To eat fish safely in a specific location, people must refer to local knowledge on species and / or trust the supply from fishermen or from restaurant owners. Many people have adopted the habit of always choosing the same fish, not changing even when there is no intoxication. New Caledonia has no laws or regulations concerning ciguatera poisoning.

Ciguatera is a fisheries and a health problem in New Caledonia. As it has been known to exist since before the 1600s, people 'live with' this intoxication as a common problem associated with fish consumption. The number of severe cases is not sufficiently high to provoke a political response and the precise impact of these intoxications on social life still remains unknown.

Fish incriminated

The incriminated fish species in 90 per cent of cases are carnivorous species:

Serranidae	43% (groupers, coral trout)
Lethrinidae	13% (emperors)
Scombridae	13% (Spanish mackerel)
Lutjanidae	11% (red snapper, hussard)
Carangidae	3% (trevallies)
Haemulidae	3% (sweetlips)
Scaridae	6% (parrotfish).

Traditional medicines and tests

The use of traditional cures is appreciable. It reaches 56 per cent among Melanesians, 44 per cent for Polynesians and 36, 29 and 29 per cent for Asians, Wallisians and Europeans respectively.

The medicine preferred for 40 per cent by people is *Argusia argentea* .

In an attempt to avoid ciguatera, some local people use tests including (i) the repellent effect of toxic fishes on ants, (ii) the toxicity test on cats, (iii) black colouring of a silver stick, and (iv) an electrical sensation on tasting the liver. Only the cat test and probably the liver-tasting test are likely to provide a margin of safety.

Reference

Laurent D., P. Joannot, P. Amade, P. Maesse & B. Colmet-Daage. 1992. Knowledge on ciguatera in Noumea (New Caledonia). In: Fourth International Conference on Ciguatera Fish Poisoning, Tahiti, May 1992.

Overview of the International Workshop on Ciguatera Management

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An International Workshop on Ciguatera Management was held at QDPI's Joondoburri Conference Centre on Bribie Island in April 1993. This meeting provided the first opportunity to discuss issues related to ciguatera at an international forum in Australia.

The Workshop covered a broad range of topics through presentations from invited speakers and included two workshop sessions that addressed the clinical management of ciguatera and the detection of ciguateric fish, as well as a poster session.

The proceedings of the workshop will be published as a special issue of *Memoirs of the Queensland Museum.* We anticipate approximately 30 papers will be published in early 1994 following peer review. The workshop reinforced the need for further research on (i) the detection of ciguateric fish and (ii) the environmental factors contributing to outbreaks of ciguatera. At this meeting it was determined that the next ciguatera meeting would be in mid-1994 in Hawaii.

Fifty-six registrants from Japan, mainland USA, Hawaii, France, French Polynesia, New Caledonia, Germany and each of the eastern seaboard states of Australia attended. The invited speakers included 16 international leaders in the field. The Organising Committee for the workshop comprised: Richard J. Lewis (Chairman), Michael J. Holmes, Michelle Sellin, Barry Pollock, Mike Dredge and Noel Gillespie.

The Scientific Committee comprised: Richard J. Lewis (Australia, Chairman), Michael J. Holmes (Australia), John H. Pearn (Australia), Milani Y. Chaloupka (Australia), Anne-Marie Legrand (French Polynesia) and Takeshi Yasumoto (Japan). Four main areas of ciguatera management were covered by the workshop.

Detection of ciguateric fish

At the meeting a cost-effective screen for ciguateric fish was widely recognised as perhaps the single most effective management tool able to directly reduce the adverse effects of ciguatera on public health, fisheries, trade and tourism (R. Lewis). Several different approaches to the detection of toxic fish were presented.

Two approaches measured the interaction between ciguatoxin and the sodium channel through (i) the inhibition of brevetoxin binding to sodium channels in a rat brain synaptosome preparation (A-M. Legrand), and (ii) the cytotoxic effects of ciguatoxin on sodium channel-containing cell lines preexposed to ouabain and veratridine (R. Manger). Both assays were more sensitive than the mouse bioassay and may replace *in vivo* assays in laboratories possessing the specialised equipment required. These approaches require further development before they can be used as cost-effective screens.

Antibody-based screens or related assays still hold most promise for the cost-effective detection of ciguateric fish. This approach is the basis of a potential commercial test to detect ciguateric fish being developed by Hawaii-Chemtect. D. Park presented a summary of the performance of the solid-phase immunobead assay (Ciguatect™) which was claimed to be able to detect ciguateric fish.

D. Park reported that the test may be unsuitable for detecting toxins in slightly acidic fish flesh (pH ≈ 6.5), a factor that could considerably limit the usefulness of the test. Y. Hokama commented that the test may not work because the solid-phase used in the Ciguatect™ test may not be as efficient at extracting ciguatoxins from fish as the 'correction fluid' used for the solid-phase in the format of the stick test (the same antibody was apparently used for both tests).

This explanation does not account for the high number of positive results obtained by the Ciguatect™ test. Predictive indices from 5% to 75% (compared with carefully conducted mouse bioassay results) were obtained when this test was used in an independent study of ciguateric fish from the Caribbean by R. Dickey (Food and Drug Administration, USA). Lack of available pure ciguatoxin and inability to independently validate the levels of ciguatoxins present in test fish samples hamper attempts to validate any potential screen, including the Ciguatect™ test.

Pharmacology and treatment of ciguatera

Major advances are being made in knowledge of how ciguatoxins cause poisoning (P. Hamblin, J. Brock, J. Molgo, M. Capra, F. Vogalis, C. Purcell, E. Benoit, K. Terao), but the precise mechanism of action of mannitol to relieve the symptoms of ciguatera is still a matter of debate.

A double-blind clinical study of the mannitol treatment is being conducted, but the results of this study are being acquired slowly and were not available at the time of the meeting (N. Palafox). Clinical experiences with mannitol therapy continue to be positive and mannitol should remain the treatment of choice for ciguatera in Australia, especially for the acute phase of the disease (N. Palafox, D. G. Blythe) especially as mannitol has proven a safe therapy. Full acceptance by medical practitioners of the therapy will come about slowly until the treatment is confirmed by clinical studies, preferably with the support of an animal model for ciguatera that responds to mannitol.

Clinical aspects and epidemiology of ciguatera

While most of the clinical features of ciguatera are well documented, the long-term effects of ciguatera and how frequently these occur are poorly understood. Follow-up research on victims is required to establish the true extent of long-term effects, especially the allergy-like reactions that can last after a single exposure to toxic fish (T. Ruff). The significant problems of misdiagnosis and non-reporting were discussed by J. Pearn.

Analysis of the ciguatera database maintained by QDPI using the most recently developed statistical modelling approaches revealed major shifts over time in the nature of the poisoning in Queensland and in the species of fish involved (M. Chaloupka). The high incidence of ciguatera in the Pacific Islands region and a detailed report of how these countries address the problem was discussed by P. Dalzell.

The legal situation with regard to ciguatera in Queensland was also discussed (J. Payne). Duty-of-care issues and the Queensland Workplace Health and Safety Act could be pursued for a successful court action against suppliers of toxic fish. The 'ban on red bass and chinaman fish, but not on other species known to be

intermittently toxic in Queensland (especially coral trout and Spanish mackerel), may weaken industry's argument that it is satisfying duty-of-care issues with regard to ciguatera.

Origin of the toxins involved in ciguatera

Gambierdiscus toxicus is now widely accepted as the organism that produces the toxins (ciguatoxins and gambiertoxins) involved in ciguatera (T. Yasumoto, M. Holmes). Indeed this organism may be the only source of toxins involved in ciguatera. Structure for GTX-4A (52 epi-GTX-4B), the major gambiertoxin produced by a Rangiroa Atoll strain of *G. toxicus* grown in culture, was presented at the meeting (T. Yasumoto). This toxin is likely to be the precursor of ciguatoxin-2 (CTX-2).

From this work we now have a much clearer understanding of how the ciguatera toxins arise. GTX-4A and further oxidised forms could undergo acid-catalysed spiroisomerisation to the other ciguatoxins found in fish (ie GTX-4B, CTX-I and -3). The structure of maitotoxin was also presented at this meeting by T. Yasumoto. Maitotoxin consists of numerous transfused polyether rings, as do the ciguatoxins, but otherwise is not closely related to the ciguatoxins.

At the present time little is known of the environmental factors that cause the upsurges of ciguatera (M. Holmes, J-P. Vernoux, U. Kaly, S. Hahn, J. Babinchak, R. Bagnis, G. Hallegraeff, Y. Hokama, P. Scheuer). Further research in this area is expected to result in significant advances, perhaps leading to an understanding of how human activities influence the distribution of ciguateric fish.

Also discussed at the meeting was the potential for a range of other toxic algae to be introduced into Australia with resultant outbreaks of diarrhoeic, paralytic, neurotoxic and amnesic shellfish poisoning (G. Hallegraeff). Such outbreaks may arise through ballast water introduction and/or environmental degradation. These biotoxins have the potential to severely damage a number of fisheries in the Pacific as well as Australia.

Fish poisoning cases (1991–1992)

Source: South Pacific Epidemiological and Health Information Services (SPEHIS) SPC, Noumea

The South Pacific Epidemiological and Health Information Service records between 3,500 and 5,000 cases of fish poisoning each year (see tables on the following pages). Not all of these are due to ciguatera intoxication.

The effect that fish poisoning has on island societies is largely unknown due to the poor reporting of case histories. To improve the current under reporting, it is necessary to encourage both health and fisheries workers in the region to record cases histories on a standard ciguatera reporting form (attached with this bulletin), and to send them to SPC where they can be entered in a database.

This form can be used as a template for making multiple copies, or, where copying facilities are unavailable, the Resource Assessment Section (contact Paul Dalzell) will be happy to supply copies.

We also would be glad to hear from persons who have criticisms or suggestions for improving the form.

Finally, we would encourage fisheries workers in the region to work in co-operation with their colleagues in their health departments to record all incidents of ciguatera that they hear about. Only with your help can we gauge the true extent of this problem and plan to coordinate future work accordingly.