

SOUTH PACIFIC COMMISSION

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THIS ISSUE . . .

. . . Three articles highlight the problem of ciguatera fish poisoning. These include a report by Dr Yoshitsugi Hokama, who is developing a simple test to detect the toxin (page 28), a review of a recent report on the research and spread of the ciguatera problem in South Tarawa Atoll (page 22), and a medical doctor's prescribed diet for those recovering from the poison (page 19). These are presented in response to the interest in this topic shown by delegates to the Seventeenth SPC Regional Technical Meeting on Fisheries, held in Noumea in August.

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SPC ACTIVITIES

17th Regional Technical Meeting on Fisheries

More than 60 representatives and observers from South Pacific Commission member countries, international organisations and other institutions attended the 1985 annual Technical Meeting on Fisheries, which was held at SPC headquarters in Noumea from 5 to 9 August. Participants included fisheries officers, technical specialists, and representatives of aid programmes, educational establishments and industry.

Discussions during the meeting closely followed the provisional agenda (see SPC Fisheries Newsletter No. 33, p3). After the opening formalities, the first subject, a review of the SPC coastal fisheries work programme, was introduced by the Commission's Fisheries Adviser, Barney Smith, who outlined the activities of the SPC Deep Sea Fisheries Development Project over the past year. The Project's three field staff, master fishermen Paul Mead, Pale Taumaia and Lindsay Chapman, each described their own country assignments in detail, and many questions and comments ensued which led to discussions on practical aspects of fisheries development work, varying from the deployment of FADs to the detection of ciguatera in fish. An important recommendation to come out of the discussions was that the project be restructured to enable longer country assignments when these have a regional significance, and to allow one master fisherman to be assigned full-time to the development of new and innovative fishing methods suitable for small-scale use in Pacific Island countries.

The next main discussion item was the SPC/UNDP Regional Refrigeration Assessment and Training Project. Following a presentation made by SPC Assistant Fisheries Officer Garry Preston on the assessment phase of the project, the refrigeration course held in Rarotonga was described by UN Refrigeration Specialist Mike Vincent. Various questions and technical discussion followed, which concluded with many delegates supporting the idea of further training in this subject for fisheries personnel. A recommendation for two further refrigeration courses was subsequently made.

The meeting then turned its attention to the Commission's Regional Fisheries Training Project, endorsed by last year's meeting as a vehicle by which the South Pacific Commission could increase its involvement in the provision of vocational training in the fisheries field. The Commission's ongoing training activities, including the SPC/Nelson Polytechnic Pacific Islands Fisheries Officer Training Course, and various forms of attachment training, were discussed under this item. Mr Smith then introduced the subject of regional training needs and priorities, and the development of a core training programme for the 1986-87 period. Almost all countries commented on their own training priorities, and the training opportunities available to them.

Extensive discussions followed, and these led to the recommendation that the South Pacific Commission review existing training opportunities, assess the training needs of individual countries through consultative visits, and develop regional and sub-regional training programmes to respond to these needs. Subjects earmarked for priority attention were marine engineering, outboard engineering, refrigeration engineering, business management, fish handling and processing, communication skills, fish marketing, aquaculture, navigation and chartwork, fishing operations, fishing gear design and development, and fish quality control.

The next agenda item related to the work of the SPC Tuna and Billfish Assessment Programme and was presented by the Programme Co-ordinator, Dr John Sibert. Progress with priority items of the programme was outlined, and the meeting agreed to a revision of these items in the light of new work being requested of the Programme by individual countries. This was followed by a presentation on the status of the western Pacific yellowfin fishery, which again brought to light the fact that incomplete data continued to constrain the work of the Programme. The meeting recommended that the Commission renew its appeals to those nations whose vessels fish in waters within the region, and who do not provide adequate data to the Programme, to do so. At a subsequent point, the meeting also recommended that the Commission seek funding for a new tagging project, mainly directed towards yellowfin, which would enable the analysis of interactions between surface and longline fisheries in the Western Pacific.

In discussing future institutional arrangements for the Tuna and Billfish Assessment Programme, delegates were aided in their deliberations by a presentation made by Mr Terry Curtin, one of two consultants appointed by the SPC Committee of Representatives of Governments and Administrations (CRGA) to review and make recommendations on this subject. Many delegates noted the importance of the programme to their own countries, and the meeting agreed on a resolution expressing strong support for its continuation. The resolution was adopted in view of the fact that the Programme's future will come under review at the 25th South Pacific Conference to be held in Honiara in October this year.

The meeting continued with several sessions under the item on Fish Aggregation Devices (FADs). Mooring specialist Lieutenant Richard Boy opened the session on design improvements to FAD moorings by briefly recapitulating on the main points of the SPC design study of FADs carried out two years ago, before describing modifications which could be used when deploying FADs in relatively shallow water. Extensive discussion on the technicalities of assembling and deploying FADs followed, before the next session, which concerned biological and behavioural studies of fish aggregations associated with FADs. This was presented by Dr Kim Holland, who has been carrying out research on tuna movements and on their feeding behaviour in Hawaii. Several delegates related fishing experiences in their own countries which seemed to agree with the scientific findings presented by Dr Holland. The meeting then considered a proposal from the Tuna and Billfish Programme for research on optimal FAD deployment and management for commercial exploitation, and recommended that the Commission proceed with the proposal's development to enable the study of the dynamics of tuna aggregations at FADs.

The next agenda item was a workshop on the management of deep bottom fish resources in the region. This session was chaired by Dr Stephen Ralston, of the University of Hawaii, who presented a summary of a recent scientific meeting on deep water snapper and grouper biology which he and his colleagues had convened in Honolulu earlier in the year. Various delegates then outlined research work on these fish carried out in Australia, Vanuatu, Hawaii, and the Northern Marina Islands, touching on aspects of behaviour, recruitment, growth, population structure and susceptibility to fishing, and the relevance of these considerations to resource management.

The last main agenda item concerned recent developments in mariculture within the region. Dr Tony Lewis of Fiji and Mr Steve Why of Kiribati described the results of seaweed farming projects they were carrying out, which have generally been very encouraging. Mr Martin Coeroli of French Polynesia made a detailed presentation on pearl farming techniques and technology, which included an excellent video on the subject. The session closed with descriptions of giant clam and trochus culture projects by Dr John Munro (ICLARM) and Dr Tony Lewis, and a caution from several delegates on the potential hazards of introducing organisms, and possibly their unwanted parasites and diseases, into areas where they do not presently occur. The meeting was in agreement on the dangers of this practice and adopted a recommendation laying out interim guidelines to be followed when contemplating the transfer of exotic species (see article on page 17-18).

Final discussions at the meeting concerned the use of satellite imagery for resource mapping, and a case study on trochus in New Caledonia was presented by Dr Willy Bour of the Office de Recherche Scientifique et Technique d'Outre Mer (ORSTOM). The meeting concluded by addressing minor items of other business.

Overall the meeting was an interesting and productive one, which covered a wide range of topics and provided important guidance for future SPC fisheries-related work programme activities. As always, much business was conducted outside the meeting room, and many delegates benefitted from the opportunity to establish personal contact with representatives of other countries and institutions.

Deep Sea Fisheries Development (DSFD) Project Notes

All three SPC master fishermen interrupted their work programmes in August to attend the 17th SPC Regional Technical Meeting on Fisheries in Noumea, New Caledonia, where they made presentations on various aspects of their work over the past 12 months. Each officer returned to his current assignment after an absence of one to two weeks.

--Analysis of DSFD Project Fishing Data--

Immediately after the Technical Meeting, Master Fishermen Paul Mead and Lindsay Chapman participated in discussions with visiting fisheries scientist Dr Steve Ralston, SPC Fisheries Adviser Barney Smith, and Assistant Fisheries Officer Garry Preston on the subject of a regional analysis of accumulated DSFD Project fishing data. This consists of catch, effort, and a good deal of related data collected by SPC fishing projects in Pacific Island countries over the past eight years.

Although very variable in quality, this data comprises a unique record of fishing potentials throughout the SPC region, and the idea of utilising it to add to the present knowledge of the biology of deep-water fish species has been planned for some time. Unfortunately, budgetary constraints have prevented an analysis of the data so far, as there are very many man-hours of work involved in examining and coding the data forms for reliability, accounting for the numerous changes of scientific names and taxonomic classifications which make consistent species identification difficult, before any analytical work can begin. However, it may be possible to carry out a preliminary examination of the data in 1986, and with this in mind Dr Ralston and the SPC staff exchanged ideas on the types of analysis which might be most useful or meaningful, and on the collection of data during future SPC fishing projects.

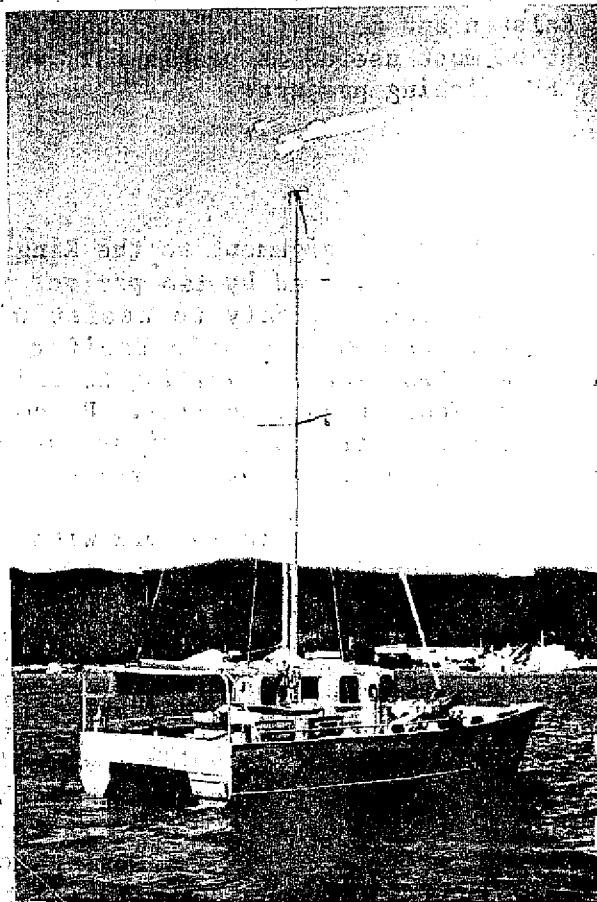
--Tonga--

Master Fisherman Paul Mead's assignment to the Kingdom of Tonga, which commenced in April, has been interrupted by two periods of absence -- six weeks spent in Fiji during June and July to assist with the practical fishing module of the SPC/Nelson Polytechnic Pacific Islands Fisheries Officer Training Course, and two weeks travelling to and attendance at the 17th SPC Regional Technical Meeting on Fisheries. Hence his work programme up until mid-August has consisted of broken periods during which the main activity has been gear rigging and vessel preparation.

The main aim of this project visit is to work with local boat owners in Tongatapu, Ha'apai, and Vava'u, to improve the effectiveness of small-scale fishing operations. As well as conducting trips with fishermen on their own boats, Paul and his counterpart officers from the Fisheries Division have rigged up the government's mini-longliner 'Vete' as a demonstration vessel to enable fishermen to see unfamiliar fishing methods such as vertical longlining. Demonstration trips will take place in conjunction with a programme of fish aggregation device (FAD) deployments planned for the coming months by the Foundation for the Peoples of the South Pacific (FPSP). Meanwhile, Paul is mainly carrying out bottom fishing trips with local commercial vessels working out of Tongatapu, and assisting the boat owners both to improve their fishing techniques, and to organise their vessels, gear, and fishing schedules more effectively. Extension visits to Ha'apai and Vava'u are planned for the coming months.

--New Caledonia--

Master Fisherman Lindsay Chapman has been working in New Caledonia with the staff of the Government Fisheries Department since June. The main objectives during his assignment have been the teaching of Fisheries Division staff in FAD-fishing methods, and the demonstration of deep-bottom fishing techniques to local fishermen. Fishing has been carried out from the Government vessel 'Dar Mad', a 35-foot aluminium motor-sailing catamaran. FAD-fishing has included trolling in a variety of styles, vertical longlining, handlining, and the use of gill nets. On the whole, catches of pelagic species have been poor, due at least in part to seasonal effects on fish abundance. Bottom catches, on the other hand, have been good. An unusual feature of the bottom fishing in New Caledonia is the fact that many species occur in much shallower waters here than in other countries where the master fishermen have operated. This may be related to lower water temperatures, but the same pattern was not observed in other locations at similar latitudes (e.g. southern Tonga, or Rarotonga in the Cook Islands).



Dar Mad, 38-foot research and extension vessel
of the New Caledonia Fisheries Department.

--Marshall Islands--

SPC Master Fisherman Pale Taumaia concluded his assignment to the Republic of the Marshall Islands at the end of September, with the completion of his training programme in deep-bottom fishing. After carrying out training/demonstration fishing trips for a number of local fishermen from Majuro in the earlier months of the visit, Pale started a more in-depth training programme for selected fishermen from the earlier groups, in July. This included instruction in making wooden fishing reels, preparing anchors and anchor ropes, and the use of echo-sounders and compasses. This was followed by a series of fishing trips to Arno atoll, where good fishing was found and the first Pristipomoides (deep-water jobfish) of the project visit were caught. Unfortunately, large numbers of sharks were also present, and on each trip did considerable damage to both the catch and the fishing gear. Hence a lot of time had to be spent on shore re-rigging lines, replacing hooks, and making new sinkers. Also, much difficulty was found in selling a lot of the catch: the people of Majuro are not familiar with most of the deep-water snapper species, and almost all the Pristipomoides, normally considered high-grade fish, ultimately had to be given away.

Pale spent his last couple of weeks in Majuro writing up the report of his work and packing his fishing gear for his next assignment to Tuvalu.

Review of Fisheries Training Opportunities and Needs Underway

One of the priority tasks assigned to the SPC Regional Fisheries Training Project by delegates to the 17th SPC Regional Technical Meeting on Fisheries was a review of the fisheries-related training requirements of SPC member countries, and particularly of the opportunities currently available to them to meet these needs. This review is now underway. SPC Fisheries Training Officer Alastair Robertson has a busy travel schedule in the coming months, which will enable him to consult with many Pacific Island governments and regionally-based educational institutions and organisations involved in training activities. His assistant, Sylvia Rodgers, is compiling a directory of institutions involved in fisheries-related training, which includes details of the size, nature and location of the institution concerned, the courses offered or activities undertaken, and the entrance requirements and other criteria for admission of Pacific Island students. Initially this is being compiled from existing information currently on file with the South Pacific Commission. However, all entries will be updated by means of questionnaires or, where appropriate, visits to the institutions themselves.

The purpose of the review exercise is to ensure that training activities undertaken by the Regional Fisheries Training Project are fully complementary to those of already established training bodies. However the review, and particularly the directory, will also inform SPC member countries of training opportunities possibly unknown to them, and help countries take full advantage of them.

SPC Fishing Handbooks in Preparation

Graphic artist Steve Belew travelled to Noumea late in August to work with coastal fisheries staff on the finalisation of two SPC handbooks on fishing techniques. Preparation for these two publications began over two years ago (see SPC Fisheries Newsletter No. 26, p3) as an attempt to distil the collective practical experience of SPC's field fishing staff into two publications, one on trolling and the other on deep-bottom fishing. To this end, a working group of all SPC's coastal fisheries staff was organised, and this enabled many of the practical fishing techniques and considerations normally taken for granted by the master fishermen to be documented. However, the first drafts that emerged from this meeting were lengthy and detailed, and the task of putting them into easily comprehensible yet concise texts was a difficult one which was ultimately abandoned in favour of a graphic approach.

The format now decided on for the handbooks consist of a reasonably comprehensive text, but one which relies heavily on drawings and diagrams to emphasise important points. The handbooks are designed for use in both SPC- and nationally-organised training activities, and are directed towards the small-scale commercial or semi-commercial fisherman operating in Pacific Island countries. The text will be in simple English, and the drawings will be laid out in such a way as to allow the replacement of English-language labelling with local vernacular terms.

Both handbooks will be published in 1986.

SPC/Nelson Polytechnic Pacific Islands Fisheries Officer Training Course

The 1985 SPC/Nelson course ended in July with the completion of the five-week practical fishing module held in Fiji. The 1986 course was advertised in September by SPC Savingram 42/85, and nominations invited from SPC member governments.

This course was initiated in 1979 and to date has been run six times, during which period 69 students from 16 SPC member countries and territories have participated. During that period the course has continually evolved from a training programme based mainly on New Zealand fishing cadet courses run by the Nelson Polytechnic, to the present programme which is tailored very closely to the expressed needs of Pacific Island countries. The course is practical in nature, and oriented towards the fisheries officer posted in the field who needs to be able to keep machinery or boats running and undertake practical tasks related to fishery activities. The subjects covered include net-making, ropework, fishing theory, navigation and chartwork, refrigeration, fish quality control, metalwork, inboard and outboard engine maintenance, fibreglassing and welding, plus attachment periods spent in a fish processing factory and at New Zealand's Fisheries Research Division.

Significant among the changes made to the course in recent years is the introduction in 1984 of the practical fishing module, a five-week period spent in a Pacific Island country carrying out practical fishing activities under the supervision of one of the three SPC master fishermen. The module has effectively replaced the time that students on earlier courses spent at sea on New Zealand fishing vessels with training in practical fishing under conditions more akin to those prevailing in their own countries. This period also provides an opportunity for the students to put their classroom and workshop training into practice in the field, while still under supervision. The module was held in Fiji in 1984 and 1985, with the generous and capable support of the Fiji Government's Fisheries Division. Planning is currently underway for the 1986 module to be held in Tonga.

Other modifications will continue to be made to the course as the need arises. In 1985, the outboard motor maintenance section of the course was increased in length, and instruction in wooden boat construction and maintenance was introduced. A small portable bottom-fishing echo sounder was also purchased for the course and students were trained in its use by connecting it to the college's simulator. Discussions are now underway with the college as to the possibility of introducing the subject of fish aggregation device (FAD) construction into next year's syllabus.

Dynamics of Tuna Aggregations Under Anchored Rafts

Since 1981, a 481 GRT New Zealand based single purse seiner has been operating during the New Zealand off season (August-December) in the waters of Fiji, fishing almost exclusively around fish aggregation devices (FADs). There are catch data or acoustic estimates for rafts placed at 70 locations over the four years, and these offer much information on the abundance of tuna under FADs over time. These data were examined by SPC Tuna and Billfish Assessment Programme scientist Richard Farman in an attempt to describe the dynamics of tuna aggregations around the FADs and to identify some of their mechanisms.

Catches at the most fished rafts plotted against the number of days since the last set seemed to exhibit a cyclic variation. However, a model fitting a sine wave to the data failed to account for more of the variation than the normal deviation from the mean. The complete data set also exhibits much variation, due in part to differences between the rafts (location). Large concentrations (38 tonnes) were caught as early as eight days after the previous set making recruitment to the raft appear discrete rather than continuous, at least in the first instance.

The operation is believed to be dependent on a light source to 'hold' the fish at the raft over night and moving them away from the mooring before the pre-dawn set, and the influence of the full moon is thus taken to be disruptive. The same data were analysed for evidence of correlation between the phase of the moon and the catch of tuna at the rafts. There is a possible correlation for catch at the most productive rafts ($r = 0.6$) but when the data are expanded to include all rafts, there is none. Factors such as cloud cover could have influenced illumination, and the lack of correlation is not conclusive.

NEWS FROM IN AND AROUND THE REGION

Marine Training for Tonga and Western Samoa (Sources: Tonga Chronicle, Islands Business)

The Tonga Marine Polytechnic Institute at 'Anana, Ma'ufanga, will begin its training course this October with an enrolment of between 14 and 20 students. The \$650,000 complex was built with aid from the Ministry of Technical Co-operation of the Federal Republic of Germany, which also contributed a training boat and equipment worth \$450,000. The head of the school is Capt. Malakai Tapealava, recently transferred from the Fisheries Division.

Three German officials have arrived in Tonga along with five Tongan instructors who have been studying in Germany since last March. Capt. Klaus Thomas and his two German staff will remain in the Kingdom for five years as consultants to assist with the smooth operation of the institute. During that period, the Tongan Government will gradually assume responsibility, including financial, for the school.

The Tongan staff obtained theoretical training at the Schleswig-Holsteinische Seemannsschule in Lubeck-Travemunde. They completed practical training at the Hanseatic Marine Training School in Cyprus, where they temporarily replaced the regular instructors.

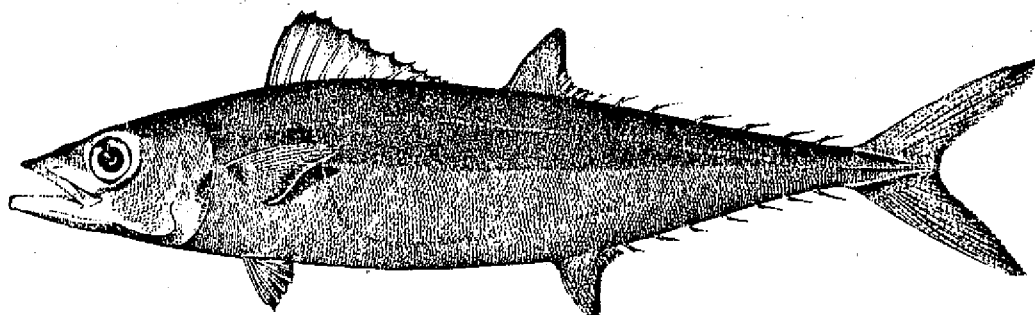
Students attending the Tonga Marine Polytechnic Institute will receive five months of training in deck, engineering, and catering subjects before undergoing an additional five months of training as sea cadets. Upon completion of the 10-month tenure the students could be employed as seamen, during which time they may enroll in refresher courses to complete certificates of competency. Capt. Thomas said that seamen with no formal training can also enroll at the institute to upgrade their skills and to ensure competency in all fields of seamanship.

Meanwhile, in Western Samoa, there has been a decision to reopen a marine training school that was closed two years ago. Fresh funds for the school, which will now also train airline staff, are being supplied by the governments of Western Samoa and New Zealand, the airport authority and shipping services.

Two Species of Double-Lined Mackerel Recognised (Source: Queensland Department of Primary Industries; SPC)

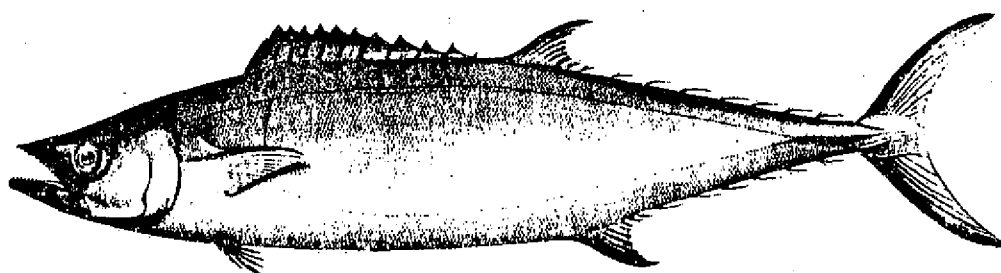
For years, fishermen in Northern Australia and several Pacific Island countries have recognised two species of double-lined mackerel. However, until very recently, only one species (Grammatocynus bicarinatus) was officially recognised. Now the fish experts agree with the fishermen. Studies on the protein composition, bony parts, gut morphology and body proportions of specimens from Australia and the Indo-Pacific zone have led to the recognition of two distinct species.

Scad, *Grammatocynus bilineatus*: This small species has many gill rakers (19-24 on the first gill arch), a large eye (7-9% of fork length) and seldom has dark spots on the lower sides of the body. The scad has an Indo-Pacific Ocean distribution and attains a maximum recorded size of about 3 kg.



Grammatocynus bilineatus

Shark mackerel, *Grammatocynus bicarinatus*: The larger of the two species, the shark mackerel has fewer gill rakers (12-15 on the first gill arch), a small eye (3-4% of fork length) and, frequently, dark spots on the lower sides of the body. A maximum size of 13.5 kg is recorded. Distribution is said to be restricted to the Gulf of Papua and northern Australia. However, there are unconfirmed reports that this species occurs as far east as Tokelau, so future examinations may lead to extensions to the recorded present range.



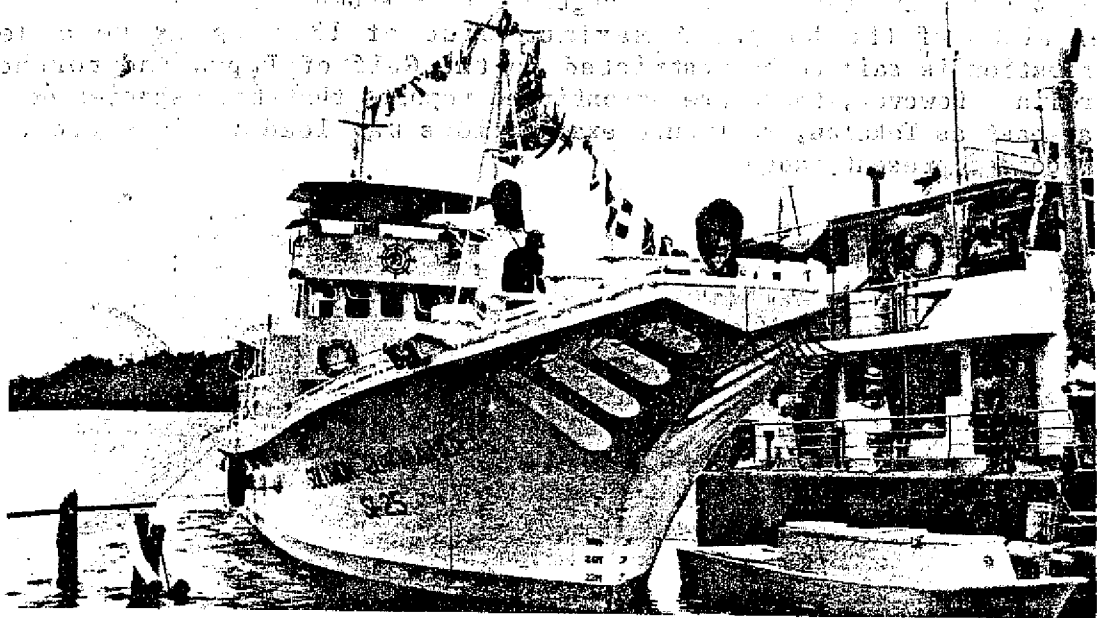
Grammatocynus bicarinatus

'Solomon Commander' Joins Fishing Fleet (Sourced Solomon Islands Government Monthly) The 'Solomon Commander' is a 100-ton ferro-cement pole-and-line vessel built by the National Fisheries Development (NFD) Company at Sasape boat building yard (now called Sasape Marina), was officially launched on August 2.

At the launching, the Minister of Natural Resources, Mr Daniel Sande, thanked the New Zealand Government for the consultants who contributed so much to this phase of the Solomon Islands Government's national tuna fishery development project, which is just about to end. He was also grateful to all the other aid donors involved.

Mr Sande said that the previous company NFD would now be split into two separate entities. Sasape Marina would concentrate on boat building commercially, while the other part of NFD would concentrate on fishing operations.

The last of the ferro-cement boats is to be launched sometime in October this year. It will be the 'Solomon Pathfinder'. Sasape Marina would then go into its second phase, building steel vessels.



(photo: Solomon Islands Government Monthly)

Solomon Commander at the Sasape Marina slipway.
The vessel will be manned by a local crew of 27.

Joint Surveys in Tuvalu, Kiribati and Fiji waters

(Sources: Fiji Times, The South Sea Digest, and Tuvalu Echos)

The Fijian naval vessel, 'Kula', transporting the Royal Australian Army Survey Corps, returned to Suva in September following the successful completion of Operation Anon 85. A joint Fiji/Australia Aid Project, the voyage was the second phase of a two-phase operation to establish the base lines for the 200-mile Exclusive Economic Zones (EEZ) of Tuvalu and Kiribati. A survey of the Line Islands in Kiribati has also been completed with the help of the New Zealand survey ship, HMNZS 'Monowai'. The whole survey was financed under the Defence Co-operation Programme at a reported cost of nearly \$A1.5 million.

Tuvalu's pole-and-line fishing vessel 'Te Tautai' is continuing survey work in Tuvalu waters under charter to the Japanese International Co-operation Agency. The overall aims of the survey are to assess fishery resources, and to give a clearer picture of commercial fishing potential in Tuvalu and Fiji waters. The present survey work will include the waters around four Tuvalu islands: Nukufetau, Vaitupu, Nukulaelae and Niulakita, as well as offshore areas. It will be carried out by Japanese, Tuvaluan and some Fijian crew, and will concentrate mainly on surface fishing (pole-and-line and trolling), for skipjack and yellowfin tuna.

In late October the 'Te Tautai' is to leave Tuvalu to return to Fiji to carry out a further fishing survey that will last until February 1986. This will include bottom longlining for deep-water snapper, as well as pelagic fishing.

Norfolk Islanders Want Local Fishing Protection

(Source: The South Sea Digest)

The Norfolk Island Legislative Assembly and local fishermen have expressed concern that the island's fishing industry is declining. The fishermen have suggested that the island could have a certain area (30 miles is suggested) declared as an exclusive fishing zone within the 200-mile fishing zone controlled by Australia to ensure adequate fish stocks for local consumption.

Compensation for Loss of Fishery Rights

(Source: The South Sea Digest)

Fijian holders of fishing rights at Sabeto near Nadi in Fiji's main island of Viti Levu have been awarded \$F145,000 in compensation for loss of customary fishing rights in an area between the mouths of the Sabeto and Natocola rivers. Developers of a \$10 million resort, Vulani Island Destination, plan to build four international-type hotels on 52.8 hectares of foreshore, 120 housing lots, a commercial lot, parkland and golf course. Stressing that the developments being made for tourism were of economic value to the country, the independent arbitrator, Mr Raman Nair, said they destroyed highly-productive mangrove. Several similar compensation awards have been made, but this is the largest.

Later, Mr Nair made an award of \$110,400 to holders of customary fishing rights at Wairabetia, near Lautoka where the government plans an industrial estate on 48.8 ha of foreshore land.

Fish to Be Protected from Divers

(Source: Islands Business)

Niue has decided to give its fish a partial break from being speargun targets. Its Parliament has been asked to approve legislation to make it illegal to fish with the help of underwater breathing apparatus. The penalty for stalking fish with an airtank strapped to your back could be a fine up to \$1,000 or up to six months in jail. The law won't apply to wearers of snorkel masks trying to plug fish from the surface or going after them with just a deep breath.

Scuba diving was introduced to Niue some years ago as a sport for people who just wanted to look at the marine world. When some scuba divers began to shoot fish and collect shells, concern was felt about the security of Niue's comparatively slender inshore fishing resources.

Artificial Reef for Increased Bottomfish Production

(Source: Honolulu Star-Bulletin; NMFS Report of Activities)

A 13-ton artificial reef from Japan has been dropped onto the sandy plains of Penguin Bank in the deep waters off the island of Molokai, Hawaii. It's hoped that the huge fibreglass reef will provide a home for commercially valuable fish. Car bodies and concrete pipes have been dumped in Island waters in the past to create artificial reefs, but there has been concern whether they were "biologically appropriate," said fishery biologist Jeff Polovina, Leader, Artificial Reef and Enhancement Program, at the Honolulu Laboratory of the Southwest Fisheries Center, which is part of the U.S. National Marines Fisheries Service.

The artificial reef was purchased from Japan for about US\$10,000. The fixings for the artificial reef -- 10 fibreglass reinforced plastic cylinders -- were brought to Hawaii from Japan on the Honolulu Laboratory's research vessel Townsend Cromwell, and were assembled at the University of Hawaii marine center at Sand Island. Two blocks of concrete were added to the structure to hold it down in the surge.

The finished product is 23 by 20 feet and 16 feet high. It has an enclosed volume of 3,800 cubic feet for fish to congregate and feed. It was placed at a depth of 130 m.

Eight other smaller artificial reef modules, made of concrete pipes of 0.3- and 0.6-m diameter assembled in bundles of three and six pipes, were also deployed. They were placed in two groups of four at depths of 50 and 100 m to provide habitat primarily for lobster.

Russia Commences Fishing in Kiribati Waters

(Sources: Islands Business; The South Sea Digest)

From August 18, up to 16 Russian tuna fishing vessels became legally entitled to fish within the 200-mile exclusive economic zone of Kiribati, following the signing in Manila of an agreement between the Kiribati Government and the Russian fishing company of Sovrybflot. Under the agreement, the company will pay a fee worth US\$1.5 million for 12 months fishing access. However, the Soviet vessels will not be allowed to enter the 12-mile territorial limit.

Many are watching to see the outcome of the Kiribati-Russian arrangement. Vanuatu says it will assess the results of the new agreement before deciding whether to enter into fishing rights negotiations with the Russians.

Within the United States, the Kiribati-Russian accord is being pointed out as a reason for the U.S. to hurriedly make amends with the South Pacific Island countries in respect to reaching regional fishing agreements with them.

BASIC Fishery Biology Programmes for IBM PC Users

(Source: Fishbyte)

Dr Saul Saila, Dr Conrad Recksiek and Dr Michael Prager are working on a book to be entitled "BASIC Fishery Biology Programs" which is to be published by Elsevier sometime next year. The book, aimed at IBM PC users, will have programmes for data editing; simple statistics; non-linear least square for growth, recruitment, allometry, and other models; linear, multiple, and polynomial regression; graphics; catch curve analysis and many other fishery models. The authors also plan to make available a floppy diskette containing the programmes.

New Packaging Book Out

(Source: NZ Fishing Industry Board Bulletin)

The aim of Ross Palmer's recently published book, Packaging your seafood products (NZFIB, 1984), is to assist the fishing industry to develop and improve its packaging principles, materials and applications of materials and package forms. It also discusses current methods and materials and new developments in packaging.

One of the highlights of the book is the chapter entitled 'Approaching a packaging problem'. It stresses a multidisciplinary approach to developing a package concept for any given product, and presents a long 'prompt list' of questions to be asked in the early stages of the development. Some of the questions given in the list are straightforward, while others are designed to prompt thinking on a particular aspect of the overall problem.

A copy of the book will be sent to relevant industry members free of charge. Additional copies are available at the price of \$25.

Fish Processing Operations in the Region
(Sources: Marshall Islands Journal, Fiji Times, Tonga Chronicle, Islands Business)

The Marshall Islands government has signed a letter of intent to establish a tuna canning operation in the Marshall Islands. The tuna canning plant when operating is expected to provide jobs for 100 Marshallese. The project is jointly financed by the Danish government and the Copenhagen Handels Bank, and will be owned and operated by the Marshall Islands government. The plant will consume 10 tons of raw fish in an eight-hour workshift. That amount is expected to produce 25,000 cans of tuna. (Presumably most of the tuna will be for export.)

Also in the Marshall Islands, the Nankatsu Corporation is in full swing making katsuo-bushi (a smoke-dried fish product used in Japan as a condiment) from local skipjack resources. In the process, 43 Marshallese workers cut fish in preparation for boiling and smoke drying the fish. Three Japanese experts have been brought in to train the local workers.

And, in Tonga, experimental processing of 'lapila' (tilapia) fish from Vailahi Lake, Niufo'ou, is to be conducted soon in Vava'u. His Majesty King Taufa'ahau Tupou IV made the announcement in opening the Niufo'ou Royal Agricultural Show in September.

The lapila are to be processed using a Japanese method called 'kamaboko', said the King. This process involves descaling the fish, removing skin and bones, and then grinding and steam-cooking the flesh, which is then dried. After processing, the preserved fish is wrapped and will keep without refrigeration in shops and homes for several months. Since lapila fish were introduced into the crater lake more than 20 years ago, they have become a source of protein for the 1,000 islanders.

Tonga also hopes to increase its tuna fleet to four ships, making enough profit for one ship to be replaced every two years. Tonga's present tuna 'fleet', consists of only one vessel, a 39-metre longliner, the 'Lofa'. Since she first went to work in 1982, she has caught \$T1.5 million-worth of fish for a profit of \$225,000, according to Tonga's agricultural information service. The ultimate government target is to supply fish for a small local cannery that would market substitutes for imported canned fish and also manufacture animal feed.

Meanwhile, in Fiji, a new mackerel canning factory at Wailada in Lami is awaiting approval of a loan before it starts production in early November, said a company official. The company is a F\$1.5 million joint venture between Vonu Industries, C.J. Patel (both of Fiji) and Dae Young Company of South Korea.

Virus Kills Mother-of-Pearl in French Polynesia
(Source: The South Sea Digest)

Up to a million mother-of-pearl-producing oysters have died of a mysterious virus on Takapoto Atoll, in French Polynesia's Tuamotu group. The loss is a heavy blow to local communities, who depend on the raising of shells for their income. At the territorial level, it also represents a serious problem since mother-of-pearl and cultured pearls are prime export items. Exports of culture pearls represented an income for the territory of CFP600 million (about \$A5.2 million) in the first quarter of 1985 alone.

The virus first appeared on some atolls in the Gambier group. The same ban on transfer of oysters from these atolls to other areas will now be applied to Takapoto.

Introductions: Sometimes More than You Bargained For
(Sources: Australian Fisheries; South Pacific Commission)

A recently published article reporting on the disastrous ecological and social consequences that have resulted from introducing Nile perch into Lake Victoria in east Africa has caused a flurry of reaction including the decision by the Queensland Government to reconsider its program to stock the state's lakes with the species.

The article, which appeared in the scientific journal 'Nature' (May 2, 1985), said that since the arrival of the Nile perch to the lake almost all the indigenous fishes of commercial importance have not merely declined, they have virtually disappeared.

In the article, the authors discuss the more general situation in Africa and the world and conclude that, except for fishless lakes and man-made reservoirs, introductions have normally failed to achieve their objectives, and sometimes the results have been disastrous. A major scientific objection is that the outcome is often unpredictable.

In response to the article and subsequent debates on the subject, the Queensland government has decided to reevaluate its Nile perch project. The State Minister for Primary Industries, Mr Neil Turner, said in a statement on August 2 that it would be irresponsible for the State Government to proceed with its program before the reports had been fully assessed and tested. It is being arranged for a freshwater fish biologist to visit Kenya to study the impact of the perch on indigenous fish and to obtain information on the effect of water temperature on the geographical distribution of the species, Mr Turner said.

The topic of species introduction is of significant importance to South Pacific Island countries, and was a subject of discussion at the latest Regional Technical Meeting on Fisheries held at the South Pacific Commission headquarters in Noumea this August. The discussion centered around the wide interest throughout the tropical Pacific to introduce giant clams for possible commercial purposes. During the discussion it was pointed out that the cultivation, introduction and transfer of clams carries with it a number of risks, including those of introducing undesirable diseases, parasites, predators, and inferior strains. It was also pointed out that with introduction "entirely unforeseen ecological consequences might result."

As an outcome of the talks, the delegates of the meeting readily recommended the adoption of the following interim guidelines concerning the introduction and transfer of clams, and noted that these precautions are relevant to most biological transfers in the marine environment.

- (i) No species of clam should be introduced to areas outside its known recent distributional range.
- (ii) Where transfers are to be effected within the natural range of a species, the spat should be reared in sea water filtered to 1 micron and be maintained in ultra-filtered, recirculating, ultra-violet irradiated sea water in the four weeks preceding the transfer.
- (iii) Giant clam seed or spat should be transferred at the earliest possible stage in their life history.
- (iv) The receiving institution should maintain the spat or seed in quarantine tanks or raceways, preferably filled with filtered sea water, for at least six months. The overflow water from the tanks or raceways must flow to waste into a septic tank or other in-ground sump and must not be drained back into the sea.
- (v) In the event that during the quarantine period any diseases, parasites or predators appear in the introduced stock, the stock should be destroyed by boiling, all equipment sterilised and a fresh start made.
- (vi) The country exporting the clam seed or spat should accept the responsibility of ensuring that the above-mentioned guidelines are adhered to and undertake to issue a certificate to that effect.

Free Access to Tropical Fisheries Information

(Source: ICLARM Newsletter)

ICLARM's Selective Information Service, a free question/answer service to researchers in tropical developing areas, is again inviting enquiries relating to finfish and mollusc aquaculture, integrated farming, small-scale fisheries and resource management. The Service, which was opened in April 1984, received 170 enquiries during its first year.

Information packages sent to enquirers typically include a reference list generated from library or online computer searching, photocopies of some important articles, and often relevant publications from ICLARM's technical series. Names and addresses of other people working in the same subject area as the enquirer are also provided when possible.

The service is free. There is no limit to the number of times you use it. When using the service, you are asked to keep enquiries as specific as possible. Send your enquiry to Selective Information Service, ICLARM, P.O. Box 1501, Makati, Metro Manila, Philippines.

The Diet in Ciguatera Fish Poisoning

(Source: J. K. Sims, M.D., Communicable Disease Report, Hawaii State Dept. of Health)

Human ciguatera fish poisoning usually results from the consumption of reef fish bearing a multiplicity of toxins, including ciguatoxin. Poisonings resembling ciguatera have also resulted from the ingestion of marine snails (e.g. the turban shell Turbo pica) and shellfish in areas endemic for ciguatera fish poisoning (particularly during ciguatera outbreaks). In acute ciguatera the clinical manifestations are varied and can include nausea, vomiting, generalized numbness including of the extremities and the throat, diarrhea, hives, weakness, 'carbonation' sensation upon drinking non-carbonated liquids, temperature sensation reversal phenomenon, pain in muscles and joints, slow pulse rate, low blood pressure, and many other signs and symptoms. Features suggesting low blood volume, low calcium volume in the blood, and allergic reactions may be present. A number of these acute manifestations can persist or recur in the condition known as chronic ciguatera fish poisoning.

The purpose of the diet in ciguatera fish poisoning is to promote recovery from the poisoning and to reduce recurrent poisoning during the acute, chronic, and/or post-recovery phases. After the poisoning episode, an as-tolerated progressive diet (i.e. clear liquids, full liquids, soft liquids) can be instituted with advancement to a high protein, high carbohydrate diet, as appropriate (the high protein diet should be monitored as to adequate water intake), with the following being strictly excluded from the diet:

- fish (all: fresh, marine, canned, dried, etc.)
- fish sauces
- shellfish
- shellfish sauces (e.g. oyster sauce, clam sauce)
- alcoholic beverages (beer, wine, etc.)
- nuts, nut oils (e.g. peanuts, sesame oil, etc)

Multivitamins, particularly Vitamin C and B-vitamins should be liberally provided with the diet. Some patients may have difficulty tolerating foods due to temperature (e.g. too hot, too cold).

Immune sensitization of ciguatera fish poisoning patient may account for the sensitivities to fish, shellfish, and their products. The adverse role of ethanol in ciguatera fish poisoning is not clear as to its mechanism, but has been noted in Hawaii as elsewhere, even for the alcoholic beverages of low ethanol content such as beer. Some patients develop aversion to the vapors of alcohols and other solvents, as well as to fish. The arachidonic acid content in nuts is possibly associated with adverse dietary responses in ciguatera fish poisoning by a prostaglandin metabolism mechanism.

FISHERIES SCIENCE AND TECHNOLOGY

Wide Range of Tags Made in Australia

(Source: Australian Fisheries)

Hallprint Pty Ltd of Adelaide produced their first polyethylene streamer tags in 1983 and since then many thousands have been effectively used in large-scale prawn tagging studies around Australia.

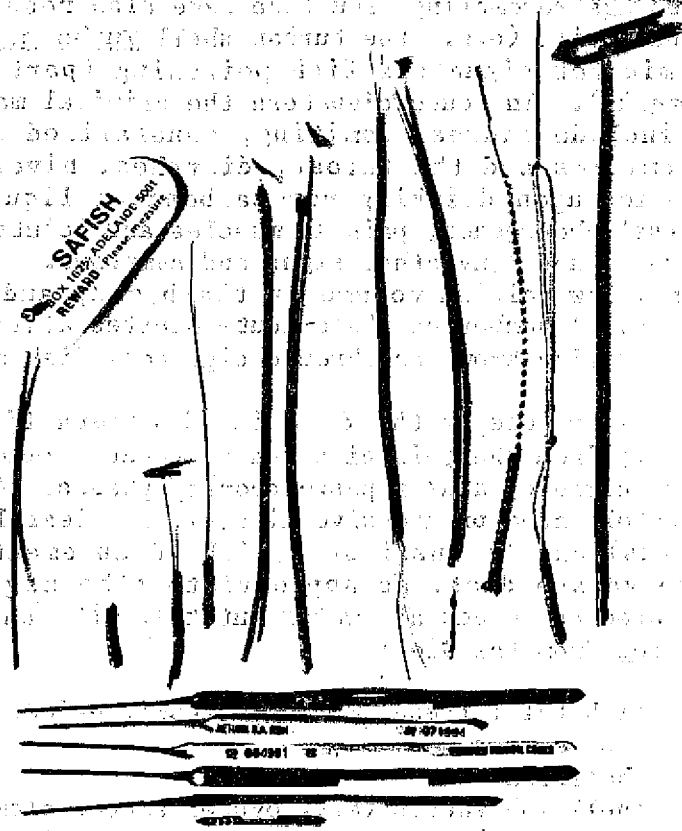
Many other types of tag are now being produced by the company, including plastic and metal dart, T-bar and loop tags in many variations. Special tags for particular needs have been developed in cooperation with biologists working in specialised fields.

One example of this is the simple wire and moulded marker tag devised specially for marking scallops in the current Port Philip Bay study to determine growth and mortality rates.

Further afield, Hallprint's new version of the self-locking loop tag has been successfully used in the New Zealand Hauraki Gulf snapper-tagging program. (Copies of a professional 20-minute video and other materials related to this program can be obtained from Hallprint).

As with all their tubular form tags, the Hallprint process eliminates the need for glue in assembly and varnish to cover essential printed information so as to partly extend its life. This is achieved by printing on an inner core of coloured polyethylene, to which is permanently fused an outer tough clear layer of the same material. This marker is also moulded around any other tag components such as stainless steel wire, metal and plastic dart heads, monofilaments and threads.

All tags are available in a widening range of colours and sizes. They can be printed with special legends and reliably numbered with combinations of up to seven alpha-numeric characters. Packaging for each tag is designed to save time and effort in use. Samples and other information are available from Hallprint Pty Ltd, 27 Jacobsen Crescent, Holden Hill, SA 5088, Australia.



Part of the Hallprint range of tags.

(photo: Australian Fisheries)

Mercury in Shark

(Source: Australian Fisheries)

Japanese researchers have described a complex chemical process which can be used to reduce the mercury level in shark flesh. Steps involved in the process include shredding and cooking the raw meat, treatment with a special acid solvent solution, with stirring and subsequent spin drying of the meat, and then washing to remove the solvent.

The final product is in the form of minced fish flesh which can be used in the preparation of formulated fish products such as fish cakes. The treated shark meat lacks gel-forming ability, so its use in production of Japanese-style fish paste is limited. Optimum treatments can remove most of the mercury, certainly below the Japanese limit of 0.4 mg/kg.

For more information, see 'Elimination of mercury from shark flesh', by E. Okazaki et al. Bulletin of the Tokai Regional Fisheries Research Lab, No 114, November 1984.

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 addresses given (not to SPC) for information on how to do so.

1. Subsistence Fishing Practices of Papua New Guinea, edited by Norman Quinn, Barbara Kojis and Paul Warpeha, 1984.

A 1980 conference on traditional conservation practices in Papua New Guinea drew attention to the fact that the senior officials responsible for resource management in the country, while often highly educated in a 'Western' sense, often had little opportunity to acquire the traditional knowledge and experience of natural resource use possessed by their elders. A recommendation arising from the conference was that all students at Papua New Guinea's higher education institutes be asked to submit reports on aspects of traditional resource use in their own villages. As well as serving to emphasise the importance of traditional knowledge to students, the reports would accumulate to provide a large and unique documentation of traditional knowledge.

Subsistence Fishing Practices of Papua New Guinea was produced in line with this recommendation, and consists of a collection of essays by fisheries students at Papua New Guinea's University of Technology. The essays are grouped according to the environment of the locality concerned (New Guinea coast, Papuan coast, Sepik low altitude fisheries, higher altitude fisheries) and relate to all manner of resources and harvesting techniques. Included are descriptions of traditional marine methods of capturing crabs, reef fish, eels, dugong, turtles and tuna, by techniques as diverse as traps, nets, spears and archery. The essays, which were prepared in consultation with elders from the students' villages, also contain important information on the social organisation of the different fishing activities described.

CONTACT ADDRESS: Appropriate Technology Development Institute, Liklik Buk Information Centre, Lae, Papua New Guinea.

2. Population Density Study on a Toxic Dinoflagellate Responsible for Ciguatera Fish Poisoning on South Tarawa Atoll, Republic of Kiribati, by Temakai Tebano, 1984.

This report not only describes recent research work on Gambierdiscus toxicus (the algae principally responsible for the production of the toxin implicated in ciguatera poisoning) population densities and distributions in South Tarawa, but also documents the growing extent of the ciguatera problem in recent decades. Ciguatoxic fish were common only in one area adjacent to Betio in early colonial times, but disturbances to the reef, principally by man, have created an environment more suitable for the algae to grow and this has resulted in the regular incidence of fish toxicity in other areas.

G. toxicus rapidly colonises denuded or broken coral surfaces, and man-made damage to coral is noted as one of the probable causative factors of the spread of ciguatera poisoning. A week of intensive bombing during the Second World War was a major such event, and in more recent times reef damage has continued with the blasting of boat passages, the excavation of channels for sewage pipelines across the reef flat and the dragging of boat anchors. Sewage disposal may also provide a nutrient supply which further encourages algal growth, including that of G. toxicus. The report notes the possibility that rubbish dumping may have some connection with the spread and increase of toxicity on South Tarawa, and concludes that any human impact or disturbance to the reef environment may have the same effect.

CONTACT ADDRESS: Atoll Research and Development Unit, Tanaea, Tarawa, Republic of Kiribati.

SPC Fisheries Newsletter No. 34
July - September 1985

THE DEVELOPMENT OF DEEP-BOTTOM FISHING
IN EAST SEPIK PROVINCE, PAPUA NEW GUINEA

by

Molean R. Chapau
Department of Primary Industry
Wewak, Papua New Guinea

Introduction

The East Sepik provincial government fish plant based in Wewak (Papua New Guinea) commenced purchasing fresh fish from fishermen in 1978. From 1978 to early 1983 a total of 66.6 tonnes of fresh fish were landed through the fish plant. The Murik Lakes fishermen landed about 50 percent of the fresh fish during that period. The remaining portion of landings came from Wewak islands, Wom and Turubu fishermen. Before the introduction of deep-bottom handlining in 1982, the main methods of fishing were gillnetting, shallow-water handlining and surface trolling.

Following demonstration and extension work by the Fisheries Division, the villagers of Turubu and Kep began fishing in 1982 using the deep-bottom handline, and by the end of 1983 five canoes from the Turubu, Kep, Seir and Sup villages were fishing for deep-water snapper and other species. These canoes landed 9 tonnes of deep-water fish between August and December in 1983. In 1984 the number of vessels entering the fishery increased to 20. Production of deep-bottom species sold through fish plants in 1984 increased to 14.5 tonnes.

Wooden handreels mounted in local outrigger canoes were used in depths of between 60 and 160 metres. Red snappers caught using this method were sold in the local market as prime fish. These are purchased from fishermen at K1.50/kg and sold at K2.40/kg retail price.

Fishing Gear and Vessels

Fishing is done from locally built outrigger canoes usually 20 to 26 feet long. The canoes are mounted with three wooden handreels, each with 300 metres of 70- to 90-kg (breaking strain) monofilament line. The end of the line is connected to a cable rigged with three hooks (one each of sizes 5, 6 and 7 tuna circle hooks) and a weight (1.5 to 2 kg) at the end. Each canoe fishes in depths between 200 to 250 m, anchoring using 6 to 8 mm diameter polypropylene/polyethylene rope and a light grapnel anchor.

Each canoe trolled for tuna around a fish aggregation device (FAD No. 2). When sufficient bait was collected, fishing would proceed around known fishing grounds in the late afternoon and the early morning hours.

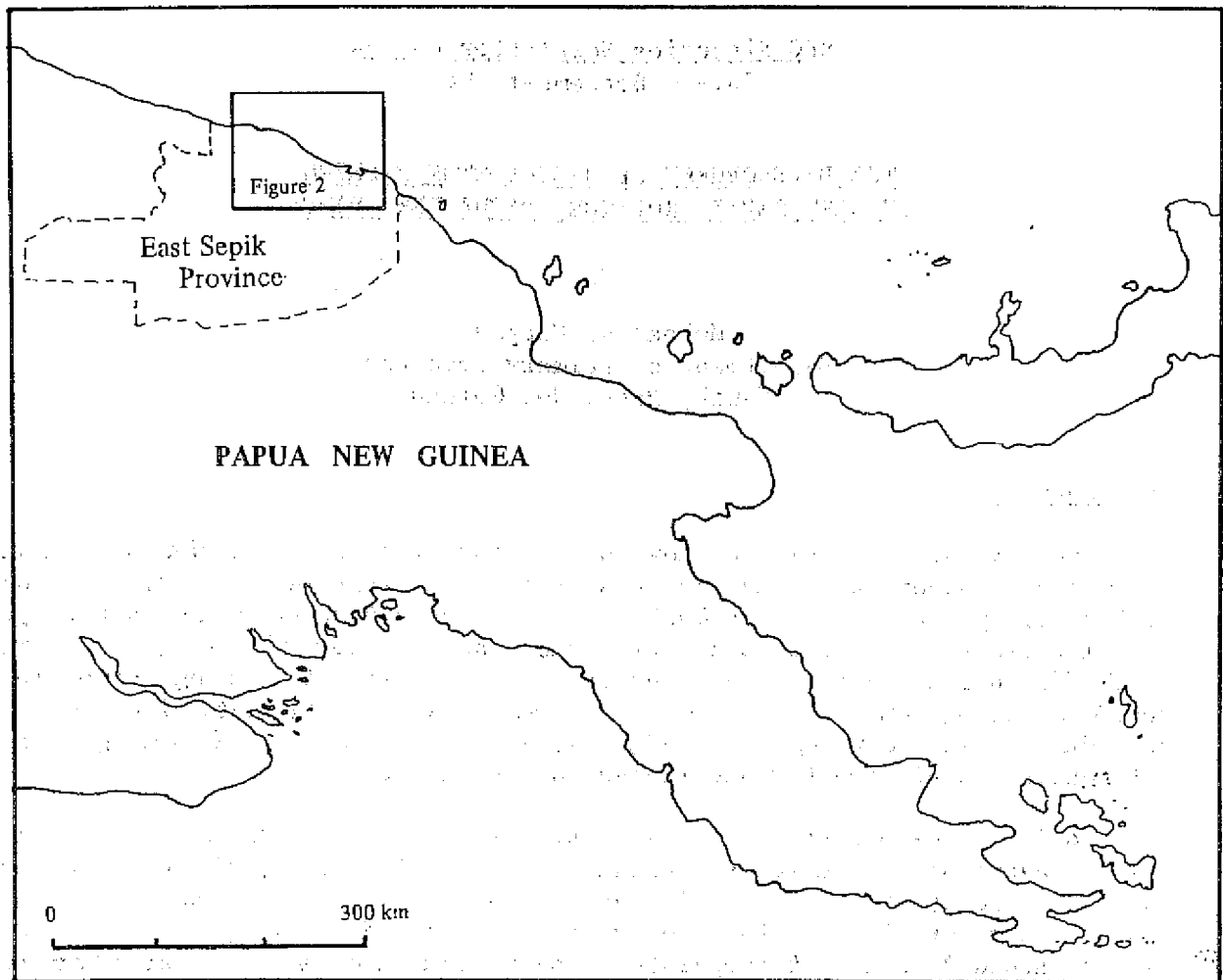


Figure 1. Map showing Papua New Guinea and East Sepik Province.

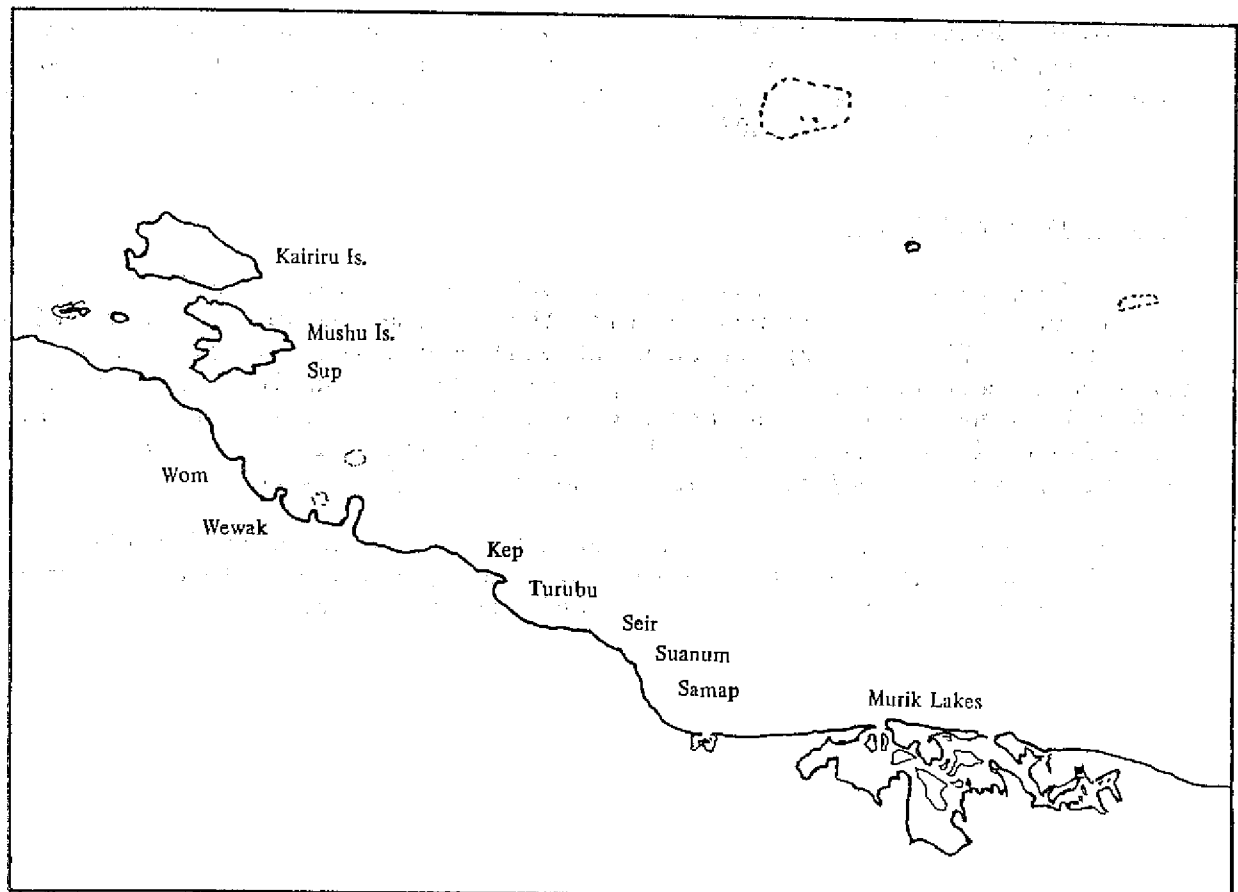


Figure 2. Map showing coastal villages involved in deep-bottom handline from 1983-85.

New Vessel Trials

A number of new fishing vessels are being tested in Wewak. These are a 20-foot Sandskipper catamaran, a 27-foot Alia catamaran and a 28-foot plywood outrigger canoe (FAO design). Fishermen are being encouraged to try out these vessels and evaluate them on their seaworthiness and cost/benefit in the local situation. Use of smaller outboard motors with traditional outrigger canoes is also being encouraged.

Despite the advantages of the new vessels, many fishermen still prefer their locally built outrigger canoes. One reason for the fishermen's reluctance to change is that during the north-west monsoons experienced along the coastline, village fishermen are subjected to unsheltered and fairly choppy conditions making it very difficult to moor their crafts. Whilst the new and improved vessels are cheaper to operate and could fish year round, these vessels are quite heavy and difficult to beach.

The Fishery

Preliminary data are available on the fishery over a three-year period. Buying price for the period averaged at K1.20/kg (US\$1.05/kg). Interest in deep-bottom fishing is increasing among fishermen.

Table 1: Number of fishermen and catches landed from August 1983 to June 1985.

Year	No. of Fishermen	No. of Vessels/ Month	Total Plant Purchases (tonnes)	Total Deep Sea Landing (tonnes)	Catch Rate (kg/hr)
1983	15	5	18.0	9.0	3.4
1984	80	20	16.1	15.0	3.8
1985*	64	16	-	3.8	3.8

* Note: data for first part of year only.

Handreel fishing has been demonstrated throughout the East Sepik Province and took off particularly in the Turubu area. However, this fishery ceased to operate in 1984 for financial and political reasons, and some development effort is required to reactivate it during 1985.

During the latter half of 1985 work will also involve conducting resource surveys south and west of Kairiru Island, coupled with demonstrations of fishing techniques to local fishermen to enable them to enter into the fishery.

At the beginning of 1985 the Fisheries Division applied for a grant of K350,000 from the Papua New Guinea government to develop this resource. The National Government under the Small-Holder Agricultural Development Programme (SADP) loan scheme has approved funding to carry out a feasibility study.

Species Composition

More than a hundred species have been identified from deep handline catches in 1985. Table 2 shows a breakdown of the major species caught. Pristipomoides and Lutjanus species make up 52.1 percent of the prime fish which are purchased at K1.50/kg. Caranx and Epinephelus species are also harvested and purchased at K1.20/kg. Both grades are retailed in the local market for K2.40/kg and K2.20/kg respectively.

Table 2: Species composition by number and weight for deep-water species landed during first half of 1985.

Generic Groups	No. of Species	Percentage by Number	Percentage by Weight
Pristipomoides	2	34.3	33.9
Caranx	6	17.5	21.4
Lutjanus	16	22.8	18.2
Epinephelus	12	3.1	4.9
Others	64	22.3	21.6

Catches

In 1984 much of the fishing effort was on a part-time basis. This was due in part to the unavailability of ice blocks and the annual north-west monsoon (October - April) when average fishing trips were usually short and fishing limited to only a few hours of each fishing day. The monthly catches in 1984 (Table 3) showed reasonably consistent catches despite a decrease in the proportion of deep-sea fish landings in the second half of the year.

Table 3: Fish catches in 1984

Month	Total Landing (kg)	Deep-sea Landing (kg)	Percent/month Total Landing	No. of Deep-sea Trips
January	2,714.8	2,351.3	86.6	31
February	1,492.2	1,212.5	81.3	22
March	2,635.6	2,008.6	76.2	40
April	3,140.6	2,969.9	94.6	38
May	3,118.9	2,774.6	89.0	38
June	1,595.8	295.5	18.5	16
July	1,800.4	228.5	12.7	8
August	1,916.8	363.5	19.0	8
September	1,395.6	418.8	30.0	11
October	1,929.6	931.7	48.3	18
November	3,312.0	879.3	26.5	17
December	1,023.6	148.6	14.5	5
TOTAL	26,075.6	14,975.7	49.8 (average)	252

Discussion

In most Pacific countries where deep-sea handline fishing has been introduced, keen fishermen have been successful with the technique. Deep-sea fishing has reached a fair degree of development in the Wewak area where fishermen prefer to use locally built outrigger canoes rigged with wooden handreels. New vessel and gear types are being encouraged into the fishery, and efforts are now being made to have the technique introduced into other areas of Papua New Guinea.

The development of the East Sepik fishery faces a number of problems, including the limited availability of suitable markets within East Sepik and Papua New Guinea for prime fish (red snappers), customary fishing rights, and the high cost of airfreighting fish to available markets. Future activities to encourage deep-bottom fishing include:

1. Development of simple small workshops to repair outboard motors and make spare parts available.
 2. Development of new markets within and outside East Sepik Province to cater for the increasing prime fish supply.
 3. Better liaison through the South Pacific Commission with other Pacific countries and territories involved in deep-sea handlining. Information is required from the SPC region to help us rationally develop our deep-sea fishery.
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SPC Fisheries Newsletter No. 34
July - September 1985

This article is based on the transcript of the 'Pacific Sealink' PEACESAT session on 'Ciguatera Poisoning'. The 'Pacific Sealink' series is jointly organised by the University of Guam, University of Hawaii, University of the South Pacific, and the Federated States of Micronesia Marine Resources Division.

AN UPDATE OF METHODS FOR CIGUATOXIN DETECTION

by

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Introduction

Ciguatera poisoning, endemic to the tropics and subtropical regions, and a health problem to the consumer, is associated with the consumption of a low dalton lipid polyether designated 'ciguatoxin'. The origin of this toxin has been shown to be a dinoflagellate named Gambierdiscus toxicus. Other structurally related polyether toxins such as okadaic acid and brevetoxin also have origins in dinoflagellates. Okadaic acid has been isolated from the dinoflagellate Prorocentrum lima as well as from the sponges in the genus Halichondria and brevetoxin from the dinoflagellate causing red tide, Ptychodiscus brevis (Gymnodinium breve). These polyether toxins appear to have an effect on membranes of nerve and muscle tissues and induce changes in ion permeability of the cells.

A major area of study initiated the past decade has been the development of sensitive and specific assay methods for the assessment of these toxins from contaminated fish tissues. Earlier assays included:

- (1) feeding of fish tissues to cats and mongoose; and
- (2) the injection of crude extracts into mice and chicks, and more recently into mosquitoes.

These tests lacked both sensitivity and specificity. More recent studies have taken the immunological approach using antibodies prepared in sheep and rabbit following immunization with conjugates of the polyether toxins.

This report presents the development and especially the assessment of a rapid, simple, specific and sensitive test procedure for the detection of ciguatoxin and related polyether toxins in contaminated fish tissues. The fishes examined included:

- (1) clinically implicated fishes from ciguatera poisoning;
- (2) other fish from the same catches as the implicated fishes;
- (3) fishes from the nearshore waters of Hawaii where toxicity occasionally occurs;
- (4) non-toxic portions of consumed fishes.

Stick Test Procedure

Small bamboo sticks (skewers or similar) were individually dipped in typists correction fluid and allowed to dry. This gave each stick a clean, white and very absorbent surface coating.

The reagents for the test were arranged in sequence in 50 ml beakers containing 30 ml of the solution as follows:

- (a) fixative;
- (b) Tris buffer B;
- (c) sheep-anti-CTX-HRP;
- (d) Tris buffer B;
- (e) Tris buffer B; and
- (f) 0.3 ml substrate for each stick
in a 10 mm x 75 mm test tube in a rack.

Fish samples were then poked with the skewer end of the stick at the dorsal-anterior and ventral-posterior sections of a side or both sides of the fish. Each stick was inserted five times into the flesh for 1 second per insertion. A single fish was examined with six sticks; three in the dorsal-anterior and three in the ventral-posterior portions of the side. The stick was air dried and then immersed into a fixative for 1 second without shaking. The excess solution was blotted onto tissue paper. The stick was next washed in Tris buffer B thoroughly with gentle shaking for 10 seconds and the excess solution blotted onto tissue paper. The stick was then immersed into sheep-anti-CTX-HRP solution (previously diluted 1:200 with Tris buffer A just prior to use) for 15 to 30 seconds without agitation. The excess antibody conjugate was blotted and washed in two consecutive solutions of Tris buffer B for 10 seconds each with gentle shaking. After the excess buffer was blotted the stick was immersed into 0.3 ml substrate with shaking and read after 10 minutes at room temperature. The intensity of the colour was compared with a colour scheme as follows:

0	Essentially no colour
1.0 ⁺	Slightly bluish-purple
1.5 to 2.0 ⁺	Lightly bluish-purple
2.0 to 2.5 ⁺	Moderately bluish-purple
3.0 to 5.0 ⁺	Moderately to intensely bluish-purple

Since results were obtained by averaging several sticks per sample the fractional values became evident.

Results

1. Stick test analysis of positive fishes from clinically documented ciguatera poisoning and negative consumed fish: The assessment of the validity of the stick test in the detection of toxic fishes can be summarized as follows. Sixteen clinically implicated raw and cooked (tissues, soup and gravy) fish samples examined by the stick test gave mean (\bar{x}) and standard deviation (s.d.) values of 3.3 ± 0.7 , while 60 non-toxic consumed fishes gave an $\bar{x} \pm$ s.d. of 1.2 ± 0.5 stick test value. The difference between these two categories was highly significant with $P < 0.005$. Examination of two samples of ahi, Thunnus albacares (yellowfin tuna), gave a stick test value of 1.1 ± 0.8 . This value was significantly different from the positive values with $P < 0.01$. Ahi, a pelagic fish, has not been implicated in ciguatera poisoning. On the basis of this study, the interpretation of the stick test values have been derived and designated as follows:

0.0 to 2.0+	Negative
2.1 to 2.4+	Borderline
Greater than 2.5+	Positive

2. Stick test analysis of corresponding catches of fishes and study of the nearshore reef fishes of Hawaii: The examination by the stick test results of several species of fishes obtained by corresponding catches with fishes implicated in ciguatera poisoning can be summarized as follows: of 120 fishes from five species examined [yellow-eyed surgeon fish (Ctenochaetus strigosus), argus grouper (Cephalopholis argus), squirrel fish (Myrispristis sp.), wrasse (Cheilinus rhodochrous), and wahanui (common names unknown -- Ed.)], 69.2% were considered toxic by the stick test (including those fishes in the borderline category). This high percentage is due to the yellow-eyed surgeon fish, which caused a large outbreak of ciguatera poisoning on Kauai in August of 1984. The gut content of all 93 samples contained 0.1 to 1.5 Gambierdiscus toxicus per microscopic viewing field at 400 X magnification.

3. Summary of stick test evaluation of nearshore reef fishes from Oahu, Hawaii and Kauai: The results of these studies are as follows: on the island of Oahu, all four species examined [yellow-eyed surgeon fish (Ctenochaetus strigosus), blue-lined snapper (Lutjanus kasmira), squirrel fish (Myrispristis sp.), and surgeon fish (Acanthurus sp.)] came from the leeward side of the nearshore waters. Fishes caught in these areas generally have the highest frequency of ciguatera poisoning, in contrast to the windward side, where essentially no ciguatera poisoning has occurred. The yellow-eyed surgeon fish, which is a herbivore, gave a higher percentage of toxic samples (43.5%) than both the carnivorous blue-lined snapper (36.5%) and the two other species examined. The positive category includes the borderline samples.

The results of the samples of three species from Hawaii (Big Island) is summarized as follows: a high percentage of positives is found in yellow-eyed surgeon fish (45.0%) as compared to rudder fish (Kyphosus cinerascens -- 0.0%) and wrasse (Cheilinus rhodochrous -- 20.8%).

The comparison of yellow-eyed surgeon fish from the three different islands by the stick test procedure shows that the highest percentage of toxicity came from samples obtained from Kauai (80.6%). Samples from Oahu and Hawaii were nearly identical, 43.5% and 45.0% respectively. This is understandable since the samples from Kauai were part of the corresponding catches of a ciguatera outbreak due to the surgeon fish. The Hawaii samples of this fish were caught in the leeward side in April of 1984 just prior to small outbreaks of ciguatera poisoning that continued throughout 1984. The fishes implicated were yellow-eyed surgeon fish, argus grouper and wrasse. The Oahu samples of the surgeon fish were obtained during the fall period of 1984 from the Barber's Point study. No incidence of ciguatera poisoning has been reported during this period (an outbreak has occurred in January of 1985 in this area). In part, this may be attributable to the fact that fishermen have not fished in this area due to the turbid water caused by the deep harbor dredging and construction at Barber's Point.

Final Comments

The results of this study suggest the feasibility of the adaptation of the enzyme immunoassay to a simple and rapid stick test procedure. This procedure retained its sensitivity and specificity using the conventional heterologous sheep-anti-CTX or the recently prepared monoclonal antibodies to toxic polyethers. The success of the procedure is probably manifested in the selective adsorption or attraction of the lipid toxins in fish tissues by a constituent(s) in the typists correction fluid coated onto the bamboo stick. The latter alone without coating had no activity in the assay. The coated sticks alone have shown essentially little activity with values equal to or below the normal value (less than 2.0+). This may be attributable in part to the non-specific binding of the antibody enzyme conjugate.

The radio immunoassay, enzyme immunoassay and the stick test all utilize the immunological approach for the detection of ciguatoxin and related polyether toxins directly from fish tissues. The major differences between these tests are the simplicity and rapidity of the stick test and the fact that it requires no equipment. The stick test can be applicable at home or in the field. Such a system may also be used for other enzyme immunoassay, but perhaps utilizing other coats to selectively adsorb the antigenic or haptenic component onto the stick. The stick test does not require the extraction of tissues as are required for the mouse bioassay and the recently described mosquito assay, although it is capable of examining such extracts. In addition, the test can be rapidly performed, while retaining its sensitivity and specificity, for mass screening of fish on a large commercial level with minimal costs.

In summation, the stick test procedure is simple, rapid, inexpensive and with sufficient specificity and sensitivity to evaluate the levels of ciguatoxin and related polyether toxins in fishes suspected of potential ciguatera poisoning.

Pacific Ocean 200-mile zone potentials as estimated by the Geography Department, University of Hanover, West Germany, under the supervision of Hans Buchholz. This map does not necessarily depict declared or agreed areas of national jurisdiction.

