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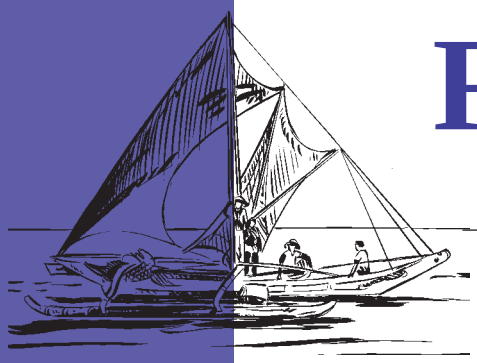


FISHERIES

Newsletter

NUMBER 88
JANUARY–MARCH 1999

IN THIS ISSUE

Ausita searching for small fish in Tuvalu

Secretariat of the Pacific Community
Prepared by the Information Section of the Marine Resources Division
Printed with the financial support of the Government of France

INFORMATION SECTION

1999 SPC Fisheries Address Book now available on the Web

The FAO/UNDP Regional Fisheries Support Programme (FAO/RFSP) used to publish the well-known *Addresses useful to Pacific Islands fisheries personnel* each year. This publication was much appreciated throughout the region.

In 1992, the work of the FAO/RFSP concluded, and the SPC Fisheries Information Section was asked by member countries and territories to continue the publication of the address book. The 1999 edition has already been distributed widely in the region. In addition to more than 1,000 addresses covering 50 countries and territories, the address book includes maps identifying Exclusive Economic Zones, and population estimates provided by the SPC Population/Demography Programme.

For the first time, the *SPC Fisheries Address Book* is also available on-line.

To access the SPC web site go to: http://www.spc.org.nc/coastfish. Then select 'Fisheries Address Book' and if you want to access addresses from a particular country or territory, click on the relevant name. If you wish to be considered for inclusion in the annual *SPC Fisheries Address Book*, click on 'Entry Form', fill in your details, and then click on the 'Submit' button at the bottom of the form.

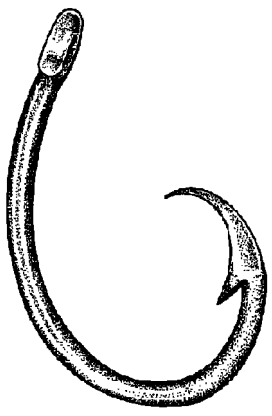
We trust that this document will remain popular and we are always open to suggestions for making it even more useful.

CAPTURE SECTION

Masterfisherman Steve Beverly spent two weeks in Tarawa, Kiribati during December 1998 to review progress being made on the Ministry of Natural Resources Development's (MNRD) new longline vessel, F/V *Tekokona II* (Figure 1). Fisheries Development Adviser, Lindsay Chapman first visited the vessel earlier in the year (*Fisheries Newsletter* nos 86 and 87) when the hulls were being built at Betiraoi Boatbuilding in Abatao.

Mike Savins, who is known throughout the Pacific, built F/V *Tekokona II*, and will be installing the hydraulic longline reel. When Steve called in at the Fisheries Division he found that the vessel had already been launched and put through preliminary sea trials in the lagoon at Tarawa. Steve went on a short spin around the lagoon on F/V *Tekokona II*, along with Mike and the crew from the Fisheries Division.

F/V *Tekokona II* will be equipped with a hydraulic longline reel built by Seamech Ltd (Fiji). While waiting for the reel and other gear to arrive, the crew kept busy making-up new longline gear.



Under the Masterfisherman's direction, they made up over 400 monofilament branchlines (Figure 2).

The branchlines were stored in two wire-mesh branchline bins that were also made by the crew. In addition, they spliced 50 floatlines and rigged 50 plastic floats. It is expected that the vessel and gear will be ready for longline fishing trials when Steve returns to Kiribati in late April 1999.

Meanwhile, Steve kept busy at SPC headquarters in Noumea, working on a manual on tuna longline fishing. This will be one in a series of Capture Section publications that includes the recently published *Vertical longlining and other methods of fishing around fish aggregating devices (FADs)—a manual for fishermen* (in both English and French), and a manual on deep bottom fishing techniques (also to be published soon). Other Section reports and manuals were progressed by Lindsay and Project Assistant Marie-Ange Roberts during this time.

During this same period, Masterfisherman Peter Watt completed his assignment with the National Fisheries College in Kavieng, Papua New Guinea. Having successfully trained the first group of students, Peter worked with and trained the second group of 20 students over three months as part of their Fishing Cadet Course. This was mainly achieved through hands-on training on-board the college's training vessel FTV *Leilani*. The training practices

Figure 1: The MNRD's new longline vessel, F/V *Tekokona II*

Figure 2: Crew of F/V *Tekokona II* making up branchlines

and the fishing methods demonstrated were the same as for the first group of students. The results from different bottom-fishing techniques (Figure 3) were good for both groups of students, however, the catch rates for tuna longlining were considerably lower for the second group. It was felt that this was due to seasonal changes.

Figure 3: Catch from bottom-fishing training sessions

Before leaving PNG, Peter drafted his report of all activities undertaken during his assignment. His draft recommendations were presented and discussed at a meeting of the National Fisheries Council, and all appeared to be well received. Following the drafting of the report, Peter went on leave for most of February.

During February 1999 Steve sat in as an observer at an ACP/EU (African-Caribbean-Pacific/European Union) Industrial Partnership Meeting, which was held in Nadi, Fiji.

The four-day meeting was hosted by the European Commission's Centre for Industrial Development, and brought together several entrepreneurs from European and Pacific Island seafood companies, as well as a variety of experts and consultants.

The aim of the meeting was to introduce EU regulations to Pacific Island fishing and seafood export companies, and to introduce European fish buyers to Pacific Island producers.

Steve learned a lot about EU import regulations, and he will be able to pass on this valuable information to SPC member countries and territories when he is working in the field with commercial fishing operations.

Pacific Island countries and territories wishing to export seafood products to EU countries will have to have appropriate legislation in place, a competent authority to inspect export and processing plants, and a laboratory for testing export products.

After these conditions have been met, EC inspectors will visit the export facilities and grant final approval. The competent authority grants an export number to the producer, and this will have to be marked clearly on all export products.

The consensus at the meeting was that Pacific Island producers would have a better chance of getting value-added products into European markets, rather than whole fresh fish. Europe, in contrast to Japan and Hawaii, does not have a large market for sashimi tuna. Opportunities in the future for export to EU countries will probably be in tinned fish and frozen loins.

While Steve was in Fiji, he took some time to visit a longline vessel from Samoa that was being re-fitted in Suva. The vessel, F/V *Courreur de Bois*, is an aluminium longliner originally from New Zealand. It is owned and operated by Apia Export Fish Packers (Samoa).

John Luff, Managing Director at AEFP, had the F/V *Courreur de Bois* lengthened by several metres and had a new engine and gearbox installed. While he was waiting for a new propeller to arrive from New Zealand, he had a newly-designed 'flopper-stopper' fabricated and installed.

Traditional flopper-stoppers, or stabilisers, are steel vanes that hang from chains from outriggers on either side of a vessel.

Their job is to keep the vessel from rolling. The port side flopper-stopper keeps the boat from rolling to starboard, and vice versa. The new design consists of an aluminium plate mounted onto a solid foldable framework (Figure 4).

One flopper-stopper on the port side (Figure 5) works to keep the boat from rolling in either direction. That way, it can be left deployed even during fishing operations. John said that most of the longline fishermen in New Zealand have installed this style of stabiliser on their vessels. It will be interesting to see if this idea takes off in the rest of the Pacific.

Peter started a new four-month project in Samoa in March. Peter will work with the staff of the Fisheries Department on their vessel F/V *Tautai Matapalapala.* The aim of the project is to conduct longlining trials to try to increase the catch rates of higher value species such as bigeye tuna (*Thunnus obesus*) and larger yellowfin tuna (*T. albacares*). Another objective is to train the vessel's crew and other interested fishermen in correct on-board handling, processing and icing practices for tunas and other species, especially export quality fish.

Also in March, Lindsay travelled to the Solomon Islands to undertake a one-week study for the Fisheries Department. The study was on 'Parameters for suitable vessels to foster domestic development of near-shore and offshore fisheries in the Solomon Islands'. The study also looked at the options available to Solomon Islanders for locating and financing suitable vessels. Marketing options, training and the availability of fuel, ice, bait, fishing gear and spare parts were also covered briefly in the study.

Figure 4: Flopper-stopper being deployed

Figure 5: Flopper-stopper deployed

TRAINING SECTION

A safety course in Kiribati for potential crew on US purse seiners

At recent FFA multi-lateral tuna treaty meetings, representatives of Pacific Island nations have raised their concerns that very few Pacific Islanders are employed onboard US purse-seiners. As a consequence, FFA and SPC agreed to collaborate with the US tuna industry with a view to mounting a training programme that would screen potential crew for employment on US seiners operating in the region.

Starting in August 1998, the SPC Fisheries Training Section has developed a set of resource materials to assist with the delivery of a pre-sea safety training course for new entrants to the purse-seine fishing industry. The course, outline, teaching and reference materials were developed in collaboration with Mr. George Souza, the general manager of GS Fisheries, a San Diego-based purse-seine company. The resource materials of the Vanuatu pre-sea fishing and safety course (for crew of Taiwanese longliners) were used as a guideline.

Late in 1998, discussions took place with several fisheries training institutions in the region to assess countries' interest in running a pilot course with SPC technical and financial assistance. The Fisheries Training Centre (FTC) in Kiribati expressed its interest and, in January 1999, FTC staff were in preparation mode for a course that was scheduled for 15 to 28 February.

Course structure

The Fisheries Training Centre had the responsibility of organising and planning this pilot course in Kiribati. Delivery of the course was a joint effort between the Ministry of Natural Resources Development (MNRD) and FTC. MNRD agreed to participate in the training through provision of resource persons with experience in purse seining. Employees of both institutions were responsible for all classroom delivery (apart from First Aid) at the FTC.

The course was on-site; accommodation was available at FTC Campus for all participants. The course opened officially on Monday, 15 February 1999, however, all students were requested to arrive at the School a day earlier, on Sunday.

Course preparation and planning

FTC had appointed one of the Senior Instructors to be the

The entire course was delivered by Kiribati institutions and Kiribati nationals

course co-ordinator, however the Principal was on hand to assist. The course organiser was familiar with the contents of the teaching package. Certain sessions have been allocated to suitable tutors. They received copies of the lesson plan and handouts for those sessions, along with the materials and reference sources, in sufficient time for them to prepare.

The SPC Fisheries Training Officer was also in Tarawa to advise local tutors and assist them with course organisation.

Facilities and materials

Kiribati has all the facilities, resources, materials and skills necessary to host such a course.

- ☞ FTC has an established background in fishing and maritime safety training. FTC has been running a nine-months fishing cadet course for the past 10 years. All the basic facilities for such training are available. Classroom facilities for course delivery were more than adequate.

- ☞ Practical at-sea fishing on a surface longliner was organised for the participants.

It should be stressed that the entire course was delivered by Kiribati institutions and Kiribati nationals, which should be considered a great success in itself. Any credit for the successful outcomes of the course must therefore lie with those agencies and individuals.

The SPC Fisheries Training Officer's role was limited to assisting with the co-ordination of the resources and materials necessary for the course and working with the various tutors to modify the outline and content of the course so that it was more appropriate to the desired outcomes.

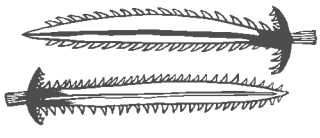
The training vessel *Te Tia Akawa*

There were no difficulties in organising resources and materials. All staff involved in providing training did very well.

Conclusion

From the 30 participants, it is expected that only a handful would get a job on a US seiner. It is therefore essential that only the top trainees be given that chance in order to establish a solid reputation for Pacific Island crew amongst the US tuna industry. One of the main purposes of the course was to screen those best trainees from the others. The essential criteria identified by US purse-seine operators are discipline (no drinkers onboard!), fitness and tolerance to long periods at sea.

This pilot course was financed by the Government of Taiwan/ROC.



To work on a purse seiner, trainees should learn to splice rope and cable and to sew nets.

A regional course on seafood business management for Pacific Island women

In addition to regional courses and workshops targeting fisheries enterprise managers and commercial fishing skippers, the SPC Fisheries Training Section and the New Zealand School of Fisheries are developing a new course for Pacific Island women.

This four-week training programme will be run in Nelson from 12 April to 7 May and will target Pacific Island women involved in the management of a seafood business. The course will be divided into two main subject areas studied for two weeks each. The first area will focus on the development of value-added seafood products using raw materials such as tuna, mackerel, squid, octopus, shark liver or fish wastes. This topic will be covered by Neil Wilson, at the School of Fisheries' wet lab.

The second area will include more theoretical subjects, such as business management skills, business planning, seafood safety and quality, HACCP and other international regulations and marketing, etc . . . These sessions will be co-ordinated by Cushla Hogarth. As for previous management workshops, guest speakers and consultants from the Nelson-based seafood industry will be invited to come and share their experiences with course participants.

The selection of course participants was carried out by Section staff early in January. This selection was a difficult task, as 75 candidates had applied for only 12 positions. Ultimately, the following countries will send representatives to this course: Tonga, Kiribati, Papua New Guinea (2), Tokelau, the Federated States of Micronesia (2), the Solomon Islands, Nauru, Fiji, Tuvalu and Palau. From the 12 selected candidates, four will come with backgrounds in industrial fisheries (prawn trawling, tuna longlining and fish smoking) while six are managers of small-scale seafood businesses. The last two participants are members of women's groups, and, as such, were selected to train other women in their home countries.

The course budget will be provided by the governments of Australia and France with additional funding donated by the United Nations Development Programme (UNDP).

Taking into account the high number of nominations for this course, the Fisheries Training Section will undertake to secure funding to repeat the training programme in 2000.

Happy twentieth birthday to the SPC/Nelson Course!

When, in 1979, the SPC advertised the Pacific Island Fisheries Officers Training Course, no-one in the region would have thought the same course would be run the following year. In fact, the SPC / Nelson Polytechnic course became an annual event, and has been attended by 222 fisheries officers from 18 countries and territories during the 1979–1998 period. What other aid-funded training programme possesses such an impressive résumé!

This year's course started on 8 February at Nelson when the 12 participants (from 10 countries and territories) were given a tour of the New Zealand School of Fisheries. Indeed, the 23-week training programme is totally different from what it was in 1979. The five-week practical fishing module now takes place in the Pacific (initially, this was run in the freezing months of the New Zealand winter!), the course duration has been extended and some topics have been added to keep the course relevant.

At the last regional fisheries meeting in Noumea (October 1998) the course was again reviewed and a new outline was proposed. Once again, the meeting gave its support to the continuation of the course but, after long discussions, participants decided to maintain the programme in its current format.

Workshop on tuna longlining, handling and grading on Christmas Island

In August 1998, the SPC Fisheries Training Adviser was in Nelson to supervise the operation of the second regional workshop for managers of fisheries enterprises. As part of the discussions held with workshop participants, a follow-up training activity was organised with Toakai Koririntetaake, the manager of Kiritimati Marine Export Ltd (KMEL).

KMEL is a seafood catching, processing and marketing company based at London, on Christmas Island in the Line group of Kiribati. The company employs over 30 staff and sells fresh fish, frozen lobster tails, dried beche-de-mer, shark fins and aquarium fish mainly to Hawaii, but also to Hong Kong.

The training need, as identified by Toakai, was in the area of fish handling and quality for chilled tunas exported to Hawaii. The need to introduce fishing techniques targeting the large deep-water tunas was also identified

On the way to the FAD, KMEL fishermen troll for wahoo which will be exported to Hawaii

as a means of catching sashimi-grade fish for exports.

Early in November, the training programme was implemented by Michel Blanc and SPC Masterfisherman, Steve Beverly. Prior to arriving on Christmas Island, the team spent four days in Honolulu, Hawaii. The objective in Honolulu was to visit fish buyers, including KMEL's present buyer, a former buyer, and a potential new buyer; and to make some fishing gear purchases from a Honolulu-based gear supplier.

Courtesy calls were also made to relevant fisheries organisations. KMEL's present buyer confirmed that tunas purchased from Christmas Island were currently too small to be placed on the lucrative sashimi markets of Hawaii or the US mainland.

The objectives of the visit to Christmas Island were to conduct a tuna handling, grading and fishing workshop for KMEL fishermen, fish processors, and managers, and to make some recommendations in order to improve the company's product quality and revenue.

The workshop consisted of two days on shore followed by one day of fishing at sea using KMEL's canoes to demonstrate vertical and horizontal longlining. On day one, Steve and Michel talked about sashimi tuna markets in Japan and Hawaii and showed the trainees some slides of the Tsukiji and Honolulu auction markets.

The lectures also covered onboard tuna handling, tuna grading and a presentation of the various tuna longlining techniques. On day two, the trainees made up a 50-hook longline using some gear (tarred kuralon and floats) left by the Overseas Fishery Cooperation Foundation (OFCF). The branchlines were made with the nylon monofilament and hooks purchased in Honolulu. On day three, two boats visited a local FAD. After a good troll that produced a bunch of wahoos, the trainees set two vertical longlines, the 50-hook horizontal longline and did some drop-stone and palu-ahi fishing. Unfortunately, tunas were not around that day! However, trainees could practice the tuna longlines and all of them were keen to try the gear again.

On the night before the team's departure from Christmas Island, KMEL staff packed about 1.5 tonnes of wahoos and a few hundred aquarium fish for export to Hawaii. The team was able to supervise the packing operation and, based on all the observations made during the visit, submitted to KMEL a set of recommendations to improve the company's catching, processing and marketing sectors.

KMEL staff making up floatlines for a 50-hook tuna longline

COMMUNITY FISHERIES SECTION

The period of November 1998 to March 1999 has been dedicated to field work in Palau and Tuvalu, completion and distribution of national assessments of the Marshall Islands and Nauru, the production and distribution of the third Women in Fisheries Special Interest Group Bulletin, *and the filming of a video in Nauru.*

National assessments

Palau

A field survey on the role of women in fishing communities was completed in Palau (16 to 30 November 1998) and a draft report compiled. The assessment was requested by the Government of Palau in response to an identified need for more information on the participation of women in the fisheries sector.

The SPC Community Fisheries Officer was assisted in the survey by Evelyn Oiterong (Division of Marine Resources, Palau) and Roberta Louch (Bureau of Women's Interests, Palau).

A draft report of the survey has been submitted to the Government of Palau, and a number of recommendations will be made once the people involved in the survey have had a chance to comment on the draft. A workshop is being planned for the women of Peleliu State following requests for training in the following areas:

- seafood quality, processing and preservation;
- marketing (packaging, developing business skills etc.);
- new recipes (for marketing pre-cooked lunch packs);
- aquaculture.

Tuvalu

The Community Fisheries Officer visited Tuvalu from 24 January to 12 February. The aim of the trip was to carry out a baseline survey, gathering relevant information for a report on fishing communities in Tuvalu and the involvement of women in fisheries activities.

The report is to provide direction for the Tuvalu Fisheries Department in addressing the needs of their subsistence and artisanal fisheries and to assist the SPC Community Fisheries Section in developing the training and income-generating activities of the project.

The survey was undertaken at the request of the Tuvalu Fisheries Department and carried out with their assistance and that of the Tuvalu National Council of Women. While in Tuvalu the Community Fisheries Officer worked with Sikela Ulumutu of the Fisheries Department and Suia Pesenga of the National Council of Women.

Tuvalu Fisheries Department boat, F/V *Manaui*

Dried fish, Vaitupu, Tuvalu

Catching eels, Nui, Tuvalu

National workshops

Wallis and Futuna

The Community Fisheries Officer and the Women's Development Officer from the Pacific Women's Resource Bureau (PWRB) will be organising and attending a workshop for fisherwomen on net mending, in collaboration with the Wallis and Futuna Fisheries Department. The workshop, to be held in Futuna, is scheduled for May 1999 and will be jointly funded by the Community Fisheries Section (CFS) and the PWRB. This is a good chance for the Community Fisheries Section to work together with the PWRB and will also be the first time that the section has conducted training in a French-speaking territory.

Income-generating projects and other national activities

Nauru

Filming of a video to teach women the rationale behind and methods of sustainable harvesting of marine resources began in November 1998.

Editing is now underway. The video, which will be available in both in English and Nauruan, is part of a programme of assistance to Nauru. The script for the video is a collaborative effort between the Community Fisheries Adviser, Ms Julie Olsson, and Pasifika Communications Limited (the company commissioned by the Section to produce the video).

Niue

As a follow-up to the two workshops organised by the Community Fisheries Adviser on shellcraft production and marketing, and seafood processing and marketing, (September / October 1998), the graduates conducted village and national activities in November and December 1998. According to local counterpart Ms Charlene Funaki, the women held a number of village workshops sharing practical skills in shellcraft production and seafood preparation. Shell handicraft and seafood dishes were displayed at the closing ceremonies. In addition, the Niue Council of Women planned to hold a national show day on shellcraft.

Publications

Women in Fisheries Special Interest Group Bulletin

Issue no. 3 of the *Women in Fisheries SIG Bulletin* was produced and distributed in English in December 1998 and in French in February 1999.

The Community Fisheries Officer (CFO) took over the responsibility of coordinator. Apart from the usual articles detailing the activities of the Section, pieces on activities in Samoa, Fiji, Papua New Guinea and New Zealand, plus information on events in India, Canada and Africa, were also included.

Details on workshops, and publications of relevance to women in fisheries, also feature in the newsletter.

Issue no. 4 was distributed in April 1999.

Training manuals

Work is underway on a Community Fisheries Management manual. This is designed to be used as a training manual in the work of the Community Fisheries Section. In addition, a seafood nutrition and recipe manual is also being put together, primarily for use by participants who attend seafood-processing workshops.

Regional collaborative work

CETC fisheries curriculum

This year the Community Fisheries Adviser (CFA) is working with the USP Director of the Postharvest Centre to develop a fisheries module for the SPC Community Education Training Centre (CETC) in Fiji. Operating for over 30 years, the Centre's aim is to provide community training to female community workers (aged between 20 and 45 years), from SPC member countries and territories. Graduates of the Centre return to their communities and

train others in extension work. Courses are provided in such subjects as agriculture, home economics, communications, health, business skills, environmental management, gender and development, and appropriate technology. To date, the topic of fisheries has been absent from the curriculum. To overcome this, the CFA and Postharvest Centre Director will be producing the fisheries module with the aim of teaching it to CETC students in September 1999.

■ REEF FISHERY ASSESSMENT AND MANAGEMENT SECTION

In Fiji . . .

The creation of a company to catch live reef fish for the restaurant trade has prompted the Fijian Government's Fisheries Division to request an assessment of the fisheries resources targeted by this project in the Bua Province of Vanua Levu. This task resulted in three visits to Fiji, totalling 33 days. The main goal was to provide recommendations for the sustainable management of this fishery. The foundations were also laid for regulating this activity in Fiji. The study's principal results and conclusions are presented in this issue (see page 25). The technical report will be published in May.

In Niue . . .

At the Government's request, the Section's team carried out a 13-day visit from 25 November to 8 December 1998. Its purpose was to:

- ☞ Assist the Fisheries Department in setting-up a marine reserve on the fringing reef north of Alofi;
- ☞ Formulate an assessment and monitoring programme for Niue's fishing activities and resources.

A sampling process was carried out for the marine reserve. Two techniques were used:

- ☞ underwater visual census (UVC) in the sub-intertidal zone;
- ☞ quadrats on the intertidal reef flats.

A total of 24 stations were covered in the UVC, while 10 quadrats were surveyed. In both the reserve site and a reference zone located at Avatele, this work yielded information on:

- ☞ resources, in terms of fish and invertebrates with potential for consumption or marketing;
- ☞ the habitat and the living organisms associated with it.

This campaign also helped to train the Department of Fisheries' technical officer in the underwater visual census method.

On the basis of the results obtained, the study will contain a plan for monitoring the resources at both sites over time. Results and conclusions will be published in April.

As for the second part of this task, discussions revealed a need, at regular intervals, to define and implement additional methods designed to assess commercial and industrial fishing catches, on the one hand, and subsistence-related catches, on the other.

No data has been collected over the past 10 years. For this reason, two surveys will be conducted during the first quarter of 1999, one targeting professional fishermen and the other consumers.

Sampling plans and questionnaires were formulated and tested. They have been sent to the Fisheries Department, which will be carrying out the surveys with help from the Section.

The objectives are to better identify species targeted for fishing, get an idea of the quantities caught and categorise seafood consumers. Over the longer term, this involves being able to identify trends on which to base proposed measures to manage this resource.

OCEANIC FISHERIES PROGRAMME

Third meeting of the SPC–FFA Tuna Fishery Data Collection Forms Committee

The third meeting of the SPC–FFA Tuna Fishery Data Collection Forms Committee was held from 9 to 10 December 1998 in Brisbane, Australia. Two participants from SPC and three from the Forum Fisheries Agency (FFA) attended the meeting. One participant from the Micronesian Maritime Authority attended as an observer.

Until recently, many different tuna fishery data collection forms have been used in the region. The Forms Committee was established by SPC and FFA in 1995 to develop standard data collection forms, including catch and effort logsheets, observer forms and port sampling forms.

The standard forms are used to collect data from domestic and foreign vessels fishing in the EEZs of SPC and FFA member countries and territories and adjacent high seas. The first meeting of the Forms Committee was held in December 1995, and the second was held in December 1996.

Participants at the third meeting reviewed the catch and effort logsheets for longline, pole-and-line and purse seine. It was recognised that the implementation of revised logsheets is a difficult process that takes at least two years. Thus the logsheets revised in 1996 are not yet fully implemented.

While some minor changes to the logsheets were considered, it was felt that none were important enough to justify issuing a new revision of the logsheets. Instead, the proposed changes will be reconsidered at the next meeting of the Forms Committee, which is scheduled for December 2000.

In contrast, the observer and port sampling forms underwent extensive revisions. The revised observer forms will be considered at the observer training course to be held by FFA and SPC in Majuro, Marshall Islands, during February 1999, and then they will be implemented in national observer programmes of SPC and FFA member countries and territories. The revised port sampling forms will be implemented during 1999.

The catch and effort logsheets, and possibly the observer and port sampling forms, will be available on the SPC web site at http://www.spc.org.nc/oceanfish/ in due course, which should improve access to the logsheets by distant-water fishing nations operating under bilateral and regional access agreements. The report of the third meeting of the Forms Committee will also be made available on the SPC web site.

The meeting considered the proposal raised by the Statistics Working Group at the Eleventh Meeting of the Standing Committee on Tuna and Billfish (SCTB11) (held from 28 May to 6 June 1998 in Honolulu) that the Statistics Working Group take over the responsibility of reviewing and maintaining the data collection forms from the Forms Committee.

It was noted that meetings of the SCTB Statistics Working Group may involve 40 or more participants, and hence it may not be practical for such a group to make decisions concerning revisions to the data collection forms. The Forms Committee therefore considered that it would be more appropriate for it to maintain responsibility for the standard forms.

On the other hand, the Forms Committee welcomed the proposal made at SCTB11 that the Statistics Working Group review the forms developed by the Forms Committee. It was felt that the participation at SCTB meetings of scientists from fishing nations and coastal states throughout the region would result in a thorough and effective review of the forms, and that any recommendations made by the Statistics Working Group would be valuable.

It was suggested that since the next meeting of the Forms Committee will take place in about December 2000, it would be more appropriate for the Statistics Working Group to review the forms and make recommendations to the Forms Committee at SCTB13, in about June 2000, rather than at SCTB12, in June 1999.

EXPERTS CALL FOR DIVERS' INSURANCE COVER FOR FIJI

Participants at a training workshop in Fiji for bêche-de-mer divers want professional training and insurance coverage for injuries sustained during diving. The workshop was attended by operators, divers, exporters and representatives from the Ministry of Labour and the Fisheries Department. Participants said they would make submissions to the Commissioner of Insurance requesting coverage for injuries sustained while diving.

Principal Fisheries Officer Malakai Tuiloa added that the participants wanted to ensure that their diving equipment was checked, repaired and updated. They also wanted to obtain diver certificates. He said that professional training for divers was necessary, keeping in mind the number of mishaps and risks involved. Mr Tuila said that trained divers had open water certificates, which included the basics of diving.

He outlined that it would become mandatory for all divers to have an advanced certificate after obtaining training from a professional. He also said that operators and divers would meet regularly to discuss problems and make the bêche-de-mer industry safe and prosperous.

90% risk their lives

Over 90% of bêche-de-mer divers are untrained. The national coordinator of the Fiji Recompression Chamber Facility, Mr Curly Carswell, said lack of training created many health problems. Speaking at an underwater breathing apparatus training workshop, Mr Carswell said he would offer discounts to operators and individuals who wanted professional training.

He said untrained divers were often unable to differentiate between symptoms of viral and diving sicknesses. He added that divers often fail to tell doctors that they have been diving, and medical staff were unaware of circumstances surrounding their illnesses. The Ministry of Health was aware of symptoms related to diving sicknesses, but divers, especially those in the villages, were ignorant. He concluded by saying that professional training was necessary to combat rising health problems.

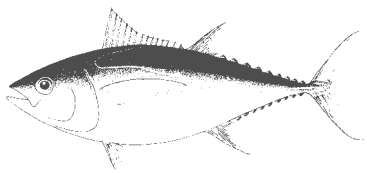
Source: *Fiji Times*, 20 March 1999

THE COLOUR OF SASHIMI — FRESH RED OR FALSE RED

A new practice poses a significant threat to the US$ 60 million domestic tuna and swordfish industry in Hawaii, American Samoa, Guam and the Northern Mariana Islands.

The process is designed to deceive consumers into purchasing inferior quality seafood that may be unsafe for consumption.

The practice exposes fish products to carbon monoxide (CO) gas prior to freezing.



The process causes the products—generally steaks or blocks for sashimi or searing—to turn an unnaturally bright red colour.

Consumers could interpret the red colour as an indicator of quality and be deceived into purchasing an inferior product at an artificially inflated price.

The substitution of the CO-treated tuna products for high-quality fresh and frozen tuna affects the Hawaii tuna fleet by reducing the market demand and value for the genuine product.

Direct health implications are most likely negligible, due to the limited amount of CO contained in the treated products and volume of the product consumed. However, the potential for secondary public health problems is significant.

The health risk results from the lack of normal colour and colour changes in the tuna. Because the products no longer turn from red to brown, consumers lose their ability to judge when the products are no longer safe to eat.

The point was demonstrated at the Western Pacific Regional Fishery Management Council meeting in Honolulu this past December. Council Chair Jim Cook placed three pieces of tuna—low-grade, regular-grade and gas-treated—on a platter and kept them exposed at room temperature throughout the

meeting. The low-and regular-grade cuts remained bright red. The only telltale sign that the red pieces were not fresh, high-quality tuna was an opaqueness rather than translucency (clarity) in colour.

Production of CO-treated tuna and swordfish occurs in Indonesia, the Maldives, the Philippines, Pohnpei and Taiwan, and was originally targeted at the Japanese market, according to a paper by John Kaneko of PACMAR Inc., a consulting firm to the local tuna industry.

Because the Japanese Government was concerned about public health and consumer fraud, it established an action limit of 200 ppm CO in seafood products, effectively restricting importation of CO-treated seafood products into Japan.

Producers have since turned to the US market, where the Food and Drug Administration (FDA) has failed to act to protect consumers from this product. Although the FDA considers treatment with CO gas to be an illegal form of adulteration (CO is not an approved food additive) and a form of economic fraud, its policy is to focus on direct—and not secondary—safety issues.

Some producers are clouding the current situation by claiming their products are 'lightly smoked' or treated with 'tasteless smoke'. The FDA is investigating the argument that CO should be generally as safe as natural wood smoking because CO is a natural component of wood smoke.

Meanwhile, US importers, wholesalers, retailers and restauranteurs are taking advantage of the attractive price differential of CO-treated tuna to use this frozen fish in preparations that, until now, have been made using only fresh and occasionally high-quality frozen tuna. In Hawaii, these include sashimi, sushi and poke.

However, Kaneko warns, 'Marketers using these products are taking the short-term view without consideration for long-term impacts . . . The issue of consumer deception and loss of consumer confidence has the potential for great negative impacts, not only on our seafood market but also on our domestic tuna fleets'.

The Council, which concurs with Kaneko's findings, has asked the FDA to consider prohibiting importation, distribution and sale of CO-treated seafood products.

Source: *Pacific Islands Fishery News*, Winter 1999

DISCARDED FOREIGN NETS CAUSING CONCERNS TO PROFESSIONAL AND TRADITIONAL FISHERMEN

Every year, around the top end of the Australian coast, lost and discarded fishing nets wash-up on northern beaches. In response to this problem, the Australian Fisheries Management Authority (AFMA), in conjunction with the Northern Prawn Fishery Management Advisory Committee (NORMAC), commissioned a local aboriginal community to undertake an intensive marine debris survey on Groote Eylandt in the Gulf of Carpentaria.

Results indicate that a large majority of the debris collected during the survey is likely to have originated in foreign waters to the North of the Australian Fishing Zone.

In 1996, reports from Australian fishermen suggested that the number of nets encountered drifting in the southern Arafura Sea was increasing. This increase coincided with an expansion of the Indonesian trawl fleet in the northern Arafura Sea. In 1997, concerns about fishing gear debris washing ashore on Australia's remote northern beaches were raised by the Anindilyakwa Land Council (ACL), which represents the traditional interests of the Anindilyakwa speaking people on Groote Eylandt.

Northern Territory Fisheries officers inspected three beaches on Groote during April 1997 to determine the amount and type of nets being washed ashore. Most of the debris was identified as trawl and gill netting, but not of the type commonly used by domestic operators. These preliminary results provided the necessary information to design a large-scale survey.

In October 1997, Northern Prawn Fishery operators provided funding to the ALC to conduct a survey over a seven-months period. During this time, marine debris was collected from all accessible Groote Eylandt beaches. A report entitled 'Groote Eylandt Fishing Gear Debris' documenting the findings of the survey was prepared for NORMAC discussion and has been provided to the ALC.

Fishing gear-related debris comprised the overwhelming majority of debris on all beaches. Large maritime debris densities were recorded on the north, east,

and south coasts of the island. The overall average debris density recorded was 1,098 kg (8.32 items) per kilometre.

Eighty-four per cent of the debris found on Groote's beaches was made up of fish trawl netting and white multi-filament gill netting. The remainder was rope, floats, plastic and a small amount of prawn trawl netting.

It is clear from the type of materials found that Australian boats are not the main source of the pollution. Prior to and at the time of the survey only one Australian fish trawler was operating within 1,000 nautical miles of Groote. It is hard to imagine that it could have accounted for over 36 tonnes of fish trawl netting. The white multi-filament netting that amounted to 15.3 tonnes is not used by northern Australian shark or barramundi fishermen. The six tonnes of general trash mainly consisted of four strand hard lay green rope. This foreign-produced rope is cheap, hard to handle and not generally used by Australian fishermen.

It appears, therefore, that large numbers of foreign nets are drifting into Australia's territorial waters, caught in the Gulf currents and blown ashore along the Northern Territory's east coast by the prevailing south-easterly winds during the dry season (May to August).

The challenge now confronting management organisations and northern Australia's professional and traditional fishermen is how to prevent foreign fishermen from dumping fishing gear debris at sea. A heavy-handed approach is unlikely to be successful. Fisheries training programmes designed to promote self-regulation of the problem, and promote domestic and foreign awareness of the impacts associated with the at-sea dumping of fishing gear, are necessary.

At the end of the day, someone is going to have to supply adequate disposal facilities at all major ports in the Arafura Sea. Only when alternatives to at-sea disposal of old fishing gear are readily available will compliance with national and international laws be a reasonable expectation.

Source: *Fishing Boat World*, January 1999

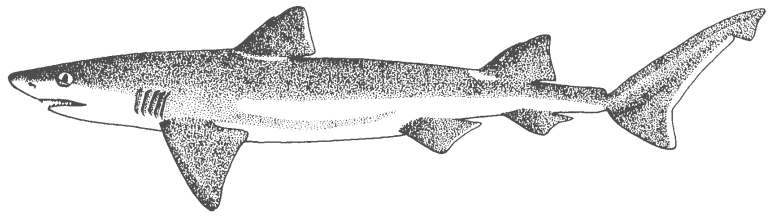
NATIONS AGREE TO GLOBAL PLAN TO RECOVER SHARKS

A newly-accepted international plan of action to conserve and manage sharks establishes concrete steps to further protect sharks and shark-like species such as skates and rays, to formulate national shark management plans by early 2001.

Member countries of the Food and Agriculture Organization (FAO) of the United Nations agreed to the plan on 29 October 1998 during a meeting in Rome.

'This international plan of action should establish sound management practices worldwide for a vulnerable category of fish that, in most of the world, is not managed at all', said chief US negotiator Terry Garcia, Assistant Secretary of Commerce for Oceans and Atmosphere.

'The United States pressed for and achieved a plan that features the use of the precautionary approach, which provides for management measures based on the best available scientific information, but does not postpone management decisions when data are less than perfect.



Further, the use of regional fishery management arrangements is encouraged to ensure the international co-ordination of shark management'.

The plan offers guidelines to states about how to conduct preliminary assessments of sharks taken within their national waters and how to prepare shark management plans.

It also provides for better data collection and monitoring, and bycatch reduction. The plan is voluntary, but is likely to be endorsed by consensus at the FAO Committee on Fisheries meeting in February 1999 and then adopted by the full FAO Conference next November.

Source: *Fisheries*, December 1998

TUNA PLANT TO BE BUILT IN MAJURO

A US$ 5 million tuna-processing factory involving San Francisco-based Pacific Micronesia and Orient Line (PM&O) and American tuna giant Star Kist began construction in the Marshall Islands at the end of March.

Marshall Islands Government, PM&O, and Bank of Marshall Islands officials signed agreements confirming a US$ 2 million loan for the new fish-loining plant, paving the way for start-up of construction.

The loan agreements were the final piece of the financing puzzle that has taken more than two years to put together for this central Pacific facility, which is expected to shave weeks off the time it takes American purse seiners to discharge their cargoes of tuna and return to nearby fishing grounds.

PM&O regional manager Keith Fawcett said that the plant was expected to be in operation by October, and would generate 300 jobs for Marshall Islanders. Local officials hailed the jobs and revenue that the plant is expected to bring to Majuro, the capital city of the Marshall Islands.

The new loining plant—which will process tuna, to be canned in American Samoa—will reduce the amount of time fishing vessels spend away from fishing grounds. 'If a purse seiner has to go to American Samoa to off-load its catch at the Star Kist cannery, it will take as much as 30 days [before it gets back to western Pacific fishing grounds],' said Fawcett.

'If they come to Majuro, they can turn around in one week. Instead of just four fishing trips a year, they can make six.'

The Marshall Islands Marine Resources Authority is providing security for a US$ 2 million loan through the Bank of Marshall Islands, while PM&O is investing US$ 3.2 million for the loining plant.

'This will be a showcase project for the Marshall Islands,' said the Government's Private Sector coordinator Robert Muller. 'It will show that the Marshall Islands is becoming attractive for foreign investments.'

Purse seiners owned by Star Kist, the largest producer of canned tuna in the world, will feed tuna to the factory.

PM&O, which already provides a monthly container shipping service to the Marshall Islands, will ship the processed and frozen fish directly from Majuro to Star Kist's American Samoa factory for canning.

Source: *Marianas Variety News and Views*, 29 March 1999

NEW SAFETY-AT-SEA DEVICE AVAILABLE

Sea fishermen in the water are just a speck to a rescue aircraft, even when flying low on a search and rescue mission. However, with the new 40 ft (12.2 m) coloured See/Rescue streamer, the odds of being picked-up can rise significantly.

A host of tributes have been paid to the See/Rescue streamer:

- 'One of the simplest, yet most effective, devices you can use to ensure that you can be found . . .'
- 'It leaves a bright trail right to you that can be spotted from the air . . .'
- 'It's an excellent addition to any raft . . .'
- 'It offers a host of advantages over traditional sea marker dye . . .'

The streamer was shown and demonstrated in November 1998, at the Fish Expo in Seattle, USA. It is a patented, compact, high-strength, bright orange device which floats to provide survivors with a large continuous, visual target to rescuers in the air and on the water.

US Coast Guard aircraft typically fly between 200 and 500 ft (60 and 150 m) when searching for people and between 1000 and 3000 ft (300 and 900 m) when looking for liferafts and/or boats. A person's head is almost impossible to see from these heights.

But, being visible over a mile away, the See/Rescue streamer can transform a man overboard from a statistic into a survivor. The device stays deployed indefinitely, provides a continuous distress signal and clips easily to whatever the person is wearing.

'It's the simplest, most convenient, high-visibility locating device ever made,' according to Rescue Technologies Corporation. In tests conducted by the US Navy, the model SAR-11—

which takes up less space than a single flare when stored—was visible from a distance of 1.5 miles (2.5 km) at a search altitude of 1500 ft (450 m).

The latest Pocket/Rescue—which is smaller than a sunglasses case when stored—was detected 1.3 miles (2.1 km) away at the same altitude. The US Navy has successfully tested and authorised the use of the new See/Rescue technology for all Navy and Marine commands.

'The incorporation of the See/Rescue high visibility locating device will increase the survivor's probability of detection and rescue.' It says. The US Air Force has also authorised the device for use in its survival kits, survival vests and multi-place liferaft accessory containers and it says it can be used as a replacement for sea marker dye.

Rescue Technology Corporation's Dr Robert Yonover, the inventor of the device, told Fishing News International that the See/Rescue can be clipped to a lifejacket (vest), boat or raft, and works continuously. There are no chemicals, batteries, smoke or dye to burn out and disappear, he explained.

The device is marked with the international distress symbol and is always ready for use, being unrolled in seconds.

'See/Rescue is the only low-cost locating device that provides a large continuous visual target to identify your position in water or on land,' says Dr Yonover, adding that night-vision goggles can pick out the streamer.

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Website: www.SeeRescue.com

Source: *Fishing News International*, January 1999

NEW TUNA PROCESSING TECHNOLOGY MAKES POSSIBLE SIGNIFICANT YIELD INCREASES

The ABM process described below makes it possible to significantly improve tuna-processing yields. Traditionally, tuna canneries have material yields of 46 to 51%. This new process can make it possible to obtain yields of nearly 60%.

The process

The process involves combining two processes, these being texturisation and better exploitation of the red meat.

Texturisation

The idea is to achieve a higher net drained weight from the same amount of tuna. To do this, ABM has adapted technology used in the saltfish industry. The principles of texturisation and incorporating brine had to be adapted to the specific characteristics of tuna meat. The goal is to get the brine to penetrate into the meat while at the same time removing certain proteins in order to form a kind of 'cement' around the fish. The difficulty arises from the special nature of the 'actin/myosin' bonds. Tuna processed by this method must, in particular, have a constant salt content.

An outline of the texturisation process is presented in Figure 1.

Texturisation is a mechanical process which allows water to be absorbed rapidly. It is based on making use of the functional properties of tuna proteins and their ability to retain a certain amount of water. This increase in yield is accomplished without using any additives. Texturisation also improves the product's 'smoothness' and can lead to the creation of new products.

However, certain precautions must be taken:

- The tuna must be clean after trimming (no blood, no scales, no bones). For this reason, work surfaces must be adapted to working with natural tuna. ABM provides the required recommendations during equipment commissioning;
- The tuna must not be left waiting too long after trimming.

Improving the quality of the red meat

It is possible to improve yields by an additional 10% by using the red meat, which is normally not used for canning.

To do this, the fibrillated proteins of the red (or brown) meat must be altered, and the meat then incorporated into the canned meat. The meat is chopped and improved through a repeated washing and draining process.

The functional differences between globular and fibrillated proteins are used, along with their respective capacities to dissolve in water. It must also be

possible to generate constant yields with fish processed in this manner, in spite of the wide differences between batches.

When used in conjunction with the texturisation process, such improved exploitation of red meat makes it possible to obtain yields of 60%.

For an average-sized factory, the return on investment time is under two months.

An outline of the process is presented in Figure 2.

This involves a mechanical process which allows the olfactory, colour and globular qualities of the red meat to be separated quickly. The difference in the behaviour of globular and fibrillated proteins after processing makes it possible to incorporate the altered red meat into the white meat. This incorporation means that a part of the meat which is normally thrown away (the red meat) can be used completely, thereby increasing material yields.

However, certain precautions must be taken:

- Dips must be strictly controlled;
- The sanitary quality of the materials used must be top-notch (welding quality, cleaning cycles, etc.);
- The sequence and length of washing / draining cycles must be carefully controlled;
- The fish must not be kept waiting too long after trimming;
- The histamine level must be carefully controlled.

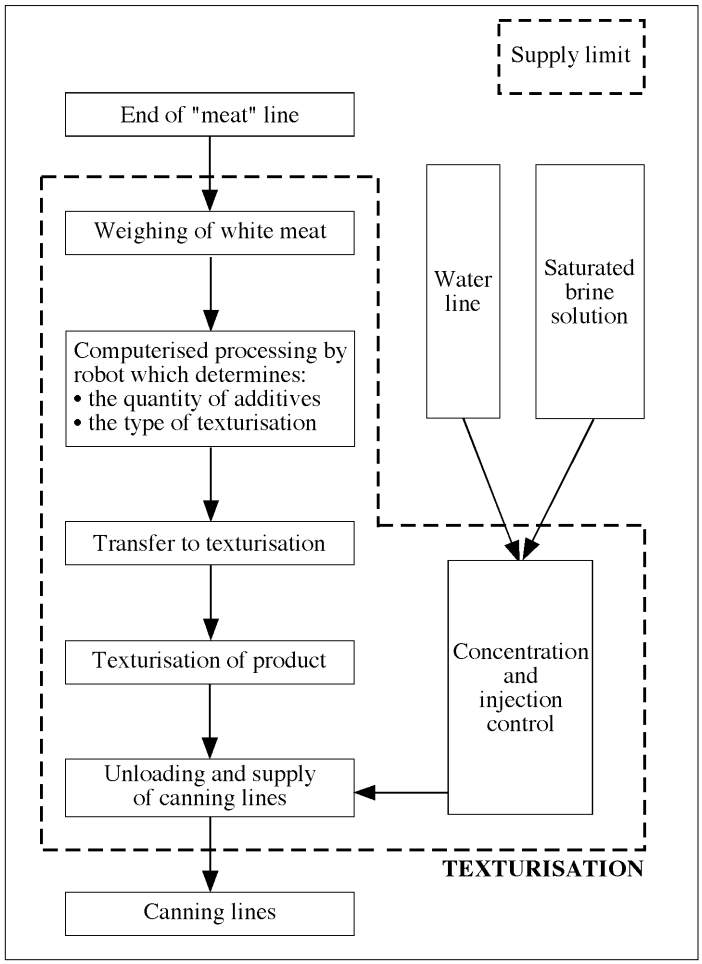

Figure 1: Texturisation of red meat

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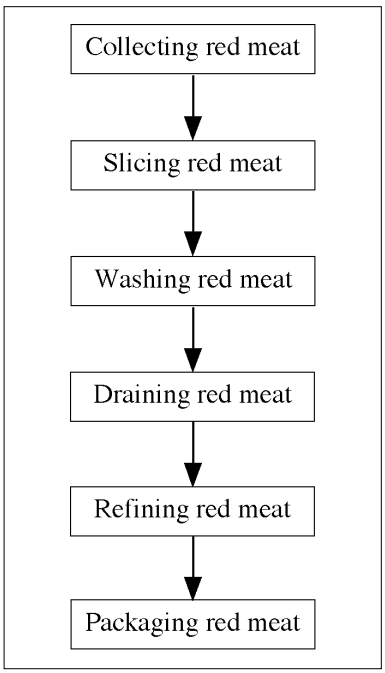

Figure 2: Improved exploitation of red meat

TOWARDS COMMERCIAL REARING OF THE MUD CRAB

Under a programme supported by the Northern Territory's Department of Primary Industry and Fisheries (NTD-PIF) and by the Australian Centre for International Agricultural Research (ACIAR), the Darwin Aquaculture Centre (DAC) is continuing to make rapid progress towards developing commercially-viable culturing techniques for the mud crab Scylla serrata. *Aquaculture Research Officer Graham Williams, who specialises in mud crab research, discusses developments, and the reasons behind the interest in culturing the species.*

There are a number of reasons for choosing mud crab as a culture species, including economics, climate and ecological motives:

- The mud crab is a high-value and extremely presentable table food item in both Australia and Asia;
- Mud crab aquaculture using wild-caught juveniles has a long-established tradition in South East Asia;
- There are existing markets for hatchery-produced juveniles at grow-out facilities;
- Niche markets for ovigerous females and soft-shell crabs attract premium prices;
- The climate in northern Australia and southern Asia is ideal for mud crabs, as it is well within their natural range;
- Mud crabs have a high fecundity, and broodstock are readily obtained in Australia;
- In northern Australia, there's the potential for mud crab culture to become a viable industry in remote coastal communities, where local employment opportunities are desperately needed;
- Aquaculture production of juveniles would remove the threat of over-exploitation of wild stock taken for subsequent grow-out in some SE Asian countries. There are also implications for mangrove protection and enhancement if mangrove stands are retained or developed as sites for the mud crab aquaculture industry;
- There are also suggestions that animals could be reared in the settling ponds in which the effluent from other aquaculture industries is treated – a diversification into polyculture.

From a more general perspective, it makes sense to diversify in the aquaculture industry for the simple reason that diversification is likely to reduce the impact of any disease outbreaks or down-turns in markets of a particular species.

The DAC thrust towards developing mud crab culture techniques is also in line with wide-ranging international interests in resolving agricultural problems in developing countries.

Preliminary work on mud crabs started in 1992 at DAC, and the programme has progressed steadily since that time. When work first started on mud crab culture at DAC, problems were encountered at every stage from spawning onwards, but since then much progress has been made, particularly in the last few years.

Beginning with broodstock ...

The earliest work performed by DAC focused on developing broodstock maintenance and management protocols. Female broodstock already inseminated prior to capture are purchased from local fishers and maintained at DAC. Currently no males are kept. Females (which can spawn several times following a single mating) are released into the wild when they have spawned twice in captivity.

The broodstock are selected using basic criteria – each must be a healthy, recently-moulted animal with all appendages intact and no damage to the body, particularly the mouth parts, something which often happens as a result of tying the crab. The eyestalks and antennae should also be undamaged, and the shell clear of fouling.

Broodstock are kept in an outdoor 7,000 litre tank 3.8 metres in diameter. The tank has a false floor covered with approximately 100 mm of sand acting as a spawning substrate for the crabs. Female crabs kept in a tank that has a bare floor may often drop their eggs on spawning as the eggs don't attach to their pleopods securely.

The tank has both 'flow-through' and 'recirculation' characteristics, and is supplied with water which is passed through a 40 micron sand filter.

Seawater is flowed through at 200% of tank volume per day, while an airlift draws water down through the sand into the under-floor space from where it is lifted back to the surface. Recirculating the water through the sand at a turnover rate of 600% per day prevents the substrate sand from becoming anaerobic.

The broodstock tanks are under a 90% shadecloth awning, and a black plastic cover directly on top of each tank keeps the crabs in a low light environment to reduce stress and algae growth.

Hygiene is very important. Leftover food and faecal strings are removed daily using scoop nets, and the sand is then 'vacuumed' at least once daily with a rake and suction device. In the cooler 'dry season' months the water temperature is maintained at 28 to 31° Celsius by a combination of flow control and immersion heaters. The salinity is kept constant at 30 ppt.

All the water used is chlorinated and then dechlorinated (using sodium thiosulphate) immediately prior to use.

Broodstock feeds

DAC has instituted a four-day rotational feeding regime. The intention is to sidestep any food preferences the crabs may otherwise develop and, since little is known about mud crab nutrition, to ensure that the diet is adequately balanced by providing a range of feeds. On any given day the crabs will be fed either coarsely-chopped mullet, prawns, squid or mussel meat. An excess of food is offered, usually once per day in the late afternoon. The amount of food left over is monitored each morning and the day's feed is then adjusted as required.

Spawning

Mud crab exhibit behavioural changes which give advance warning that they will spawn within a few days, says Graham: 'They become much more active and move around the tank with their bodies raised high above the substrate.'

The crabs generally spawn at night, the bright yellow eggs being attached under the female in a clump or 'sponge' which can contain up to 8 million eggs.

After spawning, the berried female is moved to an indoor 1 tonne hatching tank operating on a flow-through basis. There is no substrate in this tank, and feeding is ceased to minimise the risk of infection.

The incoming water is ultraviolet sterilised, and screens over a central standpipe are used to retain the larvae in the tank. The embryos take about ten days to develop and hatch as Zoea 1 (Z1) larvae. During this time the egg mass changes colour from yellow to orange to dark grey.

Experience at DAC has shown that when mud crab broodstock are properly managed, there are very few hindrances to the successful production of larvae.

Experimental work in the larval stages

The Z1 larvae are distributed as required for various experiments, into either 3 litre containers, which are convenient for replicated trials using numerous treatments, or 7,000 litre tanks, which allow experiments simulating commercial scale activity.

In the small-scale experiments the larvae are individually removed from their containers each day to allow for cleaning the container and water exchange, which is 100% per day. In the 7,000 litre tanks screens retain the larvae during water exchange, which is usually done as a batch exchange.

However, flow-through and recirculating systems have also been trialled. The main feeds used are the standard hatchery fare of rotifers and artemia nauplii, fed to the crab larvae once per day.

The main objective of DAC's current work is to develop methods for larval rearing that are viable on a scale that would be applicable to a commercial hatchery.

Experiments are carried out concurrently where possible in both 3 litre and 7,000 litre tanks, using larvae from the same batch. Survival rates of 80% from Z1 to megalopa are now routine in the small-scale experiments. Running experiments concurrently allows for factors such as batch quality and feed type to be eliminated from the equation when trying to determine the parameters needed for successful larval rearing in the 7,000 litre tanks.

A strict system for control in experimentation is followed to allow appropriate statistical analysis and interpretation of experimental results.

DAC has achieved as high as 40% survival from hatching through to the megalopa stage in 7,000 litre tanks, and has averaged approximately 15% over all of the larger-scale trials, which is probably a commercially-viable result.

However, there is considerable variation in survival rates, something that needs to be controlled before the techniques can confidently be taken up by industry.

Having a reliable control method at DAC, even on a small experimental scale, is a valuable tool, which can greatly help in determining the causes of the high variation in the larger tanks.

Work will continue with the intention of reducing this variation to a point where a reliable, commercially-viable method of producing juvenile mud crabs has been developed.

Delays, but the new DAC will be more efficient

Graham advised that crab research was currently delayed by DAC's move from the site of the old Stokes Hill Power Station in Darwin to the new Darwin Aquaculture Centre at Channel Island, approximately 35 kilometres away by road from Darwin.

Once established, he expected considerable advantage to be gained by working in an entirely new purpose-built facility, boosted by the availability of better quality sea water than that presently available near the Stokes Hill Wharf site.

It's a fairly obvious improvement, says Graham: 'The new facility will allow greater efficiency in work practices than the current facility, which grew outwards from an old workshop that the fledgling DAC inherited from an obsolete power station.'

The issues in mud crab research, he continued, are also quite clear: 'We need to improve our larger-scale results to a point where they reflect the excellent results we have achieved on a small experimental scale. And we need more work on tank hygiene, water quality, larval stocking density and feed types.'

Why is DAC doing so well with mud crabs?

The answer is simple; Graham believes the successes are due to having motivated staff and the large number of experiments which DAC runs—usually 'back-to-back' to gain the maximum amount of data quickly. And although this can place some degree of strain on the staff involved, the work is producing results in circumstances which could be regarded in some ways as unenviable by larger organisations:

'As a small aquaculture research group we are required to support our research in-house,' explained Graham. 'For example, we must grow our own algae, rotifers and artemia—we can't just order them from another part of the organisation, because there simply isn't one. This, however, has an upside in that everyone involved has a good overall perspective of the project's needs.'

In the longer term . . .

The basic plan is to extend the successes in small-scale work to the larger system. The possibility of replacing artemia (which can present hygiene and nutritional problems) with, ideally, an artificial food, will be investigated. For example, commercially-available shrimp larval feed may be appropriate, and DAC will also further examine copepods as a food source.

Another major issue is the effect of biofilm on production. Work to date indicates that removal of biofilm from the culture vessel improves success rates, but this has to clarified, and there are problems in removing biofilm, especially in commercial scenarios. Nursery and grow-out systems will also be developed.

Mud crab as farm animals —not quite the gentle Jersey cow

The mud crab, smiled Graham, has some interesting traits: 'They appear to be ineffective predators—we have watched them grab at artemia, damage them, then drop them without feeding. Care is needed when examining broodstock for damage too—don't' look too closely at the mouth parts because you may abruptly find two very large claws firmly attached to your face!'

DAC's work on mud crabs is being observed with interest and enthusiasm by the local as well as the South East Asian aquaculture industries. The mud crab team at the DAC has been a major player in the ACIAR-funded mud crab aquaculture project, and has benefited greatly from working with the other partners in the project: Queensland Department of Primary Industries (QDPI) at Bribie Island, South East Asian Fisheries Development Centre (SEAFDEC) and the University of the Philippines in the Visayas.

Source: *Austasia Aquaculture*, December 1998/January 1999

LIVE REEF FISH DEVELOPMENTS IN FIJI

by Being M. Yeeting,
Secretariat of the Pacific Community
Noumea, New Caledonia

Background

Fiji is one of the most recent countries in the Pacific to get into the live reef food fish (LRFF) trade. With interest shown by some overseas companies, LRFF was identified as a potential income-generating project for the Fiji Fisheries Department to pursue under their Commodity Development Framework (CDF) programme in 1998.

With the preliminary arrangements being negotiated for one overseas LRFF operator to commence, Fiji, unlike the other countries in the Pacific, has wisely chosen to look seriously at the management and regulatory issues relating to this fishery based on experiences and lessons learned from other countries.

The primary goal is to set-up a LRFF industry that is sustainable in the long term. Fiji Fisheries therefore decided that the first step was to understand the potential and the extent of their LRFF resource, and to set-up a management structure in the form of policies, regulations and legislation for the trade.

In August of 1998, a letter of request for assistance was received by the Secretariat of the Pacific Community (SPC) from the Ministry of Foreign Affairs and External Trade in Fiji, on behalf of the Fiji Fisheries Department.

The request for assistance

The request was for SPC to assess the potential for LRFF in an allocated fishing area in the Bua Province of Vanua Levu, and draw up some management guidelines that would be useful in the formulation of a management policy and regulations for the trade. The agreed terms of reference are (TOR) briefly outlined below:

- To find out where the spawning aggregation sites are for coral trout and cod species and the times of the year when they occur.
- To give an approximate existing stock estimate for the potential target species.
- To design catch data forms and establish a monitoring programme for catch, effort and export.
- To set-up a database for the live reef fishery in Fiji that can link and exchange information on a regional level.
- To formulate guidelines and make recommendations towards a management policy and regulations for the live reef fish trade in Fiji.

The SPC Integrated Coastal Fisheries Management Project (ICFMaP) was given the task of providing the necessary advice and assistance to Fiji Fisheries under the terms of reference.

The target area

The Province of Bua is one of the three provinces found in Vanua Levu, the second biggest island in the Fiji Group (Figure 1).

The province forms most of the southern part of Vanua Levu. It consists of 54 villages, with a predominantly indigenous Fijian population of just over 9,000.

The Bua Provincial Council, the administrative body for the province, is in Nabouwalu, the administrative centre, which is

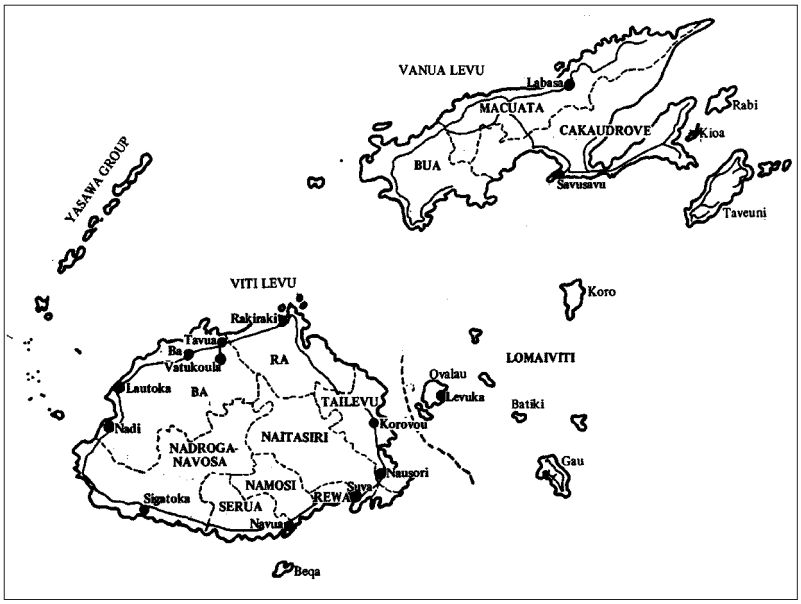

Figure 1: Map showing the Fiji Islands and the location of the Bua Province fishing area.

located almost on the southernmost tip of the island.

The main target fishing area is in the Lekutu and Navakasiga Districts and is owned by the vanua (tribes) of these two districts. The total size of the Lekutu and Navakasiga Districts' fishing right area is about 1,600 square kilometres.

The actual total reef mass in the fishing area that was surveyed consists of about 432 square kilometres of inner reef areas and about 84 square kilometres of reef in the barrier reef area. Thus, the total reef mass in the fishing right area is about 516 square kilometres, or about 30% of the total fishing right area. This area is regarded as a prime fishing ground.

The LRFF company and their plan

The partners in this new Live Reef Fish venture are Satellite Seafoods (Fiji) Ltd, an Australian-owned and based company, and Altracor (Fiji) Ltd, which is a fully Fijian-owned company. Shares are 70% and 30% respectively. The company will utilise local fishermen and their existing boats for catching fish. Assistance will be provided by the company to modify boats and train fishermen in catching and maintaining the fish alive. About 20 to 25 fish cages will be set up, of 4 m x 4 m x 6 m (depth), each with a capacity to hold up to 500 kilograms of live fish.

A live fish transport vessel (F/V *Crested Tern*), capable of holding up to 4 tonnes of live fish, would be brought in from Australia to collect the live fish from the fish cages and transport them to a main holding facility in Vanua Levu.

The live fish will then be shipped overseas using a 'live fish' carrier vessel. The owners of the *Yong Sheng Lai 18* (Yong Shing Fishery Co., based in Hong Kong) have already met with the company representatives to indicate their interest in transporting the fish.

The company is hoping to export a minimum of 10 tonnes of live fish each shipment, which will include coral trout species, groupers, rock cods and the humphead wrasse.

A memorandum of understanding between the people of Galoa in the District of Lekutu and Satellite Seafood Pty (Fiji) Ltd has been drawn-up. This outlines the payment procedures, training and other assistance that the company will provide and what the people of Galoa are required to do.

Target species

Generally, the target species are all those fish species that can be potentially sold to the live reef fish markets. The main species of interest for Fiji are the coral trouts, *Plectropomus* sp. and the humphead wrasse (*Cheilinus undulatus*). The highly-valued *Cromileptes altivelis* is not common in Fiji.

Figure 2: The fish cages

Figure 3: Modifying a local fishing boat

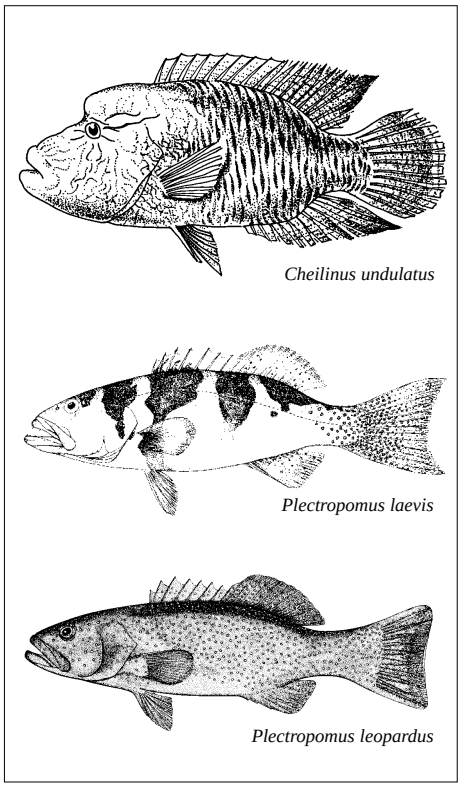

Figure 4: The main species of interest for Fiji

Survey methods

Visits were made to the Bua fishing area from 12 September to 2 October 1998 and from 17 to 26 November 1998 to do the required fieldwork.

The fieldwork conducted in the target area included informal interviews with fishermen to collect basic local information that could be useful in the preliminary assessment of the potential for live reef fish trade.

Fishermen were asked basic questions relating to fishing activities, fishing seasons, spawning seasons and spawning grounds for different species, but with the emphasis on the live reef fish target species. Questions were chosen carefully in order not to 'lead' fishermen.

In addition, fish outlets in Suva were also visited and the managers or owners were interviewed in order to get an idea of the importance and value of the LRF target species at the local market. Particular attention was paid to those fish dealers that purchase fish from the Bua Province.

A 'broad-brush' survey of fish using underwater visual census (UVC) over 50 m x 5 m transects was conducted. Sampling stations were selected haphazardly in both the inner reef areas and at the barrier reef. Sampling was also designed to look at the effects of depth (less than or equal to 10 m = shallow, greater than 10 m = deep) in both reef areas.

Densities and mean lengths of fish were estimated from the UVC surveys. From these, biomass was then calculated using length–weight relationships for the same species in New Caledonia (Letourneur et al.

1998). Where no such relationship existed, the one for the closest species was used. Stocks were then estimated for the reef areas.

Results

Fishing activities

A total of 7 fishermen were interviewed. Three of the fishermen were from Galoa Island, and 4 were from Tavea. The ages of those interviewed ranged from 39 years to 65 years. All were born on the islands and had lived on the islands all of their lives. From the interviews it became apparent that the community of Tavea did more fishing compared to that on Galoa. Part of the reason was that the fishermen of Galoa had recently become very involved in diving for bêche-de-mer, which took a lot of their fishing time.

The dominant fishing activity for both islands was handlining on the nearby reefs from small skiffs. Such trips involve long distances in order to save fuel, and because most boats used are not large enough.

The bigger boats on the islands, especially on Galoa, were all used for going out further from the shores to dive for bêche-de-mer. On Galoa, about 20 individuals took part in bêche-de-mer diving. All bêche-de-mer diving was done using hookah gear. The divers were fully aware of the dangers in using this apparatus (accidents have happened) but most of them felt it was the best way of getting good income for the family.

Other fishing activities included gillnetting on the shallow reef areas and spear fishing, which were more commonly practiced by the fishermen from Tavea. On Galoa, quite a number of women fish, mainly gleaning on the nearby reefs for clams and crabs. Most fishermen fish mainly for subsistence requirements, however, they sell their excess catch locally to other people in their communities.

On Tavea, there are part-time commercial fishermen who try to catch fish to sell to the middlemen based in Lekutu, who then sell them to fish shops in Suva. Fishermen do not seem to target any particular species of fish.

Spawning aggregations and sites

Although fishermen interviewed claimed that they were not fully aware of the spawning seasons of fish species, the information they provided in relation to the quantity of particular fish at different times of the year suggested strongly that spawning seasons and aggregations do exist.

Most of the fishermen interviewed (all but one) claimed that they have encountered big schools of donu *(Plectropomus areolatus, P. laevis and P. leopardus*) while out fishing.

The results of the interviews relating to the spawning periods and sites of different fish species are summarised in Table 1 on page 29.

Although the spawning periods seemed to vary between fishermen interviewed, for *Plectropomus areolatus* especially, there seems to be some common agreement that the spawning season is around about the southern summer period.

The Ovatoa Reef passage and Nauqina Reef are the most referred to areas. The possible spawning aggregation sites based on the results of the interviews have been marked in Figure 6. Future plans for a sampling and monitoring programme should note the need to confirm these claims.

Figure 5: The sampling stations, BR = Barrier Reef, IR = Inner Reef (Scale: 1:150 000)

Table 1: Spawning periods and sites obtained from fishermen interviewed

Fish species	Spawning period	Spawning aggregation sites
Plectropomus aerolatus	October–December	Ovatoa Reef passage
	December–January	Nauqina Reef (pass connected to Tevoro Pass)
	September–December	Ovatoa Reef passage
	September	Marovo Reef
	?	Yanganga Island reef edge
	March	Nauqina Reef (pass connecting Tevoro Pass to Nandongo Reef)
Plectropomus leopardus	March	Nauqina Reef (pass joining to Barrier Reef)
	?	Barrier Reef
	No season	Barrier Reef
Plectropomus laevis	October–December	Ovatoa
	March	Nauqina Reef (pass connected to Tevoro Pass)
Epinephelus polyphekadion	July	Ovatoa Reef passage
	September–December	Nauqina Reef (pass joining to Barrier Reef)
Valamugil seheli	November–April	Around Ovatoa Reef
Liza vaigiensis	November–April	Around Ovatoa Reef
Siganids	November–December	Around mangrove areas
	December–January	?
	November–January, but mainly in January	Reef edges around Nandongo Reef and Ovatoa Reefs
Cheilinus undulatus	?	Ovatoa Reef
Lutjanus gibbus	?	Northern parts of Nandongo Reef and around rocks at Ovatoa Reef

Figure 6: Map showing the location of the spawning aggregations grid-shaded (Scale: 1:150 000)

Underwater Visual Census (fish transects)

A total of 39 fish transects were carried out in 13 sampling stations. Twenty-four transects (8 stations) were conducted on inner reefs and 15 transects (5 stations) were used on the barrier reef area. This gave a total sampling area of 9.75 km^2 (2% of the total reef area in the fishing area).

In this sampling area, a total of 75 fish were seen, consisting of 12 species from 4 genera of interest to the LRFF trade (Table 2). Of these species, 11 were seen on the inner reefs and only 7 on the barrier reefs.

Considering the more important fish species for the LRFF trade, 4 species of the genus *Plectropomus* (coral trout) were seen on the inner reefs compared to only 2 species on the barrier reef. *Cheilinus undulatus* was observed in both the inner reef area and the barrier reef areas. The rest of the species were serranids (rock cods and groupers).

The numbers of most of the fish species seen during the survey were low, as shown in Table 2 below, except for *Plectropomus areolatus*. The low numbers could relate to the small sampling area. This would have implications for the accuracy of the estimates for biomass and the stocks of those fish species.

Therefore, further calculations and processing of the results have been limited to those species that occur in large enough numbers to give reliable estimates. This includes *Plectropomus areolatus, P. maculatus* and *Cephalopholis argus*. All the other serranids are grouped and treated together, whilst *Cheilinus undulatus* is considered too low in numbers to be included.

Table 2: Live Reef Food Fish species seen on the transect in terms of areas and numbers

Species seen	Reef area seen	Numbers seen
Cephalopholis argus	IR, BR	9
C. miniata	BR	1
Cheilinus undulatus	IR, BR	4
Epinephelus fuscoguttatus	IR, BR	3
E. maculatus	IR	4
E. merra	IR	6
E. ongus	IR	1
E. polyphekadion	IR, BR	3
Plectropomus areolatus	IR, BR	27
P. laevis	IR, BR	6
P. leopardus	IR	4
P. maculatus	IR	7

(Note: IR = Inner Reefs, BR = Barrier Reefs)

Mean length and weights of main species

Figure 7a shows the mean sizes of species counted at the inner and barrier reef stations, whilst Figure 7b shows calculated mean weights of *C. argus*, *P. areolatus* and *P. maculatus*, the three LRFF species that occurred in good numbers.

There is no significant difference in mean lengths and weights of *C. argus* between those found around the barrier reef and those found in the inner reef areas (Figure 7). *P. maculatus* was recorded only in the inner reefs, with a mean length of 20 cm.

For *P. areolatus*, however, it seems that those fish found at the barrier reef stations are significantly larger in terms of length and weight than those in the inner reef areas.

This is clearly demonstrated by comparing the length frequency distribution of this species between the two reef areas (see Figure 8).

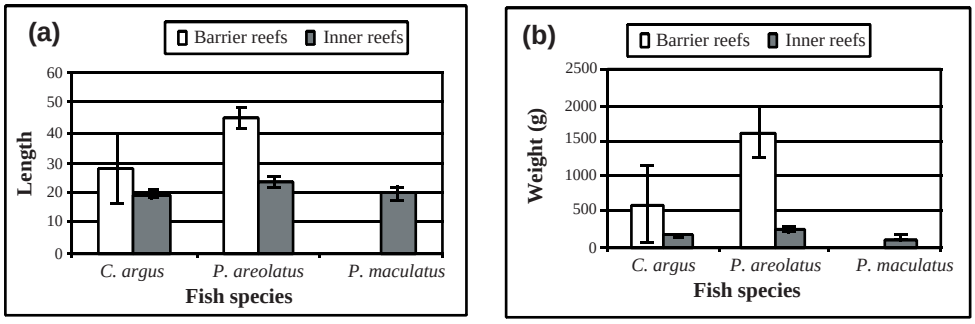

Figure 7: The (a) mean length and (b) mean weight of three LRFF species found in the barrier and inner reef areas of Bua, Fiji

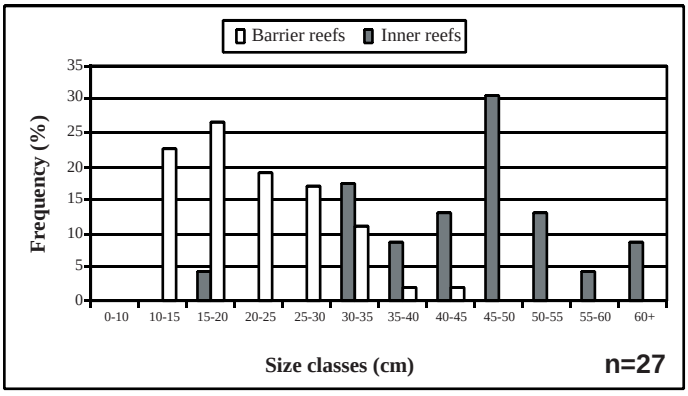

Figure 8: The length frequency distribution of *P. aerolatus* in inner and barrier reefs of Bua, Fiji

The mean size of fish in the shallow fishing areas (≤10 metres deep) was compared with those in the deep fishing area (>10 metres) for the species that were observed at the two different depths during the surveys (see Figure 9).

Generally, no apparent difference in mean lengths was noticed across most of the fish species recorded, except for *E. maculatus*, where larger fish seemed to show a preference for deeper areas, and *P. maculatus*, where larger individuals tended to be found in shallow reef areas.

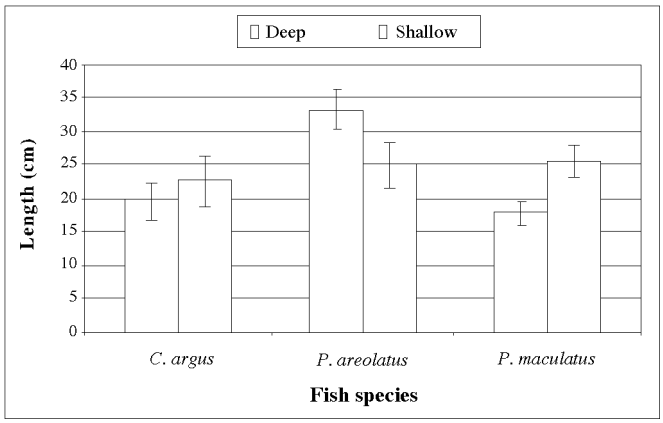

Figure 9: Mean length of LRFF species from deep and shallow stations in Bua, Fiji

For the more important *P. areolatus* species, a simple T-test was conducted to compare the mean length of fish from the deep reef areas against shallow areas.

The results confirm that there is a highly significant difference ($P<0.05$) implying that larger *P. areolatus* are more likely to be found in deeper reef fishing areas.

Fish density, biomass and stocks

It is important to note that for some fish species, numbers seen were low (less than 4 individuals). The calculated fish densities from these low numbers could give unreliable biomass and stock estimates, and therefore caution is advised when considering figures for these species. It is recommended that these figures be revised and refined with more surveys in the future.

From our data, at the species level, we unfortunately are only able to give very rough estimates of density and biomass for 3 species, namely *P. areolatus, C. argus* and *P. maculatus* (see Table 3). The two latter species are not very important in terms of abundance, or for the LRFF trade, and therefore will not be discussed in further detail.

Taking the overall mean density of fish species for the total Bua fishing area, the estimated total LRFF stock in the area comes to about 3,750 metric tons. This stock estimate is likely to be underestimated, since it has been shown that at least for some species (e.g. *Plectropomus areolatus*), length frequency distribution might be different in different reef areas (barrier or inner). The estimate, however, is useful in giving a very rough picture of what stock are potentially there.

In any case, the serranids (groupers, rock cods and coral trouts) form an important part of the stock, constituting 75% of the total stock estimate. This serranid-relative-to-total-stock estimate is dominated by *Plectropomus* species (51%), consisting mostly of *Plectropomus areolatus* (82% of the *Plectropomus* genus).

For *Plectropomus areolatus*, the density was found to be higher in the inner reef areas than the barrier reef areas (Table 4).

Biomass, however was the opposite, being higher in the barrier reefs than in the inner reefs. This difference could be related to the importance of size (weight) of fish, as is the case on the barrier reefs, where generally fish are larger compared to those on the inner reefs (see previous section).

Considering the above differences between the barrier and the inner reef areas, it would be more appropriate to calculate separate stock estimates for the two different areas in order to get a more realistic overall pic-

Table 3: Overall mean density and biomass for some selected species for the total Bua Province fishing area (standard errors are given)

Species	Mean density (numbers/1,000 sq.m)	Mean biomass (kg/1,000 sq.m)	Mean stock (tonnes)
Cephalopholis argus	2.05 ± 0.69	0.53 ± 0.26	274.75 ± 134.68
Plectropomus areolatus	8.72 ± 2.00	5.12 ± 1.31	1604.10 ± 438.10
Plectropomus maculatus	0.92 ± 0.34	0.12 ± 0.05	59.86 ± 25.80
All Serranids	15.59 ± 4.73	7.46 ± 2.64	2813.52 ± 1123.53
Total LRFF	16.00 ± 6.79	8.74 ± 4.42	3749.62 ± 1613.06

Table 4: Densities and biomass of *P. areolatus* on the inner reefs and the barrier reefs (standard errors are given)

Reef area	Densities (numbers/1,000 sq.m)	Biomass (kg/1,000 sq.m)	Estimated stock (tonnes)
Inner	10.33 ± 3.08	2.15 ± 0.47	928.29 ± 204.19
Barrier	5.07 ± 1.48	8.04 ± 2.79	675.81 ± 233.91
Total	8.72 ± 2.00	5.12 ± 1.31	1604.10 ± 438.10

ture for the Bua fishing area. From the density estimates for the different fishing areas, the total stock estimate for *P. areolatus* comes to just over 1,600 tonnes of which 58% comes from the inner reefs, and 42% from the barrier reefs (see Table 4).

Findings and Recommendations

The study was intended to give a snapshot view of the current status of the reef fish species with potential for the live reef fish trade. The primary aim such a study is to indicate of what is there. The actual stock estimates of the different fish species are expected to provide some basis for management decisions before more accurate information becomes available.

They simply show what species are there, and in what quantities on the day of the survey. The information gathered from the interviews and the underwater surveys, although preliminary, will hopefully provide the baseline data to direct future efforts to gain further knowledge and understanding of the live reef fish species.

The results obtained from the interviews strongly indicate that local fishing efforts are mostly concentrated on the nearby reefs.

The lack of big boats, the cost of fuel and the safety consciousness of local fishermen were major factors that contributed to concentrated fishing efforts on the nearby reefs.

Unfortunately, it seems that one of the most commonly-fished nearby reefs is a possible spawning aggregation site for the *Plectropomus* species, and some of the groupers.

Based on the information collected from the local fishermen, there might be spawning aggregation sites in the area. Fisheries Division should try to verify the location of the spawning aggregation sites and periods. Once these have been verified, it is recommended that fishing be banned at spawning aggregation sites.

The accounts of some fishing trips by local fishermen indicate that there has been quite a large amount of fishing during spawning aggregations done unintentionally. There is therefore a strong possibility that these unintentional fishing efforts on spawning aggregations might have taken their toll on the stocks of some serranids.

There is an urgent need for Fisheries Division to take further steps to find out more about these spawning aggregation periods and sites.

This could be done simply by monitoring fish catches from the area, and by visiting the potential aggregation sites at least once a month (for a year) and possibly more frequently during those months that have been reported as spawning aggregation times.

It was also evident that quite a large number of fishermen from Galoa Island are involved with bêche-de-mer diving. All of these fishermen use hookah. The presence of hookah gear on Galoa therefore should be considered seriously to ensure sure that it is not being used in the live reef fish trade.

To deal with this problem, the Fisheries Division should undertake an awareness programme illustrating the dangers of using hookah gear with examples from Asia, and then follow this up with regulations against its use in the live reef fish trade.

The results from the underwater surveys provided some first estimates of the status of the stock. Among the serranids, *Plectropomus areolatus* is the most abundant and most important species both in the inner reef areas as well as the barrier reef areas.

However, the mean lengths of this species differ between the two areas, with the larger fish found on the barrier reefs. This could be the result of overfishing on the inner reefs being closer to the fishing villages of the area.

For the live reef fish trade, *Plectropomus areolatus* is likely to be the main target species, being the only species that occurred in abundance, and one of the preferred species in the trade. The estimated total of the species for the total fishing area is just over 1,600 tonnes. This is equivalent to a wholesale value of US$ 56 million in the Hong

Kong market (based on 1994 prices in Johannes and Riepen, 1995). The maximum sustainable yield for the area was difficult to estimate with the currently available information, but is expected to be much less than the estimate. This lack of information thus calls for a monitoring programme.

The size of this fish is an important factor to consider in the live reef food fish trade.

The mean size of *P. areolatus* in the inner reef areas is about 23.6 cm compared to 45.4 cm on the barrier reefs. This equates to weights of 0.26 kg and 1.6 kg respectively. With the preferred weights of fish in the LRFF market being between 0.8 and 1.5 kg, then the best area to fish is therefore the barrier reef.

For the inner reefs, the smaller sizes of coral trouts should be investigated further. Considering the possibility of spawning aggregation areas being located in the inner reefs, the suspension of fishing for coral trout species and the imposition of size limits for subsistence fishing are possible management options as a start.

Once the spawning periods and sites have been established, these areas should be marked out and identified as marine reserves where fishing is banned.

The valuable *Cheilinus undulatus* was seen in very low numbers. Although our results would need to be verified by more surveys, the very low numbers should be noted, and a total ban on fishing for this species should be considered as a precautionary approach before more information and survey results are available. This ban, if imposed, should accompany efforts to research the ecology and biology of the fish species.

Considering the other serranids and other fish species, the numbers counted on the transects were too low to be able to give reliable estimates. The general low density could be a result of underestimation, relating to the sampling method used, where the width of the transect is fixed at 5 metres and therefore the total sampling area is very small relative to the total fishing area.

This might be improved upon by using a lot more transects in future surveys, and possibly by adopting a transect method of unfixed widths, which would enable surveying of more extensive areas.

The industry, being new, should be carefully monitored and controlled. Information and experience from South East Asia should be utilised to avoid making the same mistakes and to make the industry a sustainable one.

There is a strong need to set-up some management regulations backed up by specific legislation for the trade. The legal framework already exists under the Fisheries Act for the imposition of specific legislation and regulations for better management of a live reef fish trade operation. The legislation and regulations would need to be carefully worded in order to be effective as management measures for the live reef fish trade.

The customary fishing rights law provides an effective local control of activities in the fishing area and for enforcing regulations put in place. A small council is made-up of all the different parties involved legally for the protection of the resource owner's interest. A coordinated plan for enforcement of regulations, together with an outline of the different responsibilities, should be established to ensure that enforcement efforts are well supported from the community level right through to the Government.

A set of management policy guidelines for the LRFF industry is proposed below:

1) The Government regulatory agencies should recognise the live reef fishery as a distinctive fishery and should therefore:

(a) have a separate licence from other fishing activities;

(b) have carefully-worded contracts between the companies, the Government and resource owners, to ensure environmentally- and economically-sound operations;

(c) establish a catch- and export-monitoring programme, with companies being responsible for maintaining record sheets and logs of catch–effort data, and submitting them on a regular basis to the relevant government agency;

(d) ban transshipment of live reef fish at sea; require all live reef fish transport vessels to clear from a recognised port or airport where they can be checked and monitored before departing for Hong Kong;

(e) consider placing spawning aggregation sites of target species off limits to commercial fishing, or close them entirely during spawning seasons;

(f) ban the possession, use, storage and/or transportation of any explosives, and noxious substances (including sodium cyanide) on all fishing boats, fish transport vessels and LRFF operators' facilities;

(g) ban the possession, use, storage and/or transportation of compressed air (SCUBA and hookah) on live reef fishing boats and fish transport vessels;

(h) provide advice and awareness materials to local fishermen/communities concerning the problems associated with live reef fishing and how to minimise them;

(i) provide advice to resource owners or local entrepreneurs who wish to enter into formal agreements with live reef fish export companies to strengthen negotiating abilities when dealing with foreign dealers;

(j) restrict fishing for live reef fish to locals only, to maximise benefits to the local community and to encourage the idea of resource owners taking care of their own resource;

(k) ban the export of the fingerlings of live reef fish, and place size limits on adult target fish species;

(l) place an export ban on wild-caught *Cheilinus undulatus* (Maori wrasse/napoleon fish) until a full stock assessment of the fishing right area has been completed;

(m) consider an environmental impact assessment (EIA) for each live reef fish export operation, with the costs of the EIA being borne by the LRFF operator;

(n) establish an annual underwater visual census (UVC) monitoring programme that would be coordinated and carried out by the Fisheries Division, with assistance provided by local divers who have been trained in the use of the method; the costs of fuel and hire of survey equipment would be borne by the live reef fish operator.

(2) The Government should ensure that an incoming company provides as much detail as possible about their intended operation in their initial proposal. The details of the plan should include as a minimum:

(a) a detailed description of the proposed operation;

(b) ownership, control and management of the operation/company;

(c) target species;

(d) the process of how fishermen would be hired, used and paid;

(e) summary of negotiations with the customary owners, and any agreements or terms reached;

(f) fishing methods, equipment and treatments to be used;

(g) infrastructure (existing and proposed);

(h) human resource requirements, noting clearly where foreigners or non-citizens would be required, what they would be doing and for how long;

(i) training components (a detailed plan), stating clearly where locals would be trained, including the details of the training they would receive and reasons;

(j) fish storage, processing and transportation mechanisms;

(k) their proposed market;

(l) operational budget.

The live reef fishing licence agreement should be carefully worded, and should be in line with the present fisheries laws and regulations, as well as encompassing the customary ownership laws. At the minimum, the licence should be awarded consistant with the following rules and conditions. Any non-compliance with these conditions should result in the suspension and then loss of the licence.

(a) Licences should be issued for specific locations or areas for a maximum of 1 year, renewable upon review.

(b) One operator per designated area should be permitted.

(c) The LRF company should endeavour to resolve customary ownership rights and compensation issues before the licence is awarded. The applicant must produce a signed agreement with the recognised customary owners in which the terms of access and usage are explicitly set out. Any terms of the agreement must not conflict with the national/provincial laws or policies and must be endorsed by the respective provincial authorities in the presence of an authorised Fisheries Licensing Officer before a licence can be issued.

(d) Where foreign vessels are used, the foreign crew members should be limited to the minimum required to operate the vessel and maintain the fish.

(e) Foreigners or non-citizens should not be involved in the actual capturing process, except for training purposes.

(f) LRF transport vessels should not be allowed to do any fishing.

(g) Fish should not be delivered or transshipped to another vessel without prior written permission.

(h) The size of the LRF transport vessel and the number of holding pens should be limited in relation to the proposed and agreed production target.

(i) The licensee must permit a Fisheries Division officer to board the vessel at any time, and provide accommodation free of charge while the vessel is operating under licence.

(j) Export of live reef fish should only be allowed from designated ports or airports.

(k) The use, storage and/or transportation of scuba or hookah equipment should not be permitted.

(l) The use, storage, and/or transportation of any explosives, or noxious substances (including sodium cyanide) for the purpose of killing, stunning, disabling or taking of fish should not be permitted.

(m) Licensees must maintain a detailed daily record of catches or purchases on a standard record form. The records should be submitted every month. The Fisheries Division must treat these data with strict confidentiality.

(n) The vessel, its owners, operators and crew must ensure the protection of coral reefs from damage at all times during fishing and the vessel's operation.

(o) With the live reef fish trade being considered as a limited-entry fishery, it is only too appropriate to impose fees for access to the resources as a licence condition.

To accompany the management regulations and enforcement, a good monitoring programme is essential to make sure that companies are continuously complying with the rules, as well as to collect basic information that would be valuable for the future management and development of the industry. A monitoring programme is proposed below. The actual forms could be obtained from the Reef Fishery Assessment and Management Section of the SPC Coastal Fisheries Programme.

The Data Collection Programme

A data collection system has been proposed that involves most of the players in the fishery. The data collection would be considered as one of the requirements and responsibilities of the LRFF company. The Fisheries Division, however, would be the main authority, taking charge of regular monthly record submissions by the company, collecting biological information on fish that died during the handling stages, processing and analysing the data and reviewing management decisions and options.

The proposed data collection programme consists of four data sheets as described below.

1. Fishing Data Sheet – To be filled in by the fishermen as they go out on fishing trips. These detail information on the fishing effort, fishing conditions, fishing location(s) and fish catches (species, length and weight) and would be handed in to the LRFF company site manager on arrival at the LRFF holding cage site after the trip.

2. Catch Summary Form – To be filled in by the LRFF company site manager when stocking the holding cages. These record the number and weight of fish put into the holding cages by species, and also the species, number and weight of fish that are dead at this stage of handling. The dead fish would be kept aside for further data collection. Dead fish subsequently found in the fish holding cages should also be recorded on this form.

3. Biological Data Sheet (Dead Fish) – These are to be filled in by the Fisheries Division officer in charge of the LRFF industry. They record biological information on the dead fish collected during handling, including length, weight, sex, maturity stage, gonad weight and stomach contents. The Fisheries officer is expected to be responsible for these data. However we anticipate problems in keeping dead fish frozen before the Fisheries officer visits the holding cage station, rather than them being sold fresh. The ideal solution is to train someone on-site on how to handle the fish, and sex, measure, weigh and gut them. We therefore propose that the Fisheries Officer organise with the site manager for the dead fish to be measured, weighed, sexed (gonads should also be weighed) and gutted. The guts can then be frozen in a sealed plastic bag properly labelled for later identification.

4. Export Data Sheet – These are the final sheets to be filled in before the live fish are exported overseas. They are to be prepared by the LRFF company site manager, and record what species of fish, numbers and weight are exported live overseas.

The data sheets have been designed to minimise time and effort. The sheets to be filled in by the site manager are records that they would need to keep for themselves anyway. With the sheets, certain coding (a desk job for the Fisheries Officer) is required, and a list of codes to be used is provided.

The SPC Reef Fishery Assessment and Management Section would continue to provide assistance to get the monitoring programme off the ground, and especially in the analysis of data. All information would remain confidential.

Resource Assessment

This forms the second part of the monitoring programme and is basically the Fisheries Division's responsibility.

The purpose of the assessment work is to reveal the long-term impact of the industry on the reef fish stocks, as a regular check for signs of destructive fishing methods such as 'cyanide fishing', and to build up information on spawning seasons and spawning aggregation sites. It is recommended that field assessment should be done twice a year for the first 2 to 3 years, and then once a year after that.

The field work involved would utilise the underwater visual census (UVC) method. The method used should be consistent for all sampling. Some training in the UVC method was given to the local village divers and fisheries personnel involved in the study. The SPC Reef Fishery Assessment and Management Section would, however, be able to provide further training in an improved version of this method that would be standardised as a package (field method and analysis tool) throughout the region for possible comparison with other areas.

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Copies of the MOU and data collection forms are available upon request from:

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TRAWLING FOR HOKI IN COOK STRAIT

by Michel Blanc,
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Trawling is not a fishing technique commonly used in the Pacific Islands, apart from a major prawn fishery in Papua New Guinea.

Nevertheless, I could not miss a once-in-a-lifetime opportunity to join the crew of a modern fresh-hoki trawler for a two-day trip in Cook Strait.

This opportunity arose because I was in Nelson co-ordinating the second regional workshop for managers of Pacific Island fisheries enterprises.

On Monday 23 August 1998 (the workshop participants were then on their way home!), at 5:30 p.m., I jumped onboard FV *Thomas Harrison*, one of Sealord's three trawlers currently operating in New Zealand waters.

Sealord is the largest New Zealand fish catching/processing/marketing company. In addition to FV *Thomas Harrison*, the company operates several factory trawlers that target the local fish species of hoki, orange roughy, John dory, oreo dory and hake.

Sealord also charters foreign trawlers from Poland, Russia and Norway to fully catch the company's quotas. The hoki quota for Sealord is 80,000 tonnes (total for New Zealand: 250,000 tonnes, which is about 1/400 of the annual global catch for all marine and fresh-water species).

The fish is taken all year round from several parts of the New Zealand EEZ, with a major winter fishery (June–September) on spawning fish off the west coast of the South Island and in the Cook Strait, between the two islands.

Hoki (*Macruronus novaezelandiae*) belongs to the Merluciidae sub-family. It has a delicate white moist flesh. Suitable for most methods of cooking, it is exported in fillet, breaded sticks or portion forms.

The main markets are Australia, Europe and USA. Another kiwi company, Amaltal, holds a very lucrative market with the McDonald's chain for the South Pacific – if ever you try a Fillet-O-Fish at a McDonald's, you will eat a piece of hoki caught in New Zealand waters! The fresh hoki caught on F/V *Thomas Harrison* are processed at the Nelson-based Sealord factory before exports.

F/V *Harrison* was built in Portugal in 1989 for a Norwegian fishing company. Initially

A disappointing trawl scoop. Only 10 tonnes of hoki!!

designed as a prawn trawler, Sealord purchased the vessel in 1993 and refitted her as a fresh-hoki trawler. She is 43 m long, powered by a 2,400 HP MAN B&W ALPHA engine (Danish brand), with two North Star (Seattle, USA) ice machines of 25 tonnes per day capacity each.

This fresh-hoki trawler is operated by a crew of 9 (skipper, mate, chief engineer, bosun, cook, 4 crews). The refrigerated fish hold has a capacity of 200 tonnes of fish, stacked in 24 kg cases. Electronic aids include two radars, echo-sounder, fish finder, sonar, GPS, track plotter, VHF and SSB radios, Inmarsat C, net monitor and catch sensor. On average, F/V *Harrison* would catch 10,500 tonnes of fish per year, predominantly hoki (98%).

In winter, fish are so thick in Cook Strait that it sometimes takes less than 10 minutes to scoop 20 tonnes of hoki! On that particular trip, F/V *Harrison* caught 170 tonnes of hoki in 10 trawls of 10 to 20 minutes each. The duration of the trip was 44 hours, with 28 hours spent on the fishing grounds.

Hoki are usually found in big schools, at depths of 200–800 m. Once the fish are located with the boat's sonar and echo-sounder, the skipper manoeuvres to bring the boat back to the hoki school.

Before reaching the spot, the trawl net is deployed from the stern by the skipper using winch remote controls and four crew handling the net, wire cables and snap swivels on the deck. The setting operation takes less than five minutes.

Two useful pieces of equipment are then used by the skipper to supervise the trawling operation: a net monitor (NZ$ 25,000) which shows the net opening (width and height) and distance of bottom line to sea bed, and the catch sensor (NZ$ 15,000) which informs the skipper when the pre-set catch limit is reached. The trawl net itself costs around NZ $20,000.

Once hauled on-board, the fish will be immediately transferred from the codend to the stern fish hold where they will quickly be refrigerated in Refrigerated Sea Water (RSW) with the possible addition of ice if needed.

Ten to fifteen minutes after being landed, the fish will start being transferred from the RSW to the central fish hold through a series of conveyors. One or two crew stand at the first conveyor to sort out hoki from the by-catch (the marketable by-catch is kept aside for separate processing and icing while the non-marketable by-catch—damaged hoki or dogfish—are placed on a side conveyor that will dump them into the ocean).

The rest of the deck crew, with the bosun, and sometimes the cook, will work for several

Sorting out hoki from the dogfish by-catch

hours in the refrigerated fish hold at +3°C, the most experienced of them stacking the hoki falling off the conveyor into fish cases, while the others will move fish cases around and ice the fish (two shovels full of ice on top of each fish case).

An ice pump provides fresh ice on demand into the fish hold. While the trawl takes only a few minutes, the sorting and icing of the catch takes up to 3 or 4 hours.

Once all the catch is stored and iced in the fish hold, the fishing operation can start again.

Working on a fresh hoki trawler is tough: the crew shift is twelve hours, followed by a two-hour rest, and then back to work for 12 hours.

During the winter season, the Cook Strait is cold and rough. Very far from the tropical islands!

In the fish hold: leading hand Joe packing hoki in 24 kg fish cases

Two shovels full of ice in each case of fish

However, the living conditions onboard FV *Thomas Harrison* are of a high standard with comfortable cabins, showers, satellite TV and, most importantly, a genius of a cook by the name of Seamus. On the last day of the trip, just before getting to Picton where the catch was unloaded, Seamus baked some French croissants for the crew. Perhaps this was his way of celebrating in advance the victory of France in the forthcoming rugby World Cup . . .

Hoki: *Macruronus novaezelandiae*

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