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SPC ACTIVITIES

Fisheries Training Courses Planned

SPC coastal fisheries staff have recently been travelling to member countries in order to discuss a number of training activities which are planned or under consideration for the coming months. Fisheries Adviser Barney Smith and Fisheries Training Officer Alastair Robertson have recently visited Vanuatu, Fiji, Tonga, Western and American Samoa, and Niue to examine local training facilities and opportunities, gauge training priorities, and, particularly, to finalise arrangements for two training courses which will be held in 1986.

One of these is the SPC FISH HANDLING AND PROCESSING COURSE, to be held in Port Vila for 10 weeks commencing mid 1986. The course is intended for fish marketing staff responsible for supervising transportation, processing, storage and sale of seafood products. The course, which is being organised by the Fisheries Training Officer, will call on the expertise of various agencies known for their practical knowledge of Pacific fisheries. The SPC Fish Handling and Processing Officer, who will be appointed shortly, will administer the on-site running of the course and conduct lectures where appropriate. As with most SPC fisheries training activities, the course will be practically oriented, with emphasis on `hands-on´ training in fish processing rooms, cold stores and sales areas as well as "on board" handling. It is envisaged that 16 students will participate in the course, which will cover: the theory of fish spoilage, and of ways to increase storage life, including freezing, smoking, salting and drying; on-board handling of fish catches, including bleeding, spiking and coring, first-stage processing, and icing; on-shore grading, processing, preparation and display of fresh fish products; chilling, freezing, glazing, cold storage, freezer management and stock arrangement; preparation of specialist export products, including sashimi or prime-grade chilled fish, fillets, bulk packs and shatterpacks; marketing, packaging and product development; and store management including record-keeping, cash management, stock control and equipment maintenance.

This course is also envisaged as a `launching pad´ for the SPC Fish Handling and Processing Project, which will operate in SPC member countries in much the same way as the Deep Sea Fisheries Development Project. The SPC Fish Handling and Processing Officer will conduct short visits to member countries (one to six months) to carry out on-site training programmes and assist in the upgrading of local fish marketing outlets, particularly those operated by government or as part of national fisheries development activities.

Also firmly scheduled for 1986 is a repeat of the SPC/UNDP REGIONAL REFRIGERATION TRAINING COURSE. This course was initially held as a one-off exercise in 1985, but the success of the first course and continuing demand for training in the maintenance and repair of fisheries sector refrigeration equipment among member countries has prompted its repetition. Like the first course, this activity will be held in Rarotonga, Cook Islands, last for 20 weeks, and accommodate 14 students.

Further new training programmes are also under consideration. These include a sub-regional course for fisheries extension workers, to be held in Fiji, and a course in offshore navigation to be held in Western Samoa. Work is in progress to develop suitable training for fisheries officers in areas of extension skills, such as management and communication. Additionally, as reported in detail in <u>SPC Fisheries Newsletter No 34</u>, the seventh SPC/Nelson Polytechnic Pacific Fisheries Officer Course is scheduled to commence in February 1986. The students will spend the first 18 weeks of this 23-week course in Nelson, New Zealand, studying a variety of practical skills. The last five weeks will be spent in Vava'u, Tonga, in an intensive period of practical fishing experience with one of the SPC Master Fishermen.

Deep Sea Fisheries Development Project Notes

Gear Development Programme

Following recommendations from the 1984 and 1985 SPC Regional Technical Meeting on Fisheries, planning is currently underway toward establishing a gear development programme as a distinct activity within the framework of the SPC Deep Sea Fisheries Development Project. The gear development programme will involve stationing one of the SPC Master Fishermen in a locality chosen for its suitability for experimental fishing (i.e. with access to a wide variety of fishing environments which will permit fishing in most weather conditions, and with reasonably reliable communications and support services for small boat operation). The programme's aim will be to test new or exotic fishing gears and techniques, and develop them to the point where they can be demonstrated to, and used effectively by, Pacific Island fishermen via routine Deep Sea Fisheries Development Project country visits and training activities. The programme would remain in place for an initial period of two years, in order to avoid the disruptions of seasonality of fishing success, and lost time during relocation between countries, which have hampered SPC gear development efforts in the past.

After studying a number of suitable sites and tentative proposals to host the project by member countries, Vava'u, in the Kingdom of Tonga, has been provisionally selected as the site for this work. Vava'u allows access to good tuna-fishing and deep-bottom fishing grounds all around the island, and therefore fishable under most weather conditions. An active fish aggregation device (FAD) deployment programme is just commencing and there are a number of options currently under consideration which may allow the acquisition of a fishing vessel for full-time use by the programme. Importantly, the Government of Tonga is fully committed to the project, and is prepared to assist in the provision of vessel support services.

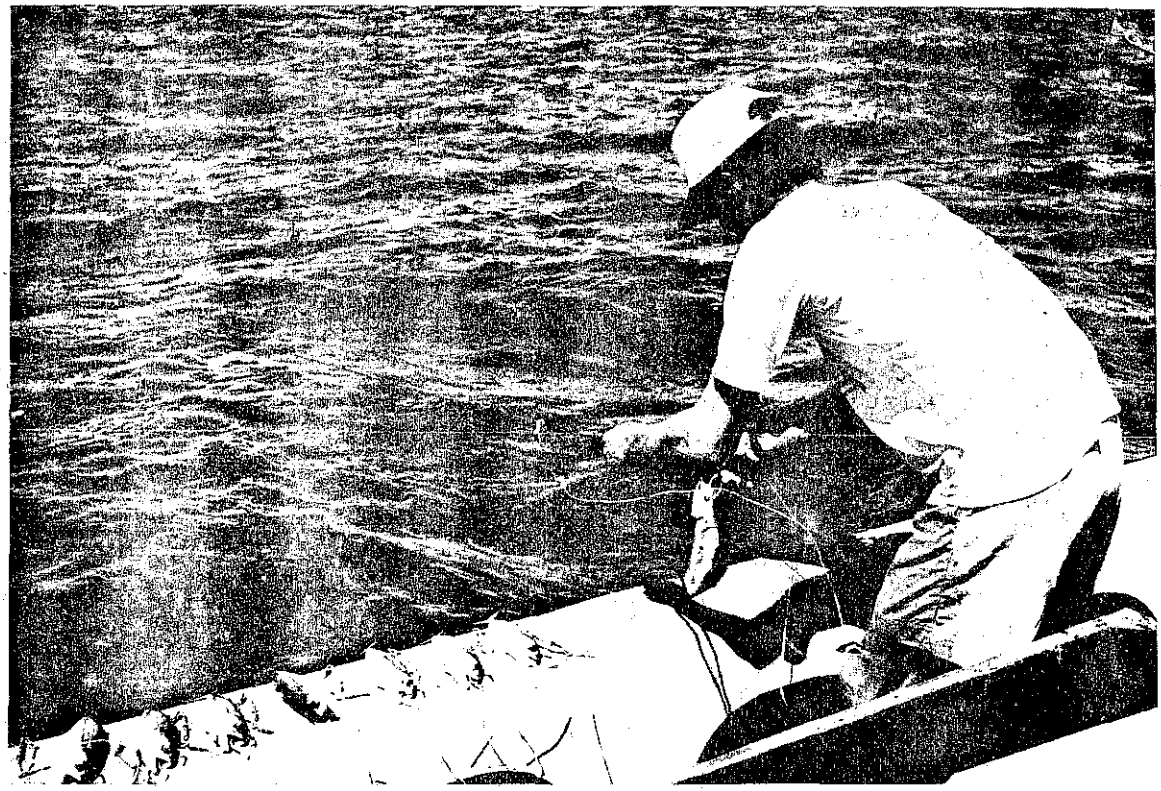
SPC Fisheries Adviser Barney Smith visited Tonga in October to discuss the details of the proposals with government officials and with SPC Master Fisherman Paul Mead, who is presently stationed in Tonga (see below) and who is likely to be in charge of the gear development programme. If all the many organisational details can be mutually agreed, the programme should commence in mid-1986.

Tonga

Master Fisherman Paul Mead has been assigned to the Kingdom of Tonga since April, although his work programme up until mid-August was fragmented because of duty travel to other countries. Since that time he has been concentrating on carrying out fishing trips with selected commercial fishermen in order to assist them improve their fishing techniques, vessel effectiveness, and business management skills. The fishermen selected are all involved in the Tongan Fisheries Division's fisheries development programme, having purchased vessels built at the Division's boatyard.

New Caledonia

Master Fisherman Lindsay Chapman concluded his assignment to New Caledonia in mid-November. His work had covered a variety of fields, including experimental fishing around FADs by means of vertical longlines, ika-shibi lines, trolling and gill netting. The project visit also included a substantial training component, including a two-week trip to Voh, on New Caledonia's west coast, to demonstrate deep-bottom fishing techniques to members of the local fishermen's co-operative. Lindsay has now left New Caledonia for his new assignment in Rarotonga, Cook Islands.



(Photo: L.B. Chapman)

Fishing Technologist Aymeric Desurmont deploying a vertical longline during experimental fishing trials in New Caledonia.

Tuvalu

Master Fisherman Pale Taumaia took up a new assignment in Tuvalu in October, in which his main duties will involve the development and demonstration of vertical longline fishing techniques around Tuvalu's FADs. Pale will be stationed on the capital, Funafuti, until early 1986, during which time he will carry out vertical longlining trials around four FADs stationed near Funafuti, and demonstrate the techniques to interested local fishermen. Pale will then move to selected outer islands to conduct more intensive training programmes with local fishermen.

18th SPC Regional Technical Meeting on Fisheries

SPC has recently circulated its provisional calendar of meetings for 1986 (SPC Savingram No 61/85). The dates for the 18th SPC Regional Technical Meeting on Fisheries have been selected as August 4-9 inclusive, with the meeting to be held at SPC headquarters in Noumea, New Caledonia. The provisional agenda for the meeting will be circulated at a later date.

SPC Supports Tuvalu Artisanal Fisheries Statistics Programme

The South Pacific Commission, through its Tuna and Billfish Assessment Programme (TBAP), has been assisting the Fisheries Division of Tuvalu in the development and improvement of its statistical system. Priorities established for the statistical system by the Tuvalu Fisheries Division are 1) estimation of the total catch for development and planning purposes and 2) the collection of simple biological data and the estimation of catch per unit of effort (CPUE) for stock assessment purposes. During an initial visit to Tuvalu by Tuna Programme Fisheries Statistician Tom Polacheck in February 1985, various methods to collect data for these purposes were evaluated. As a result of these trials, a general design for the system evolved. Mr Michael Molina of the Guam Division of Aquatic and Wildlife Resources was hired on contract by the SPC to visit Tuvalu in July and August 1985. During this second visit, details of the system were refined and local staff trained in the various aspect of the system.

The current form of the system consists of six components:

1) A census of all fishing craft in Funafuti which required physically numbering all boats and canoes.
2) On a random sample of six days each month, a complete census of fishing activity by all fishing craft on that day is conducted. This task is accomplished by making a tour of the island in the morning and late afternoon, noting which vessels are in port, which are fishing and which are out of port for other reasons.
3) Based on the results of the participation census, interviews are conducted with as many returning fishermen as possible and their catch weighed.
4) Similar surveys of shoreline participation, effort and catch are also conducted several randomly selected days per month.
5) Daily logs of fishing effort and catch are kept the vessels operated by the Fisheries Division.
6) Length frequency samples from catches by Fisheries Divison vessels are taken for six of the most important species.

Using results from components 2-5, monthly estimates of total catch for Funafuti can be calculated. For stock assessment purposes, general measures of CPUE can be derived from 3 and 4 while the results from 5 and 6 should provide more detailed information but in smaller quantities. The statistical system is at present confined to Funafuti because of the lack of fisheries personnel on the other islands and problems of transportation.

The statistical system is still evolving. As with any system, modifications are likely to be needed as conditions and requirements change or as deficiencies become apparent. At the present time, the TBAP is continuing to assist in the programme by reviewing the data and resultant catch and effort estimates to help prevent mistakes and evaluate the adequacy of the present procedures.

The statistical system that is evolving for Tuvalu highlights the fact that a system needs to be designed and developed in relation to local needs, conditons and resources. Detailed procedures and methods can not simply be borrowed from somewhere else. Thus, for example, the feasibility of conducting complete censuses of fishing participation depends on the relatively small size of Funafuti, the size of the fishing fleet, and most importantly, the willingness of the fishermen to cooperate in the programme. On the other hand, more traditional methods of surveying landing sites are not practical because of the lack of central landing sites and relative infrequency of landings.

Some benefits from the newly developed Tuavalu statistical system are already occurring. Fisheries officials in Funafuti have an accurate estimate of the number of fishing vessels for the first time. Some preliminary estimates of artisanal catch rates are availabe and were presented at the SPC Seventeenth Regional Technical Meeting on Fisheries in August 1985. Results from the improved statistical system in Tuvalu are of potentially great interest to anyone involved in fisheries in small communities.

Observer Programmes on Industrial Fishing Vessels

Several countries have requested the SPC to assist in the training of on-board fisheries observers. In response, a short course has been developed whose aim is to improve the quantity and quality of information gathered by the observers. Specifically, the course will emphasize four objectives:

(1) Clarification of national and regional reporting responsibilities.

(2) Introduction of standard formats for collection of routine data.

(3) Establishment of proper reporting and debriefing procedures.

(4) Introduction of observers to the practical aspects of their duties.

The course is designed to be carried out at a national level, in the form of a training workshop. The first draft of an observers' manual has been prepared for use in these workshops and is intended to serve as a guideline for observers in the conduct of their activities. It is hoped that, through this type of training, information gathered by different observers will be of a uniform standard and will be more useful at both national and regional levels. If the observer manual and the training workshops, which will be held during early 1986, are well received, wider distribution will be considered.

Advisory Centres and Practical Fishing Courses for Tonga
(Source: MAFF Mass Media; Tonga Chronicle)

Advisory centres for fishermen are presently being built in the outer islands of Tonga. Consisting of 12-foot by 10-foot sheds, the centres will be used for repair of nets, engine maintenance, and meetings. The first of these centres is located in Matamaka, Vava'u. The next centre is being constructed at 'Uiha, Ha'apai. The sheds will consist of a cement slab, four cocowood posts, and a tin roof. Wire mesh will surround the frames to make the sheds lockable and suitable for storage. The centres will have wall brackets for hanging engines. Rain barrels will provide fresh water for engine cleaning. Mr Semisi Fakahau, Principal Fisheries Officer, said that he would like to have centres built in all coastal villages so that fishermen could have engine maintenance courses in their own villages and spend more time fishing. The sheds are being provided by the Fisheries Division, with assistance of the Foundation for the Peoples of the South Pacific.

Sixteen fishermen attended a two-week course in practical fishing methods at the Fisheries Division in Sopu in mid-November. These men were culled from a list of 400 applicants. Those interested in purchasing an artisanal fishing craft from the Division must pass the two-week course. Topics covered included basic engine repair, engine maintenance, electronics, boat maintenance, gear technology, radio communications (theory and practice), echo sounder instruction, navigation and chartwork, operation of safety equipment, first aid, sail rigging, handline use, netting, fisheries legislation, basic sailing technique, and practical fish processing. Also covered for the first time by the course were nutrition and hygiene on fishing trips and time management.

Vanuatu's Village Fisheries Development Project
(Source: South Pacific Commission; Vanuatu Fisheries Department)

The Vanuatu Fisheries Department's `Village Fisheries Development Project' has been operating for three years now, with the aim of establishing and supporting commercial fishing activities at village level throughout Vanuatu. The general approach has been to assist local entrepeneurs set up a fishing co-operative, group, or business, and provide them with the support services they need to keep on fishing. This support includes assistance with finance, technical backup, marketing, and management, which Project leader Richard Stevens has achieved by co-ordination with other institutions in Vanuatu. Potential fishing groups are encouraged to put in a proposal for a Development Bank Loan for the purchase of capital equipment -- usually at least one vessel, and in some cases refrigeration equipment. The proposal is scrutinised and, if appropriate, supported by the Fisheries Department, which advises on the most suitable vessel type. The boats, usually 16-foot outboard-powered `Hartley' half-cabin dinghies, but sometimes other types, are constructed at the Division's boatyard on Espiritu Santo, with purchasers paying for materials only. Shortly after the vessel is delivered, a volunteer manager with a practical fishing background is selected via the Canadian University Service Overseas (CUSO) and assigned as a counterpart manager/fisherman to the group concerned.

The main fishing method is deep-bottom fishing using handlines and Samoan handreels. The catch is transported usually by air (at concessionary rates negotiated by VFDP staff) to fish markets in Port Vila

NEWS FROM IN AND AROUND THE REGION

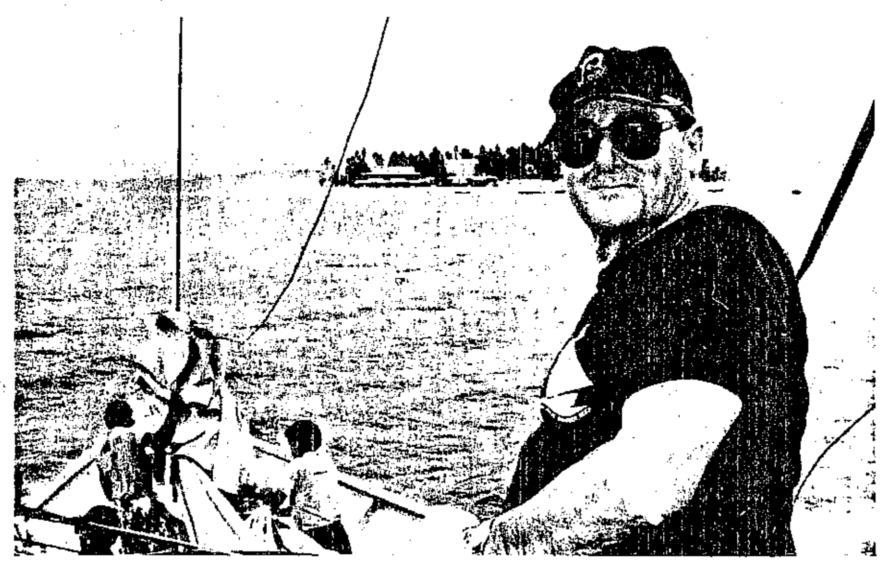
Former SPC Fisheries Officer Passes Away
(Source: South Pacific Commission)

Valentine Hinds, South Pacific Commission Fisheries Adviser between 1967 and mid 1972, died in New Zealand on September 1, 1985.

Born in the Irish Republic, Val joined the British Colonial Service in 1950 and worked in fisheries development in several countries in Africa, the Middle East, and the Pacific. He organised, and was elected chairman of, the 5th SPC Regional Tehcnical Meeting on Fisheries (1970), which at that time was held every two years. Val also travelled widely in the SPC area, advising on the establishment of fisheries services, organising training programmes and helping improve gear technology and reef and lagoon fishing. Subsequently, he became Co-director of the South Pacific Islands Fisheries Development Agency (SPIFDA), a joint UNDP/FAO/SPC organisation. His reports on Niue, Solomon Islands, Wallis Island, and Western Samoa should still be of interest to Fisheries Officers, as should his 1971 series of copiously illustrated South Pacific Bulletin articles on French Polynesia, Niue Island, and Pacific fishing boats and gear.

After leaving SPC, Val joined the New Zealand Ministry of Agriculture and Fisheries. There as Assistant Director of the Fisheries Management Division, he maintained his lively and practical interest in South Pacific fisheries, in 1975 representing New Zealand at the 8th SPC Regional Technical Meeting on Fisheries.

A practical fisherman and sailor, and a keen photographer and ham radio operator, Val was also a great teller of Pacific fishing stories. Now he himself has become part of those stories, remembered with affection and respect by those who knew him best.


(Photo: 'Catch' magazine)

Val Hinds, SPC Fisheries Officer, 1967-72.

and Luganville, using insulated boxes and bags made available by the Project. The markets purchase the catches on the spot, and resell by retailing locally, and, more recently, by organising bulk export shipments to Australia and New Caledonia. In the last few months, the Project has acquired a lease on a bankrupt `fried chicken' outlet which has been absorbing some of the market's production.

There are now about 30 established fishing groups throughout the country, and together these landed about 300 tonnes of fish in 1984. Representatives of the groups meet annually in Port Vila, together with Fisheries Officers and representatives of the other organisations involved in the VFDP, in order to discuss areas of common interest. At this year's meeting, held in November, representatives discussed ways of increasing catches, improving the quality of fish delivered to the markets, and financial aspects of Vanuatu's fisheries development projects.

One group reported on a recent spectacular catch -- a 321-kg marlin which was caught trolling. The fish was caught on a Samoan handreel fitted with 500 m of 130-kg monofilament line and a red-and-white octopus lure on a stainless steel wire trace. The marlin took two hours to land and at 6.5 m it was nearly one metre longer than the boat that caught it. Several other marlin, mostly in the 60- to 80-kg range, were also caught by Vanuatu's village fishermen during October.

(Photo: R. Stevens)

A 321-kg marlin caught by village fishermen in Vanuatu.

<u>American Samoa Data Mangement System Upgraded</u>
(Source: NMFS Honolulu Laboratory 'Report of Activities')

The American Samoa Office of Marine Resources (OMR) has modified their commercial fishery sampling programme into separate inshore and offshore creel (catch) survey systems similar to those of Guam and the Commonwealth of the Northern Mariana Islands. Using a modification of a data expansion system developed earlier, OMR will be better able to estimate total harvest of their inshore and offshore resources. The OMR is also designing and implementing a commercial system, assisted by David Hamm, Computer Systems Analyst from the National Marine Fisheries Service, Honolulu Laboratory. While at OMR, Hamm helped design a form that will be distributed to all purchasers of fresh fishery products, including stores, restaurants, and the hotel.

<u>Fibreglass Boats Becoming Popular in Fiji</u>
(Source: Professional Fisherman)

Locally made Yamaha fibreglass boats are becoming popular fishing and transport vessels among rural islanders in Fiji. Burns Philp (South Sea) Company Limited (BP), a major company which makes them under franchise in Fiji, has expanded its boat building operations to meet the growing demand for the boats.

Local fishermen have been encouraged to buy these fibreglass boats at a reduced price. A 3-metre dinghy costs F$650, a 6-metre boat costs F$1,700, and a 7-metre vessel costs F$1,800. BP is also making 5.8-metre and 7-metre open long boats that can be custom built with steering console and cabin if the buyer is interested. The popular 7-metre boat can carry up to one tonne of cargo as well as eight people and needs only a 30-40 hp engine to do this work.

Fiji is the only South Pacific country that makes Yamaha fibreglass boats. Export markets have also been established in the Pacific region in Papua New Guinea, Tonga and Samoa. In Fiji, more than 100 boats have been sold since BP started making them in October 1982.

<u>Okinawa Fisheries in Dire Straits in Papua New Guinea</u>
(Source: The Times of Papua New Guinea)

Okinawa Fisheries, based in New Ireland, Papua New Guinea, owes the government a substantial amount in unpaid taxes. The fishing company also has not paid bait royalties it owes to the local people for the month of October and November, and salary and wages of the employees.

Company President Narit Sugu Kurima said the parent company, Okinawa Kaigai Fisheries, would pay the tax and other outstanding debts. Okinawa Kaigai Fisheries had directed the local company to cease all operations because of financial difficulties. However, breakdown of the mother ship forced the company to cease operations earlier than expected. The closure has laid off more than 200 national employees, and nine fishing vessels, and caused growing concern among national and provincial authorities.

The company has been under great pressure from both Papua New Guinea provincial governments and the national government for failing to fulfil certain conditions of their agreement. Parts of the agreement called for a localisation programme, construction of an office complex, warehouse and accommodation and recreation facilities and to revamp the fish processing plant on Nongo Island. A company official claimed that there was a misunderstanding between the company executives and the national and provincial government officials.

The officials said exports of skipjack tuna to Japan, Thailand and Fiji would cease temporarily until the next season, which is in six months.

Permit System for Traditional Hunting of Dugong at Hope Vale
(Source: Great Barrier Reef Marine Park Authority)

In November 1983 the Zoning Plan for the Cairns and Cormorant Pass Sections of the Great Barrier Reef Marine Park came into operation. The Zoning Plan provides, amongst other things, that the hunting of dugongs, a traditional Aboriginal or Islander activity, may only be continued in the Marine Park subject to permits issued by the Great Barrier Reef Marine Park Authority. People other than Aboriginals or Islanders are not permitted to take dugong.

At Hope Vale, dugong hunting takes place mainly during the Christmas holiday period when the Hope Vale families tend to move from their main, inland settlements to camp for a few weeks at the beaches north and south of Cape Bedford (north of Cooktown). Authority representatives visiting Hope Vale in November 1983 discussed permit requirements and issued permits for the taking of one dugong to each of 20 dugong hunters who requested one. The figure of 20 is derived from a combination of Hope Vale's estimate of their annual dugong catch and an estimate of the likely sustainable yield of the dugong population in the locality of Hope Vale. The second estimate was provided by Dr Helene Marsh, based on her studies of dugong population biology. Unfortunately, that system as it applied to the 1983 hunting season was not popular.

Since the beginning of 1984, officers from the Authority and the Queensland National Parks and Wildlife Service have held discussions with Hope Vale representatives to improve arrangements for issuing permits to Hope Vale dugong hunters. Hope Vale people have identified a need for information about dugongs and their vulnerability and about the hunting permit system. Meetings have not been seen as an effective method of conveying the necessary information to all of the residents of the community. As a result, the Authority and the Service have jointly produced a video tape programme with assistance from the Hope Vale community. The use of video tape has been favoured because of the popularity of video equipment in the community as well as its versatility as a medium for communication.

The number of dugongs which may be taken in any particular area is firstly constrained by the sustainable yield of the local dugong population. Dr Helene Marsh is extending the scope of dugong research to provide a basis for monitoring the dugong population in the areas of the Great Barrier Reef Marine Park. The Authority hopes to build upon experience with the management of dugong at Hope Vale to develop guidelines which may be applied throughout the Marine Park.

<u>Beche-de-Mer and Miscellaneous Marine Products</u>
(Source: South Pacific Commission)

A number of buyers have approached the SPC seeking beche-de-mer and other miscellaneous marine products. These include the following:

Tai (Trading) Ltd.
B.P.O. Box 5690
308-309 International Building
141 Des Voeux Road
Central
Hong Kong
Telex: 85267 TAIHI HX

Sea Sources (Hong Kong) Company
2nd Floor, General Building
6-14 Centre Street
Saiyingpun
Hong Kong
Telex: 72088 SEAHK HX

Nam Kwong & Company
186-188 Des Voeux Rd., W. 8th Fl.
Hong Kong
Telex: 75371 NKCHK HX

We have no information as to the integrity or reliability of these companies, and would appreciate feedback.

<u>'Infofish' Tuna Trade Conference Announced'</u>
(Source: Infofish)

The FAO fisheries industry information service, Infofish, is organising a Tuna Trade Conference to be held in Bangkok, Thailand, from the 25th to the 27th of February 1986. The conference is designed to enable industry representatives to exchange new ideas, and obtain a better awareness of current problems and developments within an industry which is undergoing dramatic changes. In particular, the complexity of the industry has increased, with more coastal nations becoming involved in harvesting and processing of tuna, the imposition of national jurisdiction and licensing fees on previously uncontrolled fishing areas, and intensive competition within and between the harvesting and processing sectors.

The conference, which will be conducted in English, will be broken into five sessions:
(i) Resources and Exploitation
(ii) Industry and Market Situation
(iii) Aspects of Market Access
(iv) Industry Prospects and Opportunities
(v) Future Outlook

In addition, conference participants who so wish will be able to visit a local tuna cannery. For further information, contact: Infofish, P.O. Box 10899, 50728 Kuala Lumpur, Malaysia.

Aquaculture Position Available
(Source: ICLARM)

ICLARM recently announced that it is accepting applications for the post of Project Leader, Aquaculture Program. The successful applicant should have proven ability to lead aquaculture research projects in tropical developing countries. The appointee will be based in western or southern Africa, with extensive travel within tropical Africa. Applications including resume, publication samples and addresses of three referees should be sent to Dr Roger Pullin, Director, Aquaculture Program, ICLARM, MC P.O. Box 1501, Metro Manila, Philippines. Deadline for receipt of application is 28 February 1986.

FISHERIES SCIENCE AND TECHNOLOGY

Hokama's Test for Ciguatoxin Evaluated
(Source: Southwest Fisheries Center, N.M.F.S.)

An independent field evaluation of the ciguatera toxin test developed by Dr Yoshitsugi Hokama of the University of Hawaii (see SPC Fisheries Newsletter No 34) was conducted by Research Assistant Matthew Wilson and Paul Jokiel, Acting Leader of the Fisheries Habitat Research Program, at Midway Island in the Northwestern Hawaiian Islands. The area has experienced continual outbreaks of fish poisoning.

239 fish (34 species) were tested with the stick test. Also, samples (100 g) of flesh were frozen and returned to Honolulu for direct analysis of toxicity using the mouse bioassay. An extract was prepared and injected into mice (toxic samples will kill a mouse in less than 24 hours). The results, which will be presented in a report currently in preparation, can be summarized as follows:

1. A number of modifications were recommended in the test for use in remote field situations. It will be necessary to modify and further evaluate this test before it can be used in commercial applications.

2. The initial evaluation was very encouraging in spite of technical problems that might have reduced its accuracy. The stick test and the mouse bioassay tested negatively for species such as the mullet, *Mugil cephalus*, and the aholehole, *Kuhlia sandvicensis*, that are routinely eaten by the local population. The parrotfish, *Scarus perspicillatus*, showed extremely high toxicity by the stick test and the mouse bioassay.

3. Inconsistent results also were noted. Discrepancies are believed to result from polyethers other than ciguatoxin that are present in some of the fish. This problem is currently the focus in several laboratories, and there is hope that it will be resolved.

Promising Results from Pearl Oyster Culture
(Source: Australian Fisheries)

Researchers at the Western Australian Marine Research Laboratories have recently overcome a major obstacle in their efforts to culture the tropical pearl oyster, Pinctada maxima. Although the project began in July 1982, early efforts to successfully induce spawning and subsequent settlement of the larvae were hampered by insufficient knowledge of the species' reproductive biology.

However, last summer (1984-85) spawning techniques were developed and three spawnings were achieved using oysters collected from deepwater fishing grounds. The latest report from the research team was that the third batch of larvae reached the prediveliger stage (ranging from 165 to 405 μm in shell length).

Although settlement, which normally occurs three weeks after fertilisation, was not achieved on this occasion, the experience provided vital information on the feeding requirements of larvae which will be a valuable benefit for the ongoing research. To date about 40 spawning experiments involving more than 865 pearl oysters have been completed over the past two breeding seasons (1983-84 and 1984-85). Later experiments have utilised large amounts of heated, circulating water instead of still, aerated water as used in the past.

Attempts to induce spawning have involved manipulating water temperatures, using seawater irradiated with ultra-violet light, and the use of two chemicals known to have been effective in past experiments with bivalves. The chemicals are hydrogen peroxide buffered with TRIS (trishydroxymethylamino-methane), and serotonin, a neural transmitter. The former stimulates hormones responsible for expelling gametes from the gonads, and the latter is a vasoconstrictor, stimulating ciliary movement and the heart.

Unfortunately, both chemicals have proved inconclusive in inducing spawning in the pearl oyster, although part of the problem could be related to the broodstock being insufficiently ripe. Obtaining ripe broodstock and the long distances over which the oysters have to be flown (2,274 km from the fishing grounds to the research lab) have been the major problems encountered by the research team.

Marine Battery Needs No Service
(Source: Fishing News International)

A battery specially designed for marine use has been introduced by AC Delco. Named the 'Freedom Voyager', the battery has the major advantage of not needing topping up or routine servicing. This is because of the factory-filled electrolyte reservoir and the sealed tops. Other design features include formulated plates, a grid alloy to reduce gassing and overcharge, and marine terminals. A battery indicator uses a colour code to indicate the strength of the charge. Freedom Voyager comes in a rugged case designed to stand up to vibrations and shocks, and an acid-proof polypropylene rope provides a carrying handle. For further information, contact AC Delco, P.O. Box 5, Boscombe Road, Dunstable, Bedfordshire, LU5 4LU, England.

ABSTRACTS

This is an occasional feature intended to announce the existence of fisheries-related publications or documents specific to the SPC region, but which may receive only a limited circulation. Readers interested in obtaining copies should write to the contact address given (not to SPC) for information on how to do so.

1. Subsistence fishing and the physical environment: the mangroves of Vanuatu and their significance to fisheries, by G. David, ORSTOM, 1985 (in French).

   This report documents the types and extent of mangrove forests in the islands of Vanuatu, giving basic notes on their biology and the ecosystems they support, and then goes on to describe their utilisation by Vanuatuan fishermen in past and modern times. Mangroves are estimated to cover an area of some 3,000 hectares in Vanuatu, and several extensive mangrove woodlands exist, particularly on the island of Malekula. An estimated 20,000 to 35,000 tonnes of leaf matter from these areas enters the coastal environment each year, forming the basis of the trophic chain of the mangrove areas, but also fertilising other more distant coastal areas. The mangroves also act as a nursery area for the young of many fish species. Maskelyne island fishermen recognise at least 126 types of fish associated with the mangrove environment, and 42 of these are thought to occur only in mangroves.

   The significance of mangroves therefore extends beyond the fact that they offer fishing opportunities which can provide an immediate yield to fishermen. They also contribute to enriching coastal regions, and provide food and shelter for young creatures which may form the basis of fisheries later in their lives. The author equates the role of the mangrove woodland to that of interest-bearing capital, which should be protected from being destroyed or even encouraged to further growth.

   CONTACT ADDRESS: Mission ORSTOM de Port Vila, B.P. 76, Port Vila, Vanuatu.

2. Eucheuma Seaweed Farming in Kiribati, Central Pacific (1983), by Stephen Why, 1985.

   This publication reports the results of farming trials of the seaweed *Eucheuma striatum* in Kiribati. This seaweed, farmed commercially in the Philippines, is a source of the widely utilised colloid carrageenan. In 1983 the Kiribati government instituted this research programme to assess the potential for I-Kiribati families to farm the seaweed as a cash crop, in a manner complementing the traditional values and lifestyles of the nation.

   Initial work began with the surveying of 10 potentially suitable lagoon islands for possible farming areas, and the subsequent establishment of 32 trial sites on seven of these islands. Each trial unit consisted of a horizontally positioned 2.5-m by 4-m large mesh net planted with 136 *E. striatum* seedlings, 20 of which were tagged and weighed at weekly intervals. These measurements were used to calculate growth rates and extrapolate net Raw Production Rates (RPRs) for each site. 65% of the sites gave RPRs of 35 raw net tonnes of seaweed per hectare per year, while 40% showed RPRs of over 61 tonnes/hectare/year. These were calculated as being adequate to generate incomes of A$15/week and A$35/week respectively to a farmer working one-tenth of a hectare by this method.

Simultaneous farming trials were carried out on Tarawa atoll at several sites, both by the Fisheries Division and by interested private individuals. Growth rates were initially high, equalling those predicted by the trial units, but subsequently fell due to a combination of factors, including seasonality of growth, nutrient limitation, epiphyte infestation and grazing by rabbitfish and turtles. The author notes that further monitoring of long-term growth patterns is required before commercialisation is attempted.

Information on the costs of setting up the seaweed farms, buyers' quality requirements, prevailing prices, and transport costs is also presented. The report concludes that further research work is required but that seaweed farming has the potential to support a 'cottage industry' in Kiribati.

CONTACT ADDRESS: Natural Resources Division, Overseas Development Administration, Eland House, Stag Place, London SW1E 5DH, England.

3. Fish Traps of Tikehau -- An Aspect of Artisanal Fishing in French Polynesia, by Gilles Blanchet, Laurence Cailland and John Paoaafaite, 1985, (in French).

Tikehau is an island in the Marquesas group in French Polynesia where the use of elaborate fish 'parks' or 'traps' is a fishing method handed down by tradition. In recent years, the fishing has become commercialised, and today about a dozen fishermen and their families own and work some 30 traps. The catch is shipped or, more recently, airfreighted, to commercial markets on Makatea (Tikehau's neighbouring island, on which a phosphate mine is situated) or Papeete.

This report describes in detail the traps themselves (which are up to 150-m long by 50-m wide), the social organisation of the fishery, and its commercial structure.

CONTACT ADDRESS: Centre ORSTOM de Tahiti, B.P. 529, Papeete, French Polynesia.

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The following is an excerpt from an article by the same title which appeared in the Marine Fisheries Review, 46(4), 1984.

CORAL REEF SANCTUARIES FOR TROCHUS SHELLS

by

Gerald Heslinga, Obichang Orak and Marcus Ngiramengior

Depletion of the economically important coral reef snail, *Trochus niloticus*, through unregulated or poorly regulated harvesting is of increasing concern in the Indo-West Pacific. There are many cases where local stocks have been fished nearly to economic extinction, often in spite of regulatory measures. And, the International Union for the Conservation of Nature has recently added *T. niloticus* to its list of "commercially threatened invertebrates".

Factors contributing to such declines include the large size, accessible habitat, and sedentary habit of *T. niloticus*. Complicating factors include a suite of problems commonly associated with resource management in developing countries. Examination of trochus management in the Republic of Palau, and documentation of a successful review and policy change is therefore both timely and relevant.

Since 1960, Palau's trochus management policy has included four components: 1) size limit (7.6 cm base diameter); 2) restricted season (1 month/year, usually June); 3) a sanctuary system to protect designated areas; and 4) a moratorium system in which states or villages voluntarily stop collecting shells for one or more years.

The size limit and the seasonal restriction were originally implemented in the 1920s and 1930s during the Japanese occupation of Palau. The sanctuary system was established under the American administration following a 2.5-year investigation by McGowan, who presented data to support his position that "there has been a constant decline in the size of the catch from almost all of the trochus producing areas of the Pacific." He maintained that these declines occurred despite existing regulations on harvest and size. As for the decline in trochus harvests reported at various times from New Caledonia, the Philippines, the Andaman Islands, Yap, and Palau, McGowan concluded that "without a doubt, overfishing was the cause for these population declines, thus implying that the exsiting conservation practices were ineffective."

A trochus sanctuary system proposed by McGowan, and later implemented in Palau, Truk, Ponape, and Yap, was based on the assumption that the protected areas would serve as spawning centers from which planktonic larvae would be distributed by currents up and down the reef. Although the early life history stages of _T. niloticus_ had not been described during McGowans's studies, he hypothesized that trochus larvae must spend a short time in the plankton (days, as opposed to weeks or months) before settlement and metamorphosis. Subsequent studies have corroborated McGowan's thesis.

T. niloticus larvae are now known to be of the short term lecithotropic type which, under favorable conditions, spend only a few days in the plankton. There is a high probability that trochus larvae which recruit successfully to the benthic environment do so within a few days drift of their point of origin. From a practical standpoint, this means that larvae produced in trochus sanctuaries probably do not help populate nearby reefs. One would not necessarily expect the same to be true for gastropods with long-term plankotrophic larvae.

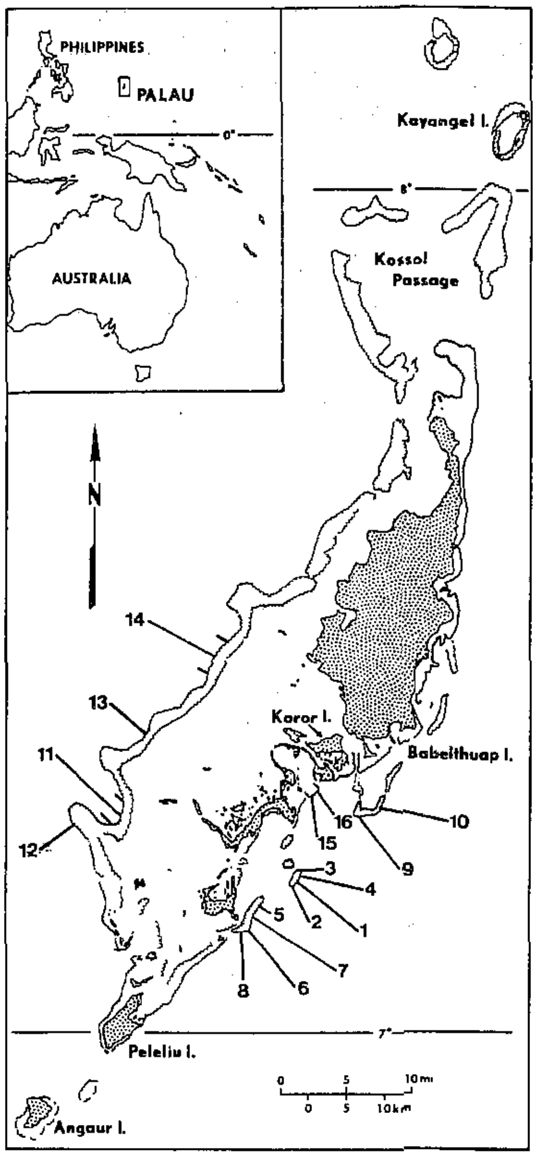
At the outset of Palau's trochus sanctuary program, McGowan recommended establishing one sanctuary per 5 miles of barrier reef. This was evidently an arbitrary decision. It was stressed that to be effective, the sanctuaries must be "well made," i.e., placed in appropriate habitats for _Trochus niloticus_, and they must be patrolled regularly during the harvest season to discourage poaching. Subsequently, trochus sanctuaries were established in Palau by members of the local Conservation Division. In Koror, the most populous state and the largest in terms of barrier reef perimeter, seven trochus sanctuaries were designated: five on the east coast and two on the west coast.

At the request of the Palau Marine Resources Division, and with financial support from the Pacific Fisheries Development Foundation, we studied the orginal seven Koror State trochus sanctuaries in March-April 1982 to see if they were fulfilling their intended function. Underwater surveys provided a quantitative assessment of the distribution and abundance of harvestable trochus in sanctuary areas and in adjacent exploited areas. The sampling technique, methods of data analysis, and report format used for the Koror State trochus survey thus represent an attempt to develop a pragmatic model that can be used for future surveys of this kind, both in Koror and elsewhere.

Koror State survey data indicate that, on average, the seven surveyed sanctuary sites had only half as many trochus as nearby exploited areas. Had the system been working as originally planned, higher trochus densities should have been found inside the sanctuaries. Thus the sanctuary system was only marginally effective at the time of the survey.

The two sanctuaries located on Koror's western barrier reef (sites 11 and 14) had such low numbers of trochus that they were essentially useless. These sites appear to have been chosen arbitrarily. Because most of Koror's western barrier reef drops off steeply, minimal intertidal and shallow subtidal habitats are available for trochus. Moreover, the outer reef flats are generally submerged at low tide and lack the boulder and rubble-strewn intertidal zone that seems favourable to the recruitment of juvenile trochus. Our census data support the position that Koror's west coast barrier reef is marginal-to-poor trochus habitat. Not surprisingly, this area is seldom visited by trochus harvesters.

Of the five remaining trochus sanctuaries in Koror State, four sites (sites 2, 8, 9 and 15) were located on the south or southeast facing sections of their respective reefs. These were relatively calm sites with sand and live coral dominating the surveyed depth contours. These substrate types offer numerous hazards to T. niloticus of all ages and are probably actively avoided. Settling larvae and post-larvae can be consumed by live corals or buried under shifting sand. Juvenile and adult trochus probably avoid sand because it inhibits locomotion and adhesion of the foot. Locomotion across live coral is undesirable because it would expose the foot to stinging nematocysts. We have never observed T. niloticus crawling on or adhering to live coral in nature. Perhaps most important, live coral and loose sand do not promote growth of the low filamentous algal species which form a principal part of the T. niloticus diet.



The Palau archipelago, showing the 16 sites surveyed for *Trochus niloticus*.

Based on this line of reasoning, we concluded that four of the five trochus sanctuaries on Koror's east coast had been placed in marginal or poor habitats. Only one of the east-coast sanctuaries (site 7), located on an east-northeast facing reef, had a suitable substrate composition (dominated by pavement and coralline algae) and a high density of trochus relative to nearby areas.

Of the areas surveyed, the one with the most favourable conditions for T. niloticus was Ikedelukes, an exposed barrier reef segment about 5 km south of the Malakal Lighthouse. Ikedelukes embodies a number of physical and biotic characteristics which we believe are ideal for trochus sanctuaries. These include an unobstructed exposure to surf generated by northeast trades, a gently sloping bottom, a wide reef flat that is exposed at spring low tides, a subtidal substrate that is predominantly pavement (especially in shallow contours), and an abundance of coralline algae and low filamentous algae at 1-3 m.

Ikedelukes supports an immense number of grazing herbivorous fishes, with acanthurids and scarids being particularly abundant. Ikedelukes is far enough from the commercial port of Palau (35 minutes by speedboat) to make pollution a minimal conern; however, the reef is close enough to allow surveillance and experimental work. Most important, Ikedelukes had high numbers of mature Trochus niloticus relative to other nearby sites. All of these considerations figured in our eventual decision to recommend Ikedelukes as a permanent trochus sanctuary for Koror State.

We emphasize that trochus sanctuaries must be placed near enough to district centers to allow periodic surveillance. Similarly, the number of reefs designated as sanctuaries should not place an excessive burden on the surveillance capabilities of local authorities. In retrospect, this was certainly the case in the Koror State system.

Following the completion of the trochus surveys in Koror State, we recommended to government officials that the trochus sanctuaries be reduced and consolidated into two moderately sized, centrally located reefs near enough to Koror to be visited frequently by conservation personnel. Ikedelukes Reef and Ngederrak Reef were selected as sanctuaries because they fulfilled the necessary physical, biotic, and geographic requirements reasonably well.

We also recommended that whole reefs (from channel to channel) be designated as sanctuaries because this would eliminate the time-consuming annual task of placing markers on the reefs to delineate sanctuaries. It seems practical, where possible, to treat whole reefs rather than portions of reefs as management units.

The proposed revisions to the Koror State trochus sanctuary system were approved in May 1982 by the Mayor and Chief, Ibedul Yutaka Gibbons. The harvest season opened the following month and lasted four weeks. The new sanctuary regulations were broadcast over local radio in the weeks before harvesting began.

The need to establish coral reef sanctuaries and other conservation measures in the nations of the tropical Pacific is widely recognized, especially in areas where traditional forms of reef tenure and resource protection have been eroded by urbanization and the effects of Western contact. Our study is constructive because it illustrates a case in which quantitative data were used successfully to lobby for the improvement of a coral reef management program. We assembled evidence showing that a 20-year-old trochus sanctuary system would likely be improved by some simple modifications, specifically, consolidation and relocation to superior habitats. Local Marine Resources Division personnel were trained to evaluate the problem and subsequently participated in proposing a solution. The assistance and approval of the Koror State Mayor and Chief were actively sought and proved instrumental in achieving an acceptable modification of policy. It is significant, too, that baseline data were established and practical methods developed to serve as a model for future comparative analyses.

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MANAGEMENT STRATEGIES FOR NEWLY DEVELOPING FISHERIES

by

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Introduction

Fisheries constitute the single most important natural resource with potential for increased development in many countries in the South Pacific region. Countries are now attempting to exploit deep bottom snapper resources in order to develop a stable source of revenue from these valuable fish. Countries are also attempting to increase their harvests of tuna, either by developing their own fishing operations or through increased sales of access licences to distant water fishing nations (DWFNs).

The biological characteristics of these two fisheries resources, snappers and tuna, are quite different, but the managerial problems to be faced in their development are similar. Neither has a long history of exploitation in the region on the scale required for full commercial development, and there is considerable uncertainty about the potential yields. Deep-bottom snappers are generally felt to be unexploited stocks that consist of old large individuals. We know little about the biology of these fish, in particular the mechanism of recruitment of juveniles to the populations. The definitions of discrete stocks are almost totally unknown as well. Similarly, there are also major uncertainties about the potential yields from the tuna resources. There are often modest local subsistence or artisanal fisheries for tuna, and in some countries considerable yields are achieved through access agreements with DWFNs or local joint ventures. Data on these fisheries have systematically been collected by the DWFNs for many years, but are not generally accessible in a form that allows individual island countries to assess potential yields. Furthermore, truly large-scale harvest of tuna by the purse seine fishery began only in the late 1970s, too recently to provide any real insight into potential yields. The Skipjack Programme of the SPC indicated a very large stock of skipjack but could not precisely determine the potential yield. The size and potential yield of the yellowfin tuna stock are even less understood, and almost nothing is known about the location and timing of spawning and recruitment of either of these two most important tuna species. Thus, for both snapper and tuna resources there are only rough indications of probable levels of sustainable exploitation on which to base development plans.

There are many objectives for fisheries development, including an increase in foreign exchange, an increase of the local protein supply, direct employment in the fishery, and development of local service and processing industries. When considering appropriate ways to develop underexploited fisheries, both the uncertainty in the dynamics of the fishery and the development objectives need to be considered. Nevertheless, it is probably true that larger, relatively stable fisheries would be a common goal. The most desirable mix of foreign exchange revenue, local food production, and secondary industry will undoubtedly depend on the specific economic goals and conditions in a particular situation, but the need for growth and stability in the fishery are universal. While it does seem clear that both the tuna and deep-bottom snapper fisheries can grow considerably in most countries of the region, it is not clear how far they can grow, nor what kind of stability can be expected.

There have been some spectacular failures in fisheries management which have occurred, in part, because of overemphasis on rapid development. The cost of overdevelopment has been the loss of potential benefits.

Figure 1 shows the catch history of the Peruvian anchoveta fishery, which for several years was the largest single fishery in the world, producing more than 12 million tonnes in its peak year. Peru used its anchoveta fishery primarily to gain foreign exchange and create employment, and rapidly developed a capital-intensive purse seine fleet and fish meal processing industry. A combination of poor recruitment, El Nino, which concentrated the fish, and serious overfishing led to a dramatic drop in catches during the early 1970s, when it became obvious that a reduction in fishing pressure was necessary to allow the stock to rebuild. However, the Peruvians were so indebted from financing the growth of their industry, and there was such political pressure from the fishing industry to keep fishing to provide ongoing employment and cash flow, that the fishing pressure was not reduced sufficiently. The tragic result is that between 1973 and 1982, the stock, which once supported the world's largest fishery, was fished to commercial extinction. (Catches of anchoveta in 1984 totalled 26,000 tonnes, or about 0.2% of the peak year's catch, as by catch in other fisheries.)

A stock that was capable of producing nearly 10 million tonnes of annual yield has been effectively wiped out. A resource that promised so much to help develop a country turned into a serious economic liability when hundreds of boats and processing plants had no fish to catch or process. We need to emphasize that the problem was not intrinsically biological but that those responsible for managing the fishery were politically unable to reduce fishing pressure when there had been a biological need to do so.

Figure 2 shows the catch history of the North Sea herring stock. The stock had supported a substantial fishery for many years, and then effort and catch were increased because of high prices and high abundance. The increase in fishing pressure combined with poor recruitment resulted in a decrease in the stock. Again, there was an obvious and urgent need to reduce fishing pressure, and again the fishery managers were politically unable to take the necessary steps. The sad result is all too familiar. Another very valuable fishery that could have provided great economic and social benefits was permanently reduced to a fraction of its potential. However, the North Sea herring appears to be coming back, and after 10 years of reduced fishing it may again be a viable resource. Nevertheless,

FIGURE 1: THE CATCH HISTORY OF THE PERUVIAN ANCHOVETA FISHERY.
By 1984 all direct commercial fishing had ceased.

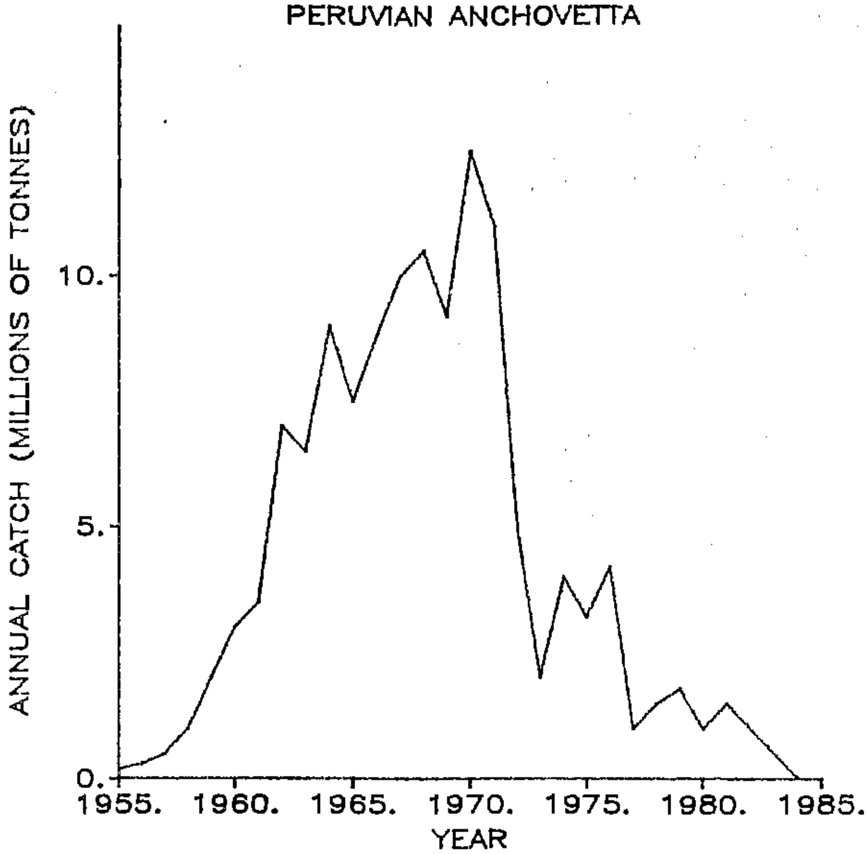
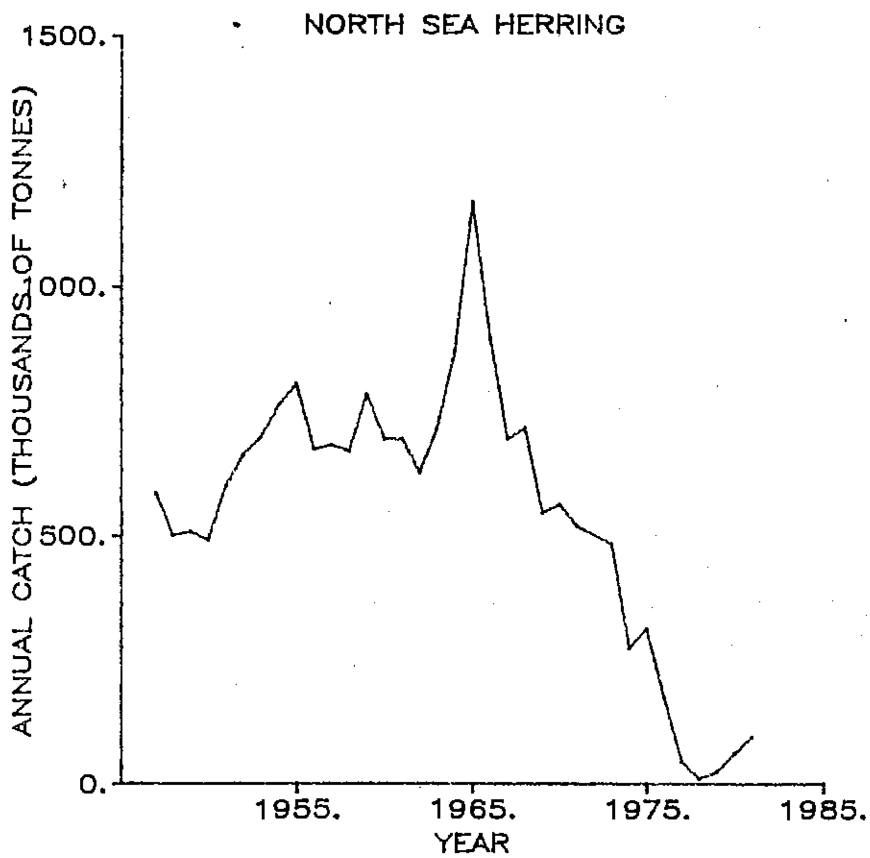


FIGURE 2: THE CATCH HISTORY OF THE NORTH SEA HERRING STOCK.



from 1967 to 1975 it was clear that the stock was declining and the biologists insisted that a reduction in fishing pressure was needed to rebuild the stock. The fishermen are now paying a very high price for political inaction.

Although these two examples are extreme, they do serve to illustrate some of the potential problems in fisheries development. We hope to outline the likely phases that a newly developing fishery of unknown productivity might encounter and the management concerns to be considered during these phases. In doing so, we will emphasize the fact that at certain times it will be absolutely necessary to reduce fishing pressure and that countries must be prepared to detect and respond to this need.

Traditional Theory

Traditional fisheries theory suggests that the yield increases as effort increases up to a certain point, usually called optimum effort, and then decreases beyond this point. The traditional fisheries development prescription is to increase fishing effort until total yield starts to drop, and then keep fishing effort near that level.

This prescription has several problems that make it somewhat difficult to implement.

1. The actual catch data do not usually follow a smooth line but will have ups and downs due to good and bad years. There will be other sources of variation as well. Some fishermen always do well relative to others. Improvements in fishing gear and technique can compensate for falling catch rates. Catches are not always accurately recorded and fisheries statistics are never complete. Thus there is always doubt whether a downward trend in catch is due to having passed the optimum or simply reflects one or two bad years. The ups and downs seen during the development of both the Peruvian anchoveta and the North Sea herring show that a downward trend cannot be detected with one point only, and that it will often take two or three years to establish any confidence. The important implication of this is that by the time you are sure you have started to overfish, you will have to reduce fishing effort to allow a recovery. Therefore one can never hope to avoid having to reduce fishing effort; it is an inescapable fact of fisheries development and management.

2. As the fishery develops, there will be higher yields than are sustainable. Initially, the unfished population may be considerably larger than would be expected under modest fishing pressure, and older large fish from the virgin stock will contribute disproportionately to the catch. This means that the catches will always drop after the optimum is reached. Thus government officials and fishermen must never expect things to always be the same. Periods of reduced catch are another inescapable fact of fishing.

3. The actual best effort level may change biologically as the environmental conditions and species mix change. The concept of each stock having a sustainable yield that does not change over time appears to be wrong. We must expect the sustainable yield to change with environmental conditions, and this again will necessitate systematic increases and decreases in fishing effort as we attempt to track the moving optimum of the stock.

4. The optimum effort may change as gear technology changes. A universal feature of fisheries is that in the absence of strict regulation the efficiency of a fishing fleet will increase over time. Thus a country might have developed its fishing fleet up to what was thought to be the appropriate size, only to have the fleet become more efficient and begin overharvesting the stock. This tendency is aggravated under a management regime which imposes a catch quota which causes fishermen to strive to be more efficient in order to compete for their share of the quota.

All of these factors contribute to the fact that we cannot count on being able to develop a fishery to the exact point of optimum effort and then hold it there. We must go beyond, even considerably beyond, the level of optimum effort before we can detect where the optimum actually is. Therefore we must then be prepared to reduce effort after having gone too far.

Figure 3 shows an idealized fisheries development scenario in which effort and catch gradually increase until the optimum yield is reached and both remain steady afterwards. The second panel in Figure 3 shows a more realistic scenario in which effort was increased until total catch failed to increase after which effort was decreased by about 40% to a sustainable level. Even this panel is optimistic because there are no random fluctuations in stock size or catch to mask the true underlying phenomenon. However, it is clear that we cannot tell when we have gone beyond the optimum without using efforts that are considerably higher than the sustainable level.

Figure 4 shows the 25-year catch history of the Eastern Pacific yellowfin tuna fishery. The fishery expanded through the 1960s and early 1970s as catch and total fleet size kept increasing. The maximum yield occurred in 1977 after which catches declined. Regulatory conventions for this fishery have not been completely successful, but the powerful bio-economic combination of declining catch rates and low prices intervened to reduce effort in the Eastern Pacific. It now appears that after several years of lower effort the stock is rebuilding.

That the Eastern Pacific yellowfin had not been driven to low levels, unlike the Peruvian anchoveta and North Sea herring, was due primarily to the economics of the fishery. The anchoveta and herring fishing boats could still meet their operating expenses when stock sizes were very low so that vessel owners wanted to continue to fish. In the tuna fishery it was often better to either tie up the boat and not fish, or to move to new fishing areas in the Western Pacific. The yellowfin story illustrates several major points. We must expect that effort will have to be reduced as a normal part of fisheries development. Although there may be an initial period of very high catches, peak period catches are never sustainable. It is possible for stocks to recover from overfishing if sufficient pressure can be brought to bear to reduce fishing effort.

FIGURE 3A: AN IDEALISED SCENARIO OF A DEVELOPING FISHERY. The solid line depicts catch and the dotted line depicts fishing effort.

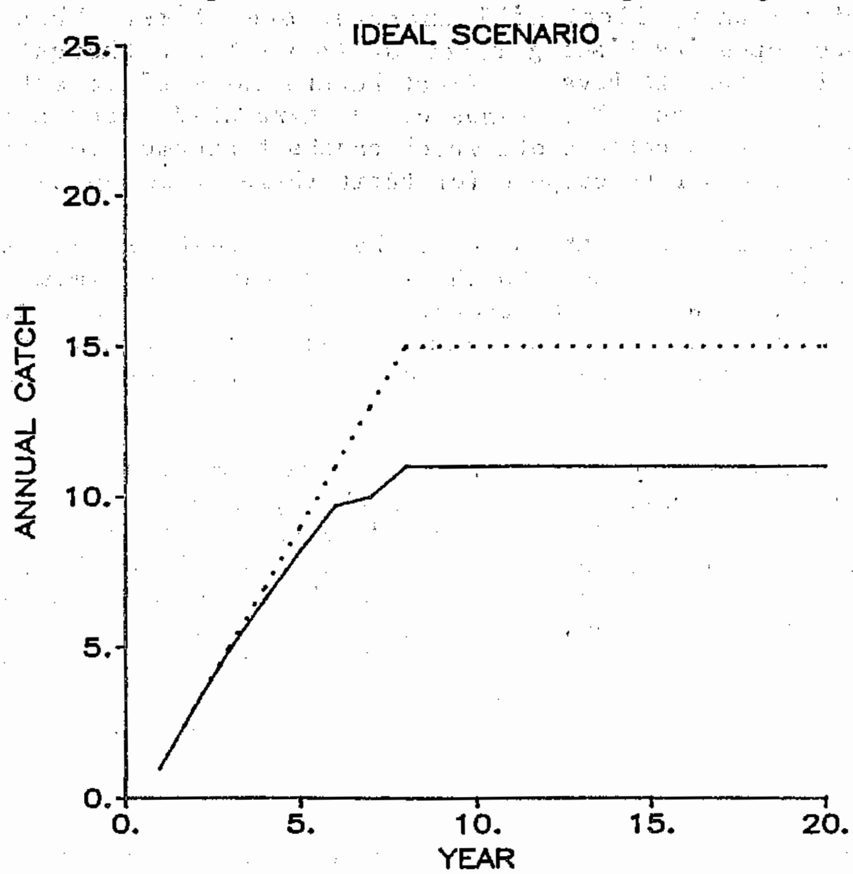


FIGURE 3B: A MORE REALISTIC SCENARIO OF A FISHERY'S DEVELOPMENT, SHOWING THE FACT THAT PEAK PERIOD YIELDS ARE HIGHER THAN SUSTAINABLE YIELDS, AND THAT SOME OVERFISHING IS REQUIRED IN ORDER TO DETERMINE THE OPTIMUM. This in turn necessitates a reduction in effort after it is determined that the stock is overfished.

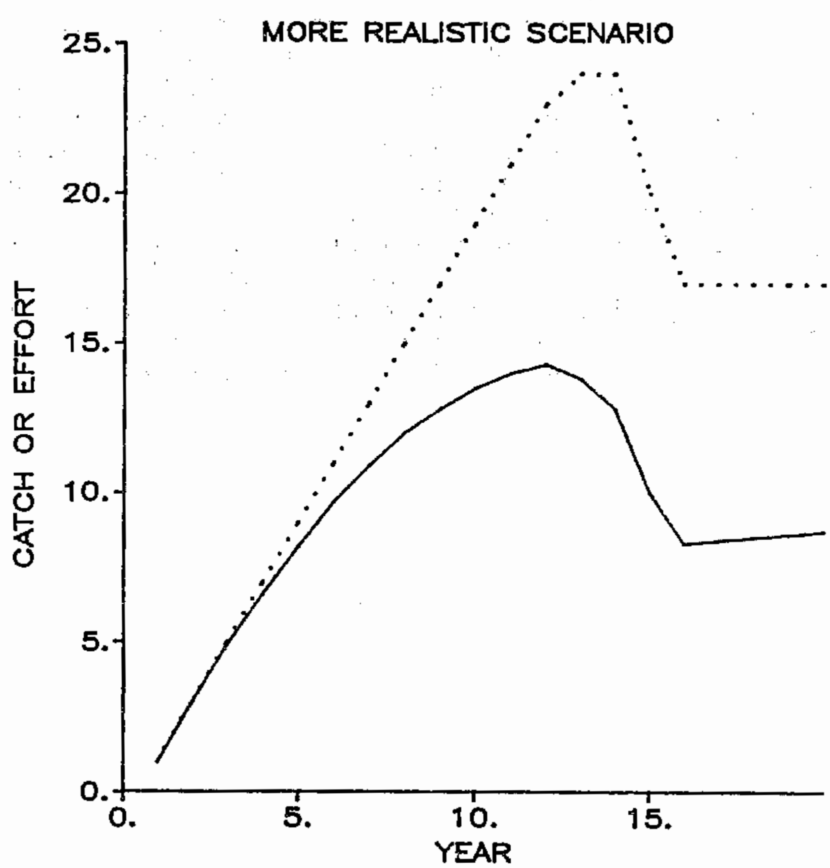
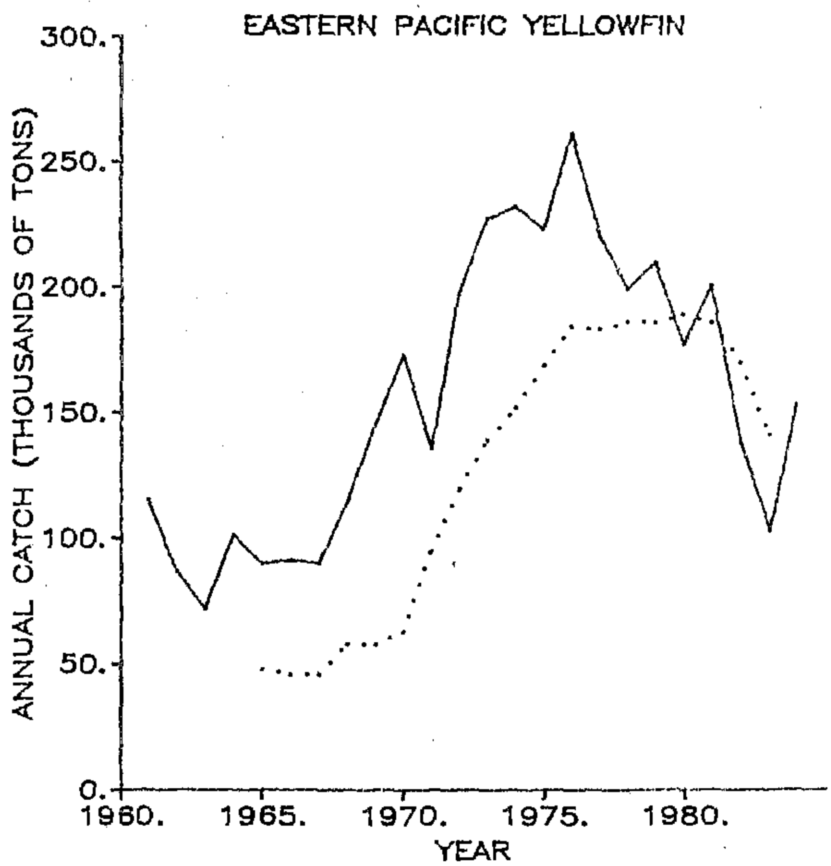


FIGURE 4: THE CATCH HISTORY OF THE EASTERN PACIFIC YELLOWFIN TUNA FISHERY. *The solid line depicts catch and the dotted line depicts the number of vessels fishing.*



Adaptive Management

This type of management, in which we detect changes in the stock and respond to them, is called "adaptive management"; we adapt to the system we are managing. There are two essential elements to adaptive management: monitoring and response. Both of these elements must be in place or it is unlikely that management goals will be achieved. We must monitor catch and effort to know when we have gone beyond the optimum level. Even for the simplest fishery, it is seldom a straightforward task to collect and interpret fisheries data. a commitment to sound fisheries management presupposes an equally strong commitment to collection and analysis of data, and a reliable system of keeping fisheries statistics should be esatblished as an integral part of fisheries development. It is equally important to be able to respond to a trend in the fishery by either increasing or reducing effort as required. This latter point is absolutely crucial. The major fisheries collapses of the world have almost always been due to the inability to reduce effort when drastic action was required. Unless we are prepared to not develop fisheries to anywhere near their optimum level, and thereby forfeit some potential benefits, we must be prepared to reduce effort once we have gone too far.

It is never a simple or popular act to reduce fishing effort. If it is widely known and well understood that an effort reduction will be necessary, then it is possible to include this knowledge in the development plan. In particular, the high catches during the initial phases of development may be viewed as a "windfall" and revenues generated can be diverted in ways most suited to the long term development goals.

It is often politically very difficult to tell fishermen they cannot fish this year as much as they did last year, or to completely eliminate some fishermen from the industry. The biggest potential danger South Pacific island countries may face in developing fisheries is being politically unable to reduce fishing pressure when the time comes that it is required. We must carefully consider the economic and social structure of the fishing industries we seek to develop to ensure that they have the robustness required to be able to make the changes in fishing effort that are required.

Many countries are generating revenue from tuna fisheries using access agreements or joint ventures. This is potentially a highly advantageous situation, since it should be much easier, in principle, to reduce effort by a distant-water fishing nation (DWFN) than it would be to reduce fishing by one's own fishermen. For example, a country might consider allocating a major portion of the catch to DWFN's, with the understanding that when the time comes to reduce fishing pressure, the DWFN's are going to lose their access first. As a better understanding of the potential sustainable yield develops, a greater portion of the total catch could be allocated to national fishermen, but always maintaining a reserve of fish allocated to DWFN's that could be revoked when needed.

Of course a country could become economically dependent upon the revenue from the access agreement, and be just as politically unable to lose this revenue as it would be unable to tell national fishermen they could not go fishing. It is on questions such as this that it becomes important to consider the overall economic development strategy and its relationship to fisheries when considering the tactics of fisheries management. Our purpose is not to identify a specific development proposal, but rather to identify some potential pitfalls in fisheries development and some tactics to avoid falling into them.

Role of Stock Assessment in Adaptive Management

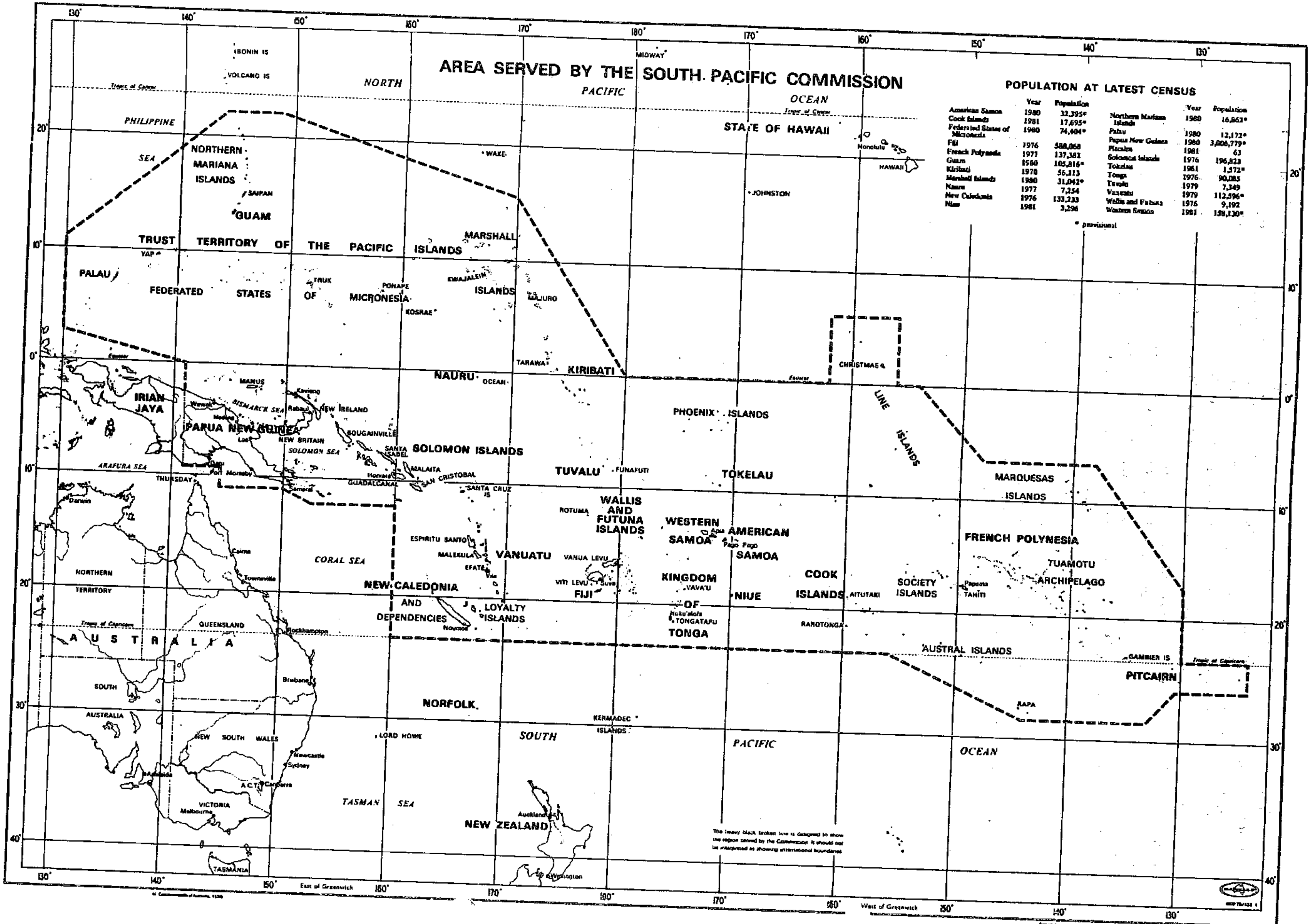
Politicians understandably often look for a technological quick fix to some of the problems we have been discussing. It is often necessary for planners to have some prior estimate of potential yield from a fishery in order to arrange financing for projects, for instance. Experts are hired to come into their country and estimate just what the sustainable yield is, how big a fleet should be built, and what sort of processing and support facilities are required. The available techniques for evaluating the potential of a fishery vary widely, and are in fact integral parts of rational fisheries management. Even the best methods of stock assessment and prediction are highly inaccurate, however. At best, a consultant might be able to predict the potential yield within 50%, if there had been considerable experience in fishing similar species in other countries. Thus during the development phase of a fishery, you will never be able to know how large the fishery can be without actually increasing the harvest and waiting for a decline.

Many politicians want their chief fisheries officers to give them a number; how many fish can we take, or how big a fleet can we have? The responsible answer has to be that we cannot know as the fishery develops. A rational fisheries management plan cannot consist of a planned growth up to a specified target harvest. Rather a fisheries management plan should consist of a monitoring system to measure catch, effort and catch rates, and a planned response to declines in catch when they occur. The fisheries agencies should plan how they will reduce fishing effort, and what data will be used to determine when fishing effort needs to be reduced.

The best stock assessments in the world are no substitute for experience with your own stocks. Even in European and North American fisheries, where there are often decades of excellent data it is not possible to predict sustainable yields within 20-30%. In these fisheries the managers are still exploring by increasing or decreasing fishing pressure, and seeing how the stock responds. A stock assessment is an integral part of an adaptive management plan, but it cannot tell you how large your potential catch will be or how big your fleet should be.

Summary

We have attempted to review the essential elements of the development of fisheries, utilizing the experience from other parts of the world. Fisheries managers must expect that fisheries development is a process of learning, and they must be prepared to adapt fishing pressure to current conditions in order to obtain the maximum yield from their stocks. It is almost inevitable that catch rates will be unsustainably high during the initial phases of fishery development and that subsequent restraints on fishing effort will be required. Most fisheries developments go astray by failing to have the political or institutional capability to reduce fishing pressure when it is needed. Pacific island countries may be fortunate in being able to allocate some portion of their catch to DWFNs that can be eliminated when total catch must be reduced. The "extra" revenue generated during the initial phases can be invested in such a way as to cushion the impact of subsequent decline in catch. Even with the best advice before development takes place, there is no substitute for accurate monitoring of the fishery as it develops, and rapid response to reduce effort when the optimum has been surpassed.



POPULATION AT LATEST CENSUS

	Year	Population
American Samoa	1980	32,395*
Cook Islands	1981	17,695*
Federated States of Micronesia	1980	74,404*
Fiji	1976	588,068
French Polynesia	1977	137,382
Guam	1980	105,816*
Kiribati	1978	56,213
Marshall Islands	1980	31,042*
Nauru	1977	7,254
New Caledonia	1976	133,233
Niue	1981	3,296
Northern Mariana Islands	1980	16,862*
Palau	1980	12,172*
Papua New Guinea	1980	3,006,779*
Pitcairn	1981	63
Solomon Islands	1976	196,823
Tokelau	1981	1,572*
Tonga	1976	90,085
Tuvalu	1979	7,349
Vanuatu	1979	112,596*
Wallis and Futuna	1976	9,192
Western Samoa	1981	158,130*

* provisional