A PRELIMINARY SURVEY ON CIGUATERA FISH POISONING ON NAURU ISLAND, CENTRAL PACIFIC

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INTRODUCTION

Ciguatera fish poisoning is the name given to the disease caused by the ingestion of a wide variety of circumtropically distributed reef fishes (Tebano and McCarthy, 1991). This form of fish poisoning is endemic in the South, Central and Western Pacific.

Symptoms which normally appear within 2 to 32 hours of consumption include a range of gastrointestinal, cardiovascular, neurological and dermal disorders (Bagnis, 1973; Withers, 1982, Yasumoto *et al*, 1984). But the most distinctive symptom is the reversal of temperature (warm things feel cold and vice versa).

The causative organism which was first promulgated by French and Japanese researchers has been disputed. *Gambierdiscus toxicus*, a dinoflagellate presumed responsible for ciguatera fish poisoning, was first isolated from detritus samples on dead corals in the Gambier Islands, French Polynesia (Yasumoto *et al., 1977a and b).* It is believed to produce the two primary toxins responsible for ciguatera fish poisoning; the water soluble maitotoxin and the lipid soluble ciguatoxin (*Yasumoto et al.*, 1979b; Bagnis *et al.*, 1980; Shimizu *et al.*, 1982).

Ciguatera fish poisoning was not known on Nauru Island prior to boat channel blasting in early 1990. It has taken the Nauruan people unaware of the danger it poses on one of their marine food sources, fish. Because the people themselves are new to this problem, many assumptions have been rumoured as how some reef fish species got poisonous. Likewise, local cures which might have been passed on from other Pacific island communities working for the Nauru Phosphate Commssion and who are more familiar with this disease in their respective countries, are also part of a new era of the formidable phenomenon.

Ciguatera fish poisoning had not been documented on Nauru since it is new to this island. A lot of concerns had been shown by the Nauruans and other ethnic groups on the problems arising from the consumption of toxic fishes. Because the people living in Nauru rely so much on reef fish for their daily living, it is envisaged that some baseline work on this problem needs to be carried out. It is, therefore, the aim of this survey to collect and collate data available on ciguatera fish poisoning on this island so that future plans could be formulated in the areas of environmental protection and management, public and health education. It is also anticipated that more work will be directed toward the monitoring of the status of this problem.

BACKGROUND

The Republic of Nauru lies 42 km south of the Equator in the Central Pacific. It is somewhat like an ukelele in shape and is 21.2 km^2 in area (Fig. 1). Its approximate distances from Melbourne and Auckland are 4830 km NE and 3542 km NW, respectively (History of Nauru).

The mean temperature is 32°C. Two distinct seasons are the Wet and Dry seasons. The former lasts from November through February/March while the latter occurs during the other 8 or 9 months. The mean rainfall is about 193 cm but it may vary from year to year (History of Nauru).

Nauru is believed to be the top of an oceanic mountain that had been blown up millions of years ago. The coral reef platform which varies in width surrounds the island with a sharp drop-off beyond the reef crests. At its highest point, the island is just under 90 m above sea level.

The island is divided up into fourteen districts supposedly owned by various tribes. All the villages occupy the coastal areas except for Buada which is the only district situated in the centre of the island (Fig. 1).

The Nauruans are Micronesian in origin but there had been intermarriage with other ethnic groups in the Pacific and elsewhere. The people are known as skilful fishermen and craftsmen.

Nauru is rich in phosphate or guano (bird droppings) and it is the main export commodity of the country, which brings in millions of dollars. Although most Nauruans enjoy a good standard of living, every household would always look at the sea as the provider of their main source of protein, fish.

Fish is consumed every day, as agricultural products are scarce and most of the demand is met by imported food items from Autralia, New Zealand and some Pacific island nations. Pelagic fish landings had been very high during the past years but now fish are scarce and heavy pressure is now being imposed on reef fish. Inflation is taking its toll on the island and the price of fish has gone up to about 400 percent. Each household prefers to fish for their own consumption rather than buy it from unregulated road-side marketing.

METHODS

Two methods were used to collect information on ciguatera fish poisoning namely: Interviews and Examination of Medical Records.

Interviews

Interviews were conducted in various districts throughout the island state. The main targets were fishermen with known reputation in either handlining, spear-fishing and other methods. The fishermen were asked to name the species which they think are toxic and where they caught them from. A list of some Nauruan fishes with local, English and scientific names is provided in Table 2. Interviews with various people who apeared to have an in depth knowledge of the problem were also noted.

Examination of medical records

Cases of fish poisoning were examined and determined on the symptoms shown in the records. Only in a few was the name of the fish consumed mentioned. None of the records reported showed where the fish that caused the sickness was caught.

RESULTS

The medical records obtained from the Nauru Phosphate Coporation Hospital showed 18 cases of fish poisoning for 1990 and 21 cases for 1991 ending September. However, when the cases were confirmed from the patient's history it was clear that only 5 genuine cases for 1990 and 3 for 1991. This indicates how ciguatera fish poisoning is poorly understood. Fish species implicated are surgeon fish, often referred to as black fish, Lutjanidae and Serranidae known as red fish, and shark liver. Other fish poisoning cases have been caused by the consumption of raw tuna or rock cod, other fish species and a shellfish presumed to be a trochus shell.

The interviews showed that certain surgeon fish species (*Acanthurus mata-**Deboe**, Ctenochaetus striatus-**Iubwiya***), honey comb (*Epinephelus merra-**Iwuro**, Epinephelus microdon-**Kawudo** and Epinephelus melanostigma-**Iwuro***), rock cod (*Cephalopholis argus-**Etom***), red snapper (*Lutjanus bohar-**Irum***) and a red emperor were toxic. Other fishes that the fishermen also named were reef stonefish (*Synanceja verrucosa-**Ngope***) and a weedy stingfish (*Scorpaenopsis cirrhosus-Ngope*).

The areas that were identified as having toxic fish are Anibare Bay particularly around the boat channel-Anibare Channel, Anabar and Anetan reefs (Fig. 1).

DISCUSSION

These fish species which were identified to have caused ciguatera fish poisoning in this small but rich island nation have been reported by various researchers (Bagnis; Yasumoto *et al*; Tebano and McCarthy; Tebano 1985). It is obvious that the herbivorous surgeon fish are always involved where there is an initial flare up in ciguatera fish poisoning. The other fishes implicated to have caused ciguatera poisoning must have obtained the toxin from these herbivorous grazers via the food chain.

Fish poisoning cases caused by the consumption a shark liver could not be identified whether they were ciguatera or hypervitaminous as the symptoms were not clearly stated. However, there is some certainty that some of the cases could have been ciguatera.

The fishermen interviewed and the general public have fairly different views on the cause of fish poisoning flare up. Some claimed that sewage was the cause while others blamed a French warship which was assumed to have done some underwater drilling and disposing of some poisonous chemicals which were taken by the fish and thus made them toxic.

One fisherman explained that when a surgeon fish becomes oily, that is the oil from the flesh sparks when grilled, then this is the time when some of the fish are bound to be toxic. He also suggested that this fish eats a brain coral which he assumes is toxic.

Other fishermen related the blasting of Anibare Channel with the flare up of ciguatera fish poisoning. One confident fisherman and keen scuba diver said that in 1990 Anibare Channel was blasted out of the reef platform to allow boats and canoes have a better access to the open fishing grounds. Several months later, toxic fishes were caught from around the channel. Later poisonous fish were reported to have been caught from nearby areas. This view is in line with what previous researchers in the field had promulgated. They believe that reef disturbance can trigger the onset of ciguatera poisoning in the sense that loose coral boulders provide new surfaces on which algae and seaweed will settle and thus provide more favourable habitats for the toxic dinoflagellate, *Gambierdiscus toxicus*. In this way the population density of this dinoflagellate may increase and at the same time help increase the amount of toxin in the herbivorous fishes to a level a human body cannot resist.

The causes of fish poisoning mentioned earlier have some truth in them. Although the sewage system has no direct effect on ciguatera poisoning, it may have some indirect contribution to the problem. The domestic and other wastes pushed out into the ocean may be useful nutrients required by the algae and seaweeds for healthy growth. The abundance of nutrients in the water column encourages algal growth. As stated earlier, more algae means an incease in the number of *Gambierdiscus toxicus cells* and thus an increase in toxin production. Drilling acts in the same way as reef blasting in providing new surfaces for algal colonisation and growth.

There are reported cases where the disposal of chemicals in the water had caused fish poisoning (Bhat *et al, 1988*), however, the cases were not ciguateric in nature. In the case of chemcial disposal in Nauru water by warships, there is no proof to substantiate this claim. But if the chemicals were in fact dumped in the water it is quite possible that they (chemicals) could act as nutrients as described above or if absorbed by the fish the sickness that may arise is not necessarily ciguatera.

The oily nature of fish that was also mentioned could be interpreted in the light of food abundance, that is, algae. The more algae that grow, as a result of reef disturbance or nutrient influx from home refuse, the more food is available and so the fatter or oilier the fish are going to be.

It is quite evident that reef disturbance has triggered the onset of ciguatera fish poisoning on Nauru. The Anibare Channel is implicated as where the poisoning began, subsequently spreading to Anabar and Anetan reefs. It may continue to spread to the neighbouring reefs.

Interestingly, the moray eels and parrot fishes which are generally very toxic in most islands where ciguatera poisoning is a severe problem, are found non-toxic here. It is quite probable these fish populations have been overfished and that their number is so low they are not a risk to health at the present time.

SUMMARY AND RECOMMENDATIONS

One point that stands out loud and clear is "the reef surrounding this beautiful island has the potential to become toxic". In other words, ciguatera fish poisoning had laid dormant since the very existence of Nauru. Until recently, a couple of months ago the dormancy was interrupted by human interference and innovation. The flare up was probably triggered by reef disturbance and the enrichment of water with domestic refuse.

Ciguatera fish poisoning is becoming a serious problem in Nauru. The surgeon fishes, coral trout/cod and snappers have become toxic and other fish species such as parrot fish, emperor fish and moray eels should be regarded as potentially toxic. Children are quite vulnerable and should be prevented from eating reef fishes which are known to be toxic as well as those which are likely to become toxic.

The toxic areas identified are Anibare, Anetan and Anabar reefs. Toxicity may spread to other areas and the public should be aware of the fact that other reefs around the island have the potential to become toxic if they are disturbed or if excess home refuse is discarded into the water.

There is some evidence to suggest that some fish species may well be overfished. These include the herbivorous parrot fishes and the carnivorous moray eels. There is a need to look into a means of managing some of the fish populations such as these, and this should help enhance the population to an exploitable level.

There is a need to devise a means of accurate recording of ciguatera incidences which would help substantiate the actual status of the problem on the island. A monitoring programme which should take into account of *Gambierdiscus toxicus* cell counts to be related to the level of the toxin in various fish species would enable one to forecast the seriousness and the trend of the problem. A fish testing unit within the Health or Fisheries divisions would certainly reduce incidences of ciguatera and other forms of fish poisoning. With a simple testing method such as the "stick or poke test" developed by Dr. Y. Hokama of the Pathology Department, University of Hawaii, effecient and reliable results can be obtained within minutes. The mouse test which can be very expensive may not be suitable in small island nations but the results are as reliable as the poke test.

Reef disturbance and sewage discharge into the sea are two of the factors that can contribute to the flare up of ciguatera. Such activities should be carefully considered and probably avoided in future in light of the problems that the people of Nauru are facing.

Public education on the conservation and management of the marine food resources should be encouraged. The marine food sources of the island are infinite and therefore require proper management in order to secure sustainable yields for the future generations of Nauru.

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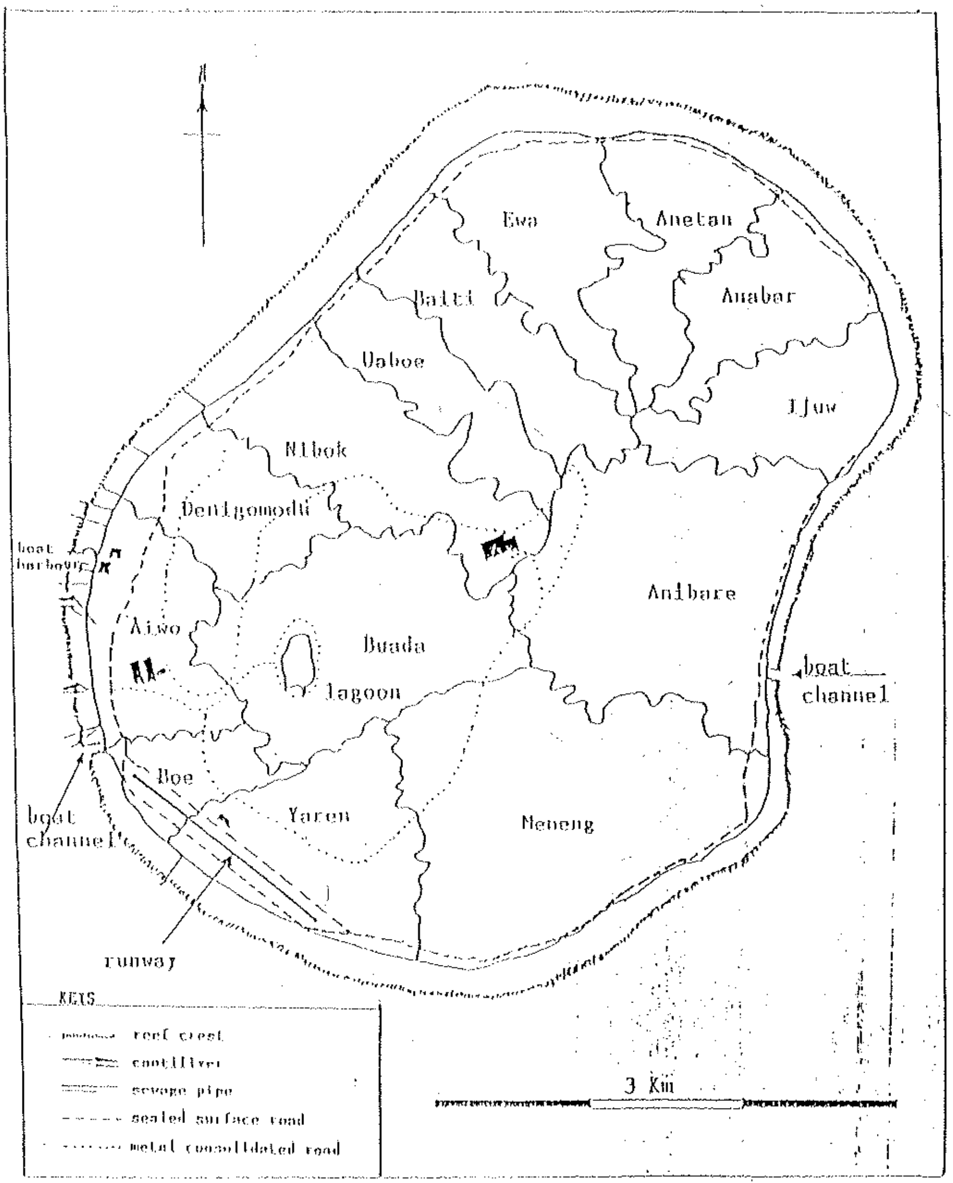

Figure 1. Map of Nauru

Table 1. Some common fishes of Nauru Island.

Nauruan name	English Name	Species Name
Apwe	Dusky jack	*Caranx sexfasciatus*
Debagommaroa	Long-tail ray	*Himantura sp.*
Deboe	**Surgeon fish**	***Acanthurus mata***
Degoriria	Tawny shark	*Ginglymostoma ferrugineum*
Degomat	Blackspotted boxfish	*Ostracion cubicus*
Dereba	Yellowspotted surgeonfish	*Acanthurus aliala*
Dereba	Redspotted surgeonfish	*Acanthurus achilles*
Dorangarang	Samoan goatfish	*Mulloidichthys samoensis*
Doruwa	Lowly trevally	*Caranx ignobilis*
Eae	Skipjack	*Katsuwonus pelamis*
Eae	Mackerel tuna	*Ethynnus affinis*
Eaeo	Gilbert's Cavalla	*Carangoides gilberti*
Earata	Scribbled leatherjacket	*Aluterus scriptus*
Eaeokwor	Oilfish	*Ruvettus pretiosus*
Eaiar	Silvery mullet	*Neomyxux chaptalli*
Eanape	Orange rockcod	*Epinephelus truncatus*
Eanape	Freckled rockcod	*Cephalopholis sexamaculata*
Earamai	Blue-fronted parrotfish	*Callyodon apicalis*
Earata	Yellowblue seaperch	*Lutjanus kasmira*
Ebawo Kumo	Whitetip shark	*Triaenodon obesus*
Ebawo	Ashen drummer	*Kyphosus cinerascens*
Ebo	Whitetail squirrelfish	*Sagocentron caudimaculatum*
Egow	Wahoo	*Acanthocybium solandri*
Egop	Hammerhead shark	*Sphyrna lewini*
Egarokoa	Silver squirrelfish	*Sargocentron microstoma*
Ekadawea	Longbill garfish	*Rynchorhampus georgi*
Eimar	Blacktipped shark	*Carcharhinus limbatus*
Ema	Smooth flutemouse	*Fistularia petimba*
Emorr	Flying fish	*Cypselurus simus*
Emwan	Bigeye squirrelfish	*Myripristis amaenus*
Emwan	Violet squirrelfish	*Myripristis violacea*
Emwan	Fleshy squirrelfish	*Plectrypops lima*
Eokong	Rabbitfaced spinefoot	*Siganus rostratus*
Eokwoy	Rainbow runner	*Elogatis bipinnulatis*
Erenai	Lunar-tailed cod	*Variola louti*
Etaro	Great barracuda	*Sphyraena barracuda*
Etom	**Peacock rockcod**	*Cephalopholis argus*
Eweo	Convict surgeonfish	*Acanthurus triostegus*
Eyongco	Scorpion cod	*Pterois antennata*
Ianen	Blacktipped rockcod	*Epinephelus fasciatus*
Ianit	Rock cod	*Epinephelus sp.*
Ibiya	Milkfish	*Chanos chanos*

Iebo	Port Fraslin squirrelfish	*Myripristis pralinia*
Ierangue	Blacktipped rockcod	*Epinephelus fasciatus*
Ieru	Snake mackerel	*Gempylus serpens*
Ikuri	Mackerel scad	*Decapterus macarellus*
Ikuri	Round scad	*Decapterus macrosoma*
Iniame Tebo	Humpback red snapper	*Lutjanus gibbus*
Iniame	Blackspot seaperch	*Lutjanus fulviflamma*
Ipwo	Leatherjacket	*Cantherhines dumerilii*
Iriname	Sailfish (pink)	*Xiphias gladiusdius*
Irum	**Twospot red snapper**	***Lutjanus bohar***
Itsibab	Bigeye tuna	*Thunnus obesus*
Itsibab	Yellowfin tuna	*Thunnus albacares*
Itsibab	Dogtooth tuna	*Gymnosarda unicolor*
Itsibab	Albacore tuna	*Thunnus alalunga*
Iubur	Black marlin	*Makaira indica*
Iubwiya	**Surgeonfish**	***Ctenochaetus striatus***
Iudud	Hawkfish	*Cirrhitus pinnulatus*
Iuiuj	Choram long-tom	*Tylosurus crocodilus*
Iwiji	Bluelined surgeonfish	*Acanthurus lineatus*
Iwuro	Greasy cod	*Epinephelus tauvina*
Iwuro	**Honeycomb rockcod**	***Epinephelus merra***
Iwuro	Orange rockcod	*Epinephelus hexagonatus*
Iwuro	**Rockcod**	***Epinephelus melanostigma***
Iyubur	Shortbill spearfish	*Tetrapturus angustirostis*
Kawudo	**Marbled rockcod**	***Epinephelus microdon***
Kawuda	Redspotted coralcod	*Plectropomus leopardus*
Kimago	Bluebanded angelfish (yellow)	*Pygoplites diacanthus*
Kiyoyo	Longhorned unicornfish	*Naso annulatus*
Kumum	Green triggerfish	*Pseudobalistes flavimarginatus*
Kwidada	Bluefin trevally	*Caranx melampygus*
Ngope	Reef stonefish	*Synanceia verrucosa*
Ngope	Weedy stingfish	*Scorpaenopsis cirrhosus*
Yab Ereber	Spotted surgeonfish	*Acanthurus guttatus*
-------	Dolphinfish	*Coryphaena hippurus*
-------	Sailfish	*Istiophorus platypterus*

NB. Toxic fishes in bold letter.