	0	3	1	4.0%	0	0.0%
Rarotonga	Pokoinu to Nikao	77	317	4.1	31	40.3%	0	4	3	3.9%	2	2.6%
Rarotonga	Rutaki and Aroa	43	156	3.6	24	55.8%	2	2	1	2.3%	1	2.3%
Rarotonga	Selected fishermen	19	96	5.1	19	100.0%	1	22	19	100.0%	18	94.7%
Rarotonga	Titikaveka	33	81	2.5	7	21.2%	0	5	1	3.0%	1	3.0%
	Sub-total	221	786	3.6	99	44.8%	3	36	25	11.3%	22	10.0%
	Total	630	2181	3.5	378	60.0%	151	164	136	21.6%	101	16.0%

Table 3: Summary of the households surveyed, identifying the number of households that were interviewed both times in each location

The second community surveys were conducted in Niue in March 2003, with Mr Jayjay Talagi from the Fisheries Department, assisting in this work. The surveys were conducted in Cook Islands in May 2003, with assistance from Ms Tuaine Turua from the Fisheries Department and with several other fisheries staff assisting from time to time in each location. Table 2 summarises the data from the second survey.

The same survey form was used for the second survey, and where possible, the same person was interviewed. This made the

Island	Village	Second survey				No. h/holds surveyed (first survey)	No. h/holds surveyed both times
		No. h/holds covered by survey	No. h/holds interviewed	No. h/holds not available	No. new h/holds surveyed		
Niue	Alofi North	27	20	7	0	27	20
Niue	Avatele	28	24	3	1	27	24
Niue	Hikutavake	14	10	2	2	12	10
Niue	Lakepa	22	21	1	0	22	21
Niue	Makefu	21	16	4	1	20	16
Niue	Namakulu	8	5	2	1	7	5
Niue	Selected fishermen	4	4	0	0	4	4
Niue	Tuapa	28	14	10	4	24	14
Niue	Vaiea	11	10	1	0	11	10
	Sub-total	163	124	30	9	154	124
Aitutaki	Amuri	54	43	11	0	54	43
Aitutaki	Arutanga and Araura	27	22	5	0	27	22
Aitutaki	Nikaupara	35	29	5	1	34	29
Aitutaki	Reureu	27	25	2	0	27	25
Aitutaki	Ureia	24	24	0	0	24	24
Aitutaki	Vaipae and Vaiepeka	80	68	12	0	80	68
	Sub-total	247	211	35	1	246	211
Rarotonga	Aroko and Avana	24	16	7	1	23	16
Rarotonga	Matavera	25	21	4	0	25	21
Rarotonga	Pokoinu to Nikao	77	61	16	0	77	61
Rarotonga	Rutaki and Aroa	43	39	4	0	43	39
Rarotonga	Selected fishermen	19	19	0	0	19	19
Rarotonga	Titikaveka	34	24	10	0	34	24
	Sub-total	222	180	41	1	221	180
	Total	632	515	106	11	621	515

survey process lengthy, as the same households needed to be found. In places such as Rarotonga, both parents often work. This necessitated conducting surveys in the evenings or on the weekend.

Care is needed when examining the data in Table 2, as the number of households surveyed is different, which alters other figures in the table such as boat and canoe numbers. Table 3 breaks down this figure into the number of households that were interviewed, and those

that were not available for various reasons. The main reasons being that the households were: on holidays, had departed permanently, had moved out of the survey area, and the combining of families. In several cases it was discovered that the same household had been surveyed

Table 4: Comparison of community survey data for households surveyed both times on Niue

Island	Village	No. h/holds surveyed	No. people covered by survey	No. people per h/hold	No. h/holds fishing	% h/holds fishing	No. canoes	No. boats	No. h/holds fishing outside reef	% h/holds fishing outside reef	No. h/holds FAD fishing	% h/holds FAD fishing
Niue-1	Alofi North	20	73	3.7	17	85.0%	12	9	9	45.0%	9	45.0%
Niue-1	Avatele	24	99	4.1	19	79.2%	25	12	17	70.8%	7	29.2%
Niue-1	Hikutavake	10	34	3.4	7	70.0%	6	0	3	30.0%	2	20.0%
Niue-1	Lakepa	21	83	4	14	66.7%	7	2	6	28.6%	3	14.3%
Niue-1	Makefu	16	65	4.1	14	87.5%	12	2	8	50.0%	2	12.5%
Niue-1	Namakulu	5	6	1.2	2	40.0%	1	0	1	20.0%	1	20.0%
Niue-1	Selected fishermen	4	21	5.3	4	100.0%	4	7	4	100.0%	4	100.0%
Niue-1	Tuapa	14	51	3.6	14	100.0%	12	4	7	50.0%	7	50.0%
Niue-1	Vaiea	10	55	5.5	9	90.0%	5	2	6	60.0%	5	50.0%
	Total	124	487	3.9	100	80.6%	84	38	61	49.2%	40	32.3%
Niue-2	Alofi North	20	76	3.8	15	75.0%	10	7	7	35.0%	7	35.0%
Niue-2	Avatele	24	86	3.6	20	83.3%	23	11	14	58.3%	10	41.7%
Niue-2	Hikutavake	10	32	3.2	7	70.0%	6	1	3	30.0%	2	20.0%
Niue-2	Lakepa	21	76	3.6	18	85.7%	7	3	4	19.0%	2	9.5%
Niue-2	Makefu	16	59	3.7	15	93.8%	10	2	6	37.5%	3	18.8%
Niue-2	Namakulu	5	4	0.8	2	40.0%	2	0	1	20.0%	1	20.0%
Niue-2	Selected	4	23	5.8	4	100.0%	9	8	4	100.0%	4	100.0%
Niue-2	Tuapa	14	49	3.5	11	78.6%	8	2	8	57.1%	7	50.0%
Niue-2	Vaiea	10	55	5.5	10	100.0%	5	6	7	70.0%	7	70.0%
	Total	124	460	3.7	102	82.3%	80	40	54	43.5%	43	34.7%

Table 5: Comparison of community survey data for households surveyed both times on Aitutaki

Island	Village	No. h/holds surveyed	No. people covered by survey	No. people per h/hold	No. h/holds fishing	% h/holds fishing	No. canoes	No. boats	No. h/holds fishing outside reef	% h/holds fishing outside reef	No. h/holds FAD fishing	% h/holds FAD fishing
Aitutaki-1	Amuri	43	183	4.3	29	67.4%	22	12	9	20.9%	6	14.0%
Aitutaki-1	Arutanga and Araura	22	101	4.6	11	50.0%	4	9	3	13.6%	3	13.6%
Aitutaki-1	Nikaupara	29	129	4.4	22	75.9%	5	20	9	31.0%	8	27.6%
Aitutaki-1	Reureu	25	117	4.7	14	56.0%	7	6	2	8.0%	1	4.0%
Aitutaki-1	Ureia	24	95	4	17	70.8%	10	10	8	33.3%	6	25.0%
Aitutaki-1	Vaipae and Vaipeka	68	318	4.7	45	66.2%	19	21	10	14.7%	9	13.2%
	Total	211	943	4.5	138	65.4%	67	78	41	19.4%	33	15.6%
Aitutaki-2	Amuri	43	175	4.1	37	86.0%	22	19	14	32.6%	9	20.9%
Aitutaki-2	Arutanga and Araura	22	89	4	17	77.3%	8	9	4	18.2%	3	13.6%
Aitutaki-2	Nikaupara	29	136	4.7	26	89.7%	8	19	9	31.0%	7	24.1%
Aitutaki-2	Reureu	25	107	4.3	19	76.0%	2	8	5	20.0%	2	8.0%
Aitutaki-2	Ureia	24	95	4	21	87.5%	6	12	11	45.8%	7	29.2%
Aitutaki-2	Vaipae and Vaipeka	68	306	4.5	49	72.1%	15	19	11	16.2%	6	8.8%
	Total	211	908	4.3	169	80.1%	61	86	54	25.6%	34	16.1%

twice, with different family members having been interviewed during the first survey.

As can be seen from Table 3, 515 households were interviewed during both surveys: 124 on Niue, 211 on Aitutaki and 180 on Rarotonga. Given the number of households that were unavailable for interview during the second survey (106), several new households were interviewed to try to increase the numbers for future surveys.

Tables 4, 5 and 6 present a comparison of the data collected by area, so that the circumstances of each area can be explored. On Niue (Table 4) the number of households fishing has increased from 100 (80.6%) in the first survey to 102 (82.3%) in the second survey. This is attributed to the subsistence needs of the community as there are few job opportunities available. In contrast, the number of households fishing outside the reef dropped from 61 (49.2%) in the first survey to 54 (43.5%) in the second survey. A possible explanation for this is the limited market on Niue for fishermen to sell their catch, which results in fewer fishermen fishing outside

the reef. However, more fishermen are using the FADs with an increase from 40 (32.3%) to 43 (34.7%). This is attributed to the better catches that can be taken from FADs and the reduced operational costs. It is also interesting to note that the numbers of canoes dropped from 84 to 80, while the number of outboard-powered boats increased from 38 to 40, as it appears fishermen are moving away from canoes to boats so they can fish the offshore FADs.

On Aitutaki, 211 households were interviewed during both surveys (Table 5). The number of households involved in fishing increased from 138 (65.4%) in the first survey to 169 (80.1%) in the second survey. This increase was mainly in the subsistence fishing with collecting on the reef and gillnetting, although there was a significant increase in the number of outboard-powered vessels, from 78 to 86 (canoe numbers dropped from 67 to 61). The increase in vessel numbers aligns with the increase in the number of households fishing outside the reef, which increased from 41 (19.4%) to 54 (25.6%). However, the increase in fishing outside

the reef was mainly for coastal fishing, with many people using boats for spearfishing and night fishing for reef fish. In looking at the number of households involved in fishing at the FADs, the increase is very small, from 33 (15.6%) to 34 (16.1%). This is attributed to the limited market for selling fish and the ability of local people to catch their own fish in the lagoon or just outside the reef.

On Rarotonga the situation is different as can be seen in Table 6. The number of households involved in fishing is decreasing from 105 (58.3%) in the first survey to 99 (55.0%) in the second survey. This reflects the ability of people to find work, and in many cases, households have both parents working. As several households stated, they now fish at the market with "20 dollar bills", and not hooks and lines or nets.

In looking more closely at the Rarotonga data, the numbers of canoes and boats has dropped, from 17 and 41 in the first survey, to 3 and 36, respectively in the second survey. In line with this trend, the numbers of households fishing outside the

Table 6: Comparison of community survey data for households surveyed both times on Rarotonga

Island	Village	No. h/holds surveyed	No. people covered by survey	No. people per h/hold	No. h/holds fishing	% h/holds fishing	No. canoes	No. boats	No. h/holds fishing outside reef	% h/holds fishing outside reef	No. h/holds FAD fishing	% h/holds FAD fishing
Rarotonga-1	Aroko and Avana	16	58	3.6	11	68.8%	0	1	0	0.0%	0	0.0%
Rarotonga-1	Matavera	21	70	3.3	10	47.6%	0	4	2	9.5%	2	9.5%
Rarotonga-1	Pokoinu to Nikao	61	268	4.4	30	49.2%	2	9	6	9.8%	4	6.6%
Rarotonga-1	Rutaki and Aroa	39	166	4.3	23	59.0%	2	2	1	2.6%	1	2.6%
Rarotonga-1	Selected fishermen	19	85	4.5	19	100.0%	5	21	19	100.0%	19	100.0%
Rarotonga-1	Titikaveka	24	104	4.3	12	50.0%	8	4	3	12.5%	3	12.5%
	Total	180	751	4.2	105	58.3%	17	41	31	17.2%	29	16.1%
Rarotonga-2	Aroko and Avana	16	61	3.8	8	50.0%	0	0	0	0.0%	0	0.0%
Rarotonga-2	Matavera	21	73	3.5	10	47.6%	0	3	1	4.8%	0	0.0%
Rarotonga-2	Pokoinu to Nikao	61	317	5.2	31	50.8%	0	4	3	4.9%	2	3.3%
Rarotonga-2	Rutaki and Aroa	39	156	4	24	61.5%	2	2	1	2.6%	1	2.6%
Rarotonga-2	Selected fishermen	19	96	5.1	19	100.0%	1	22	19	100.0%	18	94.7%
Rarotonga-2	Titikaveka	24	81	3.4	7	29.2%	0	5	1	4.2%	1	4.2%
	Total	180	784	4.4	99	55.0%	3	36	25	13.9%	22	12.2%

reef has dropped from 31 (17.2%) to 25 (13.9%), and the number of fishermen fishing the FADs has also dropped from 29 (16.1%) to 22 (12.2%). The main reason for this is the shrinking market for fishermen to sell their fish, and the competition between fishermen for the existing markets.

Rarotonga has a developing tuna longline fishery, which has only really developed in the last 18 months. As this fishery developed, considerable byproduct (saleable non-target species) and non-export quality target species have been marketed locally, with around 100 t sold on the domestic market in 2002. This has greatly affected small-scale fishermen, who are finding it difficult to market their catch in opposition to the longline fishermen. This has led to several fishermen taking onshore employment and ceasing their fishing operations to overcome the marketing problem.

Summary of fishing catch and effort

The third major component of the FAD project was the collection of catch and effort data. A catch and effort logsheet was developed in consultation with the Fisheries Departments of

both countries in September 2001. The logsheets were then made into a logbook using carbonised paper with three copies of each record (one each for SPC, the Fisheries Department and the fisherman), with 30 records to the book. The logbooks were printed in February 2002 and dispatched to both countries.

Logbook returns have been slow since the introduction of the system, although this is improving with over 1300 records received to date. Table 7 provides a summary of the trolling catch for all locations by year, with Table 8 providing a summary of the catch by other mid-water fishing techniques. A preliminary analysis of the catch and effort data on hand at the end of March 2003 was also conducted, and the results presented to fishermen at each location.

From Table 7 it can be seen that trolling around the offshore FADs produced the largest catch (8013 fish weighing 33,047 kg). Figure 1 shows the catch by month and location for trolling the offshore FADs. Yellowfin tuna (*Thunnus albacares*) and skipjack tuna (*Katsuwonus pelamis*) were the main species taken (4956 fish weighing 21,641 kg

and 2310 fish weighing 6429 kg, respectively). Mahi mahi (*Coryphaena hippurus*) and wahoo (*Acanthocybium solandri*) were also common in the catch (386 fish weighing 2995 kg and 132 fish weighing 1103 kg, respectively).

When looking at the catch from open water trolling (1924 fish weighing 17,900 kg), wahoo was the most predominant species taken (838 fish weighing 11,687 kg) followed by yellowfin tuna (505 fish weighing 2681 kg). Figure 2 shows the catch by month and location for open water trolling, where the same seasonality for wahoo is apparent (July to November) at each location.

Mid-water fishing techniques are usually used when the trolling catch is small, as a way to increase catch and earnings. Of the mid-water fishing techniques used (Table 8), vertical longlining and drop-stone were the main methods used (92 fish for 1405 kg and 258 fish for 1215 kg, respectively). Yellowfin tuna was the most predominant species in the catch (65 fish for 662 kg and 174 fish for 1054 kg, respectively).

Based on the catch and effort data provided to date, the fishermen in Rarotonga are the best data providers, and this should continue to improve after recent meetings where the

importance of the data was emphasised, especially if fishermen want to put a case forward to government in regard to the value of the small-scale fishing fleet to the Cook Islands. Four Rarotongan fishermen in particular have provided excellent data, and they are encouraging others to do the same.

Table 7: Summary of trolling catch by location for the different areas fished

Island/ year	Total effort (h)	Inshore FADs		Offshore FADs		Open water		Total	
		No.	Kg	No.	Kg	No.	Kg	No.	Kg
Niue									
2001	28.0	3	30	2	14	23	307	28	351
2002	1,412.0	221	1,792	1,258	5,012	953	9,319	2,432	16,123
2003	90.5	38	160	205	605	21	129	264	894
Sub-total	1,530.5	262	1,982	1,465	5,631	997	9,755	2,724	17,368
Aitutaki									
2002	1,061.0	222	1,126	876	4,878	405	3,515	1,503	9,519
2003	64.5	0	0	69	544	42	243	111	787
Sub-total	1,125.5	222	1,126	945	5,422	447	3,758	1,614	10,306
Rarotonga									
2002	2,438.5	106	448	2,819	10,809	436	4,007	3,361	15,264
2003	1,811.0	358	1,465	2,784	11,185	44	380	3,186	13,030
Sub-total	4,249.5	464	1,913	5,603	21,994	480	4,387	6,547	28,294
Total	6,905.5	948	5,021	8,013	33,047	1924	17,900	10,885	55,968

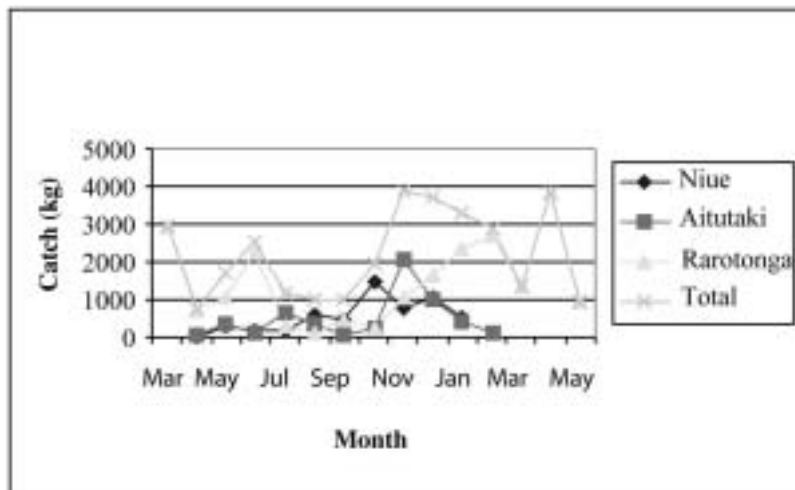


Figure 1: Monthly catch by location and total for trolling offshore FADs

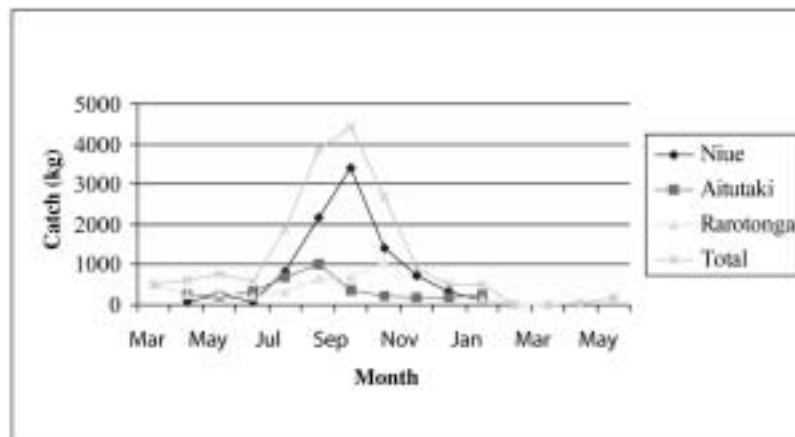


Figure 2: Monthly catch by location and total for open water trolling

During meetings with fishermen on Rarotonga and Aitutaki, six T-shirts and caps were given as an incentive to the fishermen who were providing the most consistent data (four on Rarotonga and two on Aitutaki). This created some interest, and a local businessman has donated a rod and reel to the fisherman on Rarotonga who provides the most consistent data over the next 12 months as an incentive for fishermen to complete their logbooks. While on Aitutaki, it was decided that the project would provide the same incentive (a rod and reel) for local fishermen to try to improve the level of data provision. The same incentives will also be provided to Niue in an attempt to increase the level of catch and effort data.

Overall, the limited provision of data is the area that needs the most attention in future. To do this, different incentives are being considered, including the printing of a T-shirt for data providers, and the holding of fishing competitions in each location, where only consistent data providers can enter the competition.



Table 8: Summary of the catch by other mid-water fishing techniques by location

Island/ year	Total effort (h)	Vertical longline No.	Kg	Drop-stone No.	Kg	Palu-ahi No.	Kg	Single hook line No.	Kg	Total No.	Kg
Niue											
2002	46.5	7	86	41	38	0	0	10	149	58	273
Sub-total	46.5	7	86	41	38	0	0	10	149	58	273
Aitutaki											
2002	54.5	6	104	12	49	0	0	1	38	19	191
Sub-total	54.5	6	104	12	49	0	0	1	38	19	191
Rarotonga											
2002	391	56	928	174	896	24	266	5	67	259	2,157
2003	79.5	23	287	31	232	0	0	1	12	55	531
Sub-total	470.5	79	1,215	205	1,128	24	266	6	79	314	2,688
Total	571.5	92	1,405	258	1,215	24	266	17	266	391	3,152