Excretion of ciguatoxin from fishes

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Humans who eat fish in tropical and sub-tropical areas are at risk from ciguatera. This risk stems from the ability of otherwise edible fish in tropical and sub-tropical areas to accumulate ciguatoxin through the marine food chain. Species of herbivorous, detritivorous, omnivorous and carnivorous fishes have been implicated with ciguatera.

A long-standing dogma is that, once a fish becomes contaminated with ciguatoxin, it retains this quantity of toxin over its life time. However, in a recent report from our group (Lewis et al., 1991), we indicate that a population of moray eels became progressively less toxic over time. This article summarises some of the findings of this study.

The moray eels (*Lycodontis javanicus*) were collected from Tarawa, Republic of Kiribati, in an area where ciguatera has been endemic for several decades. Moray eels were captured in fish-baited cage traps set at various locations on the ocean reefs adjacent to Teaoraereke with the assistance of T. Tebano. The viscera (including liver) of each eel were removed and stored frozen prior to air dispatch to Brisbane, Australia. Viscera were pooled to a convenient sample weight for extraction (0.3 to 1.0 kg). The lipid-soluble fractions were then bioassayed in mice to quantify the toxin content of each sample of eels. During this study, eels captured from the ocean reef adjacent to the villages of Bikenibeu, Bairiki and Betio (Figure 1) were also found to be similarly toxic to the eels from Teaoraereke. However, a pooled sample of viscera from five eels from the ocean reef adjacent to Tanaea did not contain detectable ciguatoxin.

A total of 217 eels was obtained from nine collections over a 500-day period, commencing September 1987. These eels yielded a total of 35.9 kg of viscera from which were extracted 99,200 mouse units (m.u.) of ciguatoxin. The average toxicity was 2.43 ± 1.69 m.u. per g viscera and ranged from 0.59 to 7.3 m.u. per g. Interestingly, no significant regression was found between toxicity and average viscera weight, indicating that these eels did not become more toxic the larger they grew. However, the toxicity of viscera was found to decline significantly over the 500-day period of the collections (Figure 2). An exponential relationship fitted this decrease in toxicity.

The slope of the regression estimated that the half-life for the loss of ciguatoxin from the population of eels was 264 days. All eels contained detectable ciguatoxin and no seasonal fluctuations in toxicity were evident.

We proposed that this loss of ciguatoxin from eels stems from the excretion and/or decay of ciguatoxin. Excretion (depuration) comprises the loss from eels of ciguatoxin *per se*. Decay comprises the metabolism of ciguatoxin to less toxic moieties within eels.

Case history data on fish poisoning (including ciguatera) in the Republic of Kiribati collected by the South Pacific Epidemiological and Health Information Service from 1982 to 1989 (Figure 3) indicate an upsurge in poisoning in 1986/87. The upsurge was followed by a decrease in the incidence of poisoning in 1988 and 1989. This decrease coincides with the period when eels were declining in toxicity. We suggest that moray eels could be a good indicator species for assessing ciguatera levels in an area. The upsurge in fish poisoning coincides with reef disturbance associated with the Dai Nippon causeway project several kilometres to the west of Teaoraereke (Tebano and Lewis, 1990).

References

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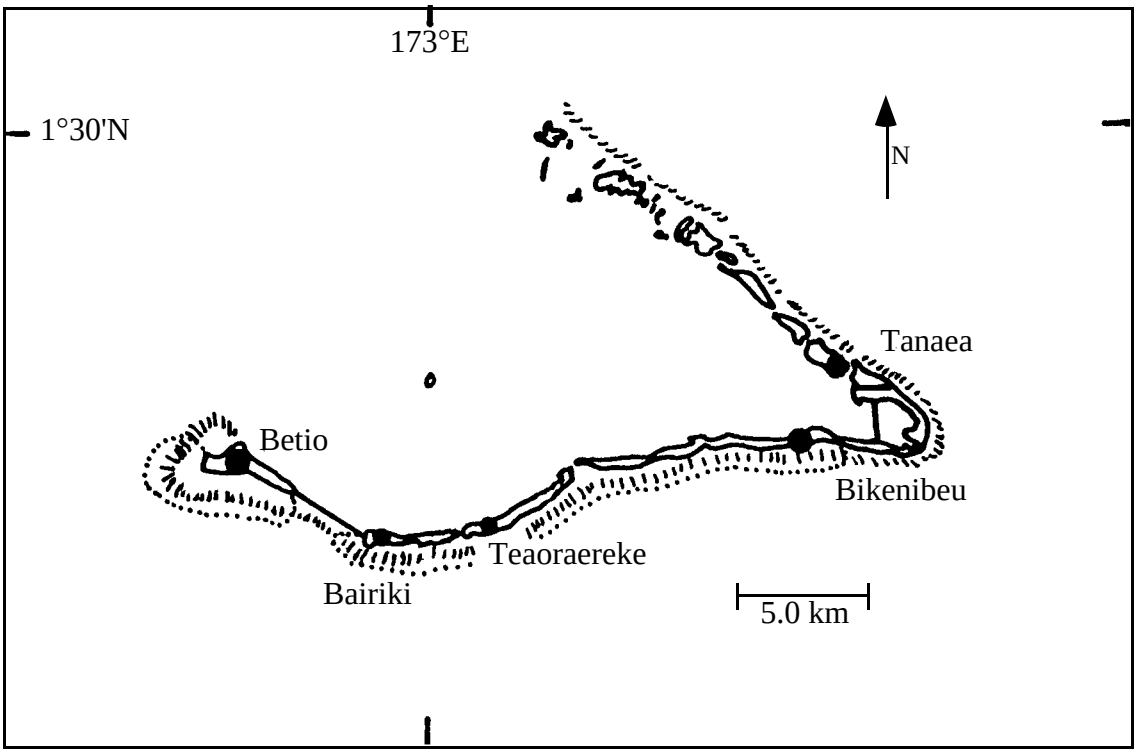

Figure 1. Map of the southern half of Tarawa, Republic of Kiribati. The dashing indicates the outer barrier reef. The areas reported toxic in 1983 are indicated by the dotted line. Eels were collected on outer reefs adjacent to Teaoraereke from September 1987 to January 1989.

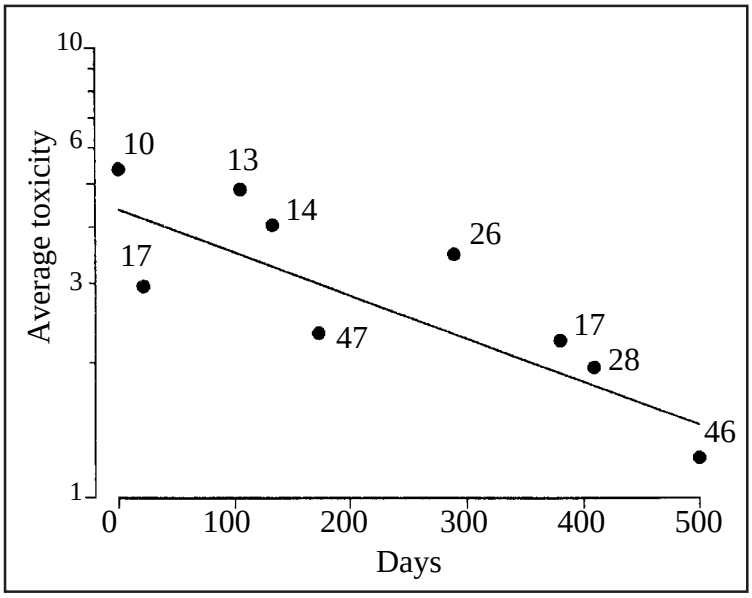

Figure 2. Toxicity (mouse units per g viscera) of eel viscera over a 500-day period. Note log scale for y axis. Numbers adjacent to each data point indicate the number of fish pooled for that collection. Toxicity declined significantly over the 500-day period.

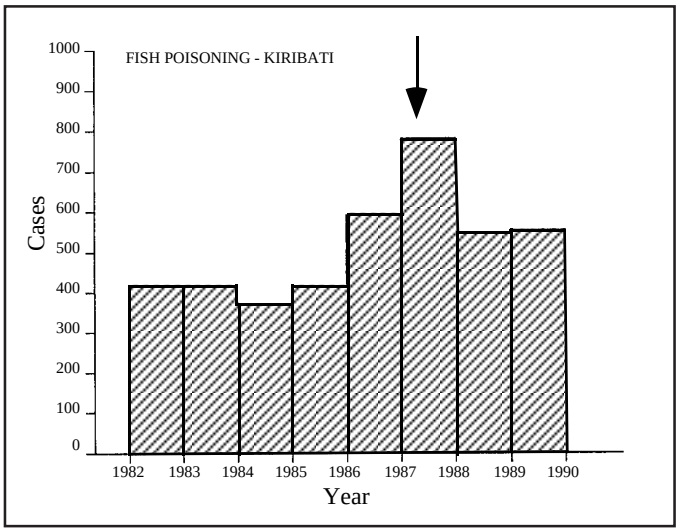

Figure 3. Annual incidence of fish poisoning in the Republic of Kiribati, 1982 to 1989. Data provided by the South Pacific Commission Epidemiological and Health Information Services and includes mostly cases of ciguatera fish poisoning. The arrow indicates the start of moray eel collections.

Improvement of ciguatera case history reporting

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Outbreaks of ciguatera can have a deleterious effect on fisheries development, since fishing grounds may be closed and certain fish species prohibited for sale. This is particularly critical in the small islands and atolls of the South Pacific where economic opportunities are limited and fresh fish comprises a substantial portion of the national diet.

The South Pacific Epidemiological and Health Information Service (SPEHIS), based at the SPC, records between 3,400 and 4,700 cases of fish poisoning each year (see tables on p. 10), although not all of these are due to ciguatera intoxication. However, at present the number of ciguatera cases reported throughout the region is thought to comprise only between 10 and 20 per cent of actual poisoning incidence. That there is a need for some form of initiative on ciguatera in the South Pacific is evident. However, the effect that this fish poisoning has on island societies is largely unknown due to the poor reporting of case histories. A first step to improve the current under-reporting is to encourage both health and fisheries workers in the region to record case histories on a standard ciguatera reporting form, and to send them to SPC where they can be collated in a database. The SPC Health Programme has circulated the form attached to this bulletin to regional health workers via the SPEHIS monthly news sheet.

The form is reproduced here for fisheries workers in the region to record cases of ciguatera poisoning that they encounter. The copy (in English and in French) attached with this bulletin can be used as a template for making multiple copies, or, where copying facilities are unavailable, the SPC Inshore Fisheries Research Project will be happy to supply copies. As this form is still undergoing trials in the field, we 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 and co-ordinate future work accordingly.