The University
of the
South Pacific

ISSN 1018-2896

# MARINE STUDIES PROGRAMME

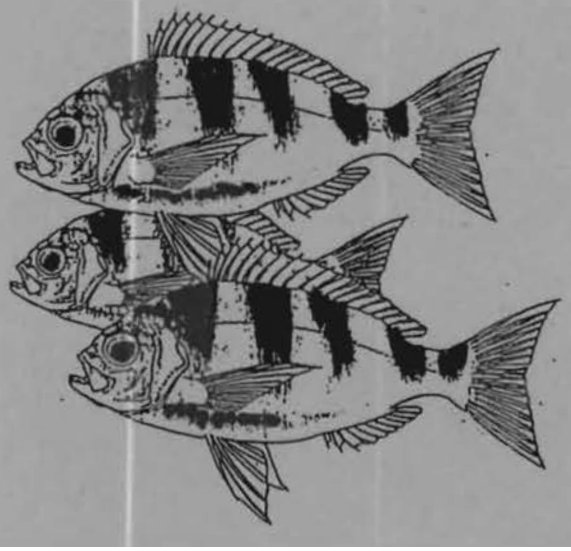
## TECHNICAL REPORT

# A PRELIMINARY SURVEY ON CIGUATERA FISH POISONING IN TUVALU.

Temakei Tebano
Institute of Marine Resources
University of the South Pacific
SUVA, FIJI.

SERIES 1991

Number 11



# A PRELIMINARY SURVEY ON CIGUATERA FISH POISONING IN TUVALU

by

Temakei Tebano
Institute of Marine Resources
University of the South Pacific
Suva, Fiji.

December 1991

CONTENTS



## INTRODUCTION

Ciguatera or ciguatoxic fish poisoning is caused by ingestion of a variety of circumtropically distributed reef fishes (Tebano and McCarthy, 1984). The Caribbean and the Pacific realms are known to have been the focus of this disease.

The symptoms include a range of gastrointestinal, cardiovascular, neurological and dermal disorders (Bagnis, 1973; Withers, 1982; Yasumoto *et al*, 1984). The most notable symptom is the reversal of temperature (warm things feel cold and cold things feel warm).

*Gambierdiscus toxicus*, a benthic dinoflagellate which grows on algae was identified by French and Japanese researchers on Gambier Islands in French Polynesia. A recent finding by a Canadian researcher, Maria Faust (1991), found a ciguatera-related toxin in another dinoflagellate, *Prorocentrum lima*, suggesting this plant may also be a potential causative organism.

The history of Tuvalu tells how toxic fish were tested by boiling a portion with a silver coin inserted in the flesh. If the coin turned black the fish was poisonous (Faaniu *et al*, 1976). The period must be after western contact and before World War II. The island referred to is Niulakita, the southernmost island in the group (Fig. 1).

The notable outbreak of ciguatera was in 1989 on the island of Niutao after a reef was blasted at the south-western part of the atoll. Fish poisoning cases from other islands prior to 1982 could also be remembered by the old people of Tuvalu. It is a serious medical and nutritional problem, not only in Tuvalu but in other Pacific islands as well.

There are different opinions regarding which activities and reef disturbances could be responsible for the onset, flare up and even the spread of ciguatera. Several researchers have linked an increase in ciguatera fish poisoning with human activites such as war material dumping, reef blasting, sewerage, shipwrecks, and many more (e.g. Cooper, 1964; Tebano 1984; Ruff, 1989). Nauru Island and one of the islands in Kiribati

(Maiana) are two classic examples where ciguatera fish poisoning was never heard of before. Nauru became toxic in early 1990 after a boat/canoe channel was blasted at Anibare reef. On Maiana Island ciguatoxic fishes were caught several months later after a ship channel was widened on the western reef. These reefs have remained toxic since (Tebano, 1991a,b,c).

Because ciguatera is becoming one of the concerns of the Tuvalu people this surrvey was designed to (i) make a preliminary survey on toxic fish species and toxic reefs, (ii) confirm if ciguatera is prevalent in the islands, (iii) identify factors that contribute or have contributed to the flare up and spread of ciguatera.

## BACKGROUND

Tuvalu was formally known as Ellice Islands. The former name was adopted after the Ellice Islands separated from the then former British colony of the Gilbert and Ellice Islands. Tuvalu is composed of nine low-lying atolls situated between longitudes 5° and 11°S, and latitudes 176° and 180°E (Fig. 1). Land surface area ranges from a mere 0.4 $km^2$ to 7 $km^2$, totalling in all some 35 $km^2$. At normal high water the land is scarcely more than 2-5 m above sea level. The only navigable lagoons are found in Funafuti and Nukufetau (Gerd, 1961)

The climate is constant throughout the year with temperatures between 29° and 32°C. It rarely go above 35°C or below 25°C. The mean annual rainfall is between 3,000 - 3,500 mm. Favourable weather periods are between October and March (Gerd, 1961).

The primary occupation for women is food gathering while the men do hard manual work and fishing. Fish was plentiful early this century, but is declining due to an increase in population. On the island of Funafuti, the capital of Tuvalu, fish is no longer the main source of protein, because reef fish in particular are getting scarce and the pelagic species can only be obtained during good weather. Imported canned fish and meat are favourite protein supplements.

Fish poisoning is perhaps one of the reasons why fewer reef fishes have been caught. But the topography of the islands may also have some effect on fish availability. As previously mentioned, only two out of nine islands have lagoons. This means that only reef and pelagic fish are available for consumption.

## METHODS

The methods used in this survey were interviews and the examination of medical records. Some fishermen and knowledgeable members of the public were asked to name the toxic fishes and where they had been caught from patients' records on fish poisoning were examined and confirmed whether they were ciguateric or other forms of fish poisoning.

## RESULTS

Fish species identified to have caused ciguatera fish poisoning in Tuvalu include "Fagamea" (*Lutjanus bohar*), "Filoa" (*Lethrinus elongatus*)"Homo" (*Acanthurus mata*), "Kapalagi" (Acanthurus xanthopterus), "Manini" (*Acanthurus spp.*), "Munua" (*Cephalopholis sonnerati*), "Ono" (*Sphyraena barracuda*), "Pokapoka" (*Naso unicornis*), "Pone lolo" (*Ctenochaetus striatus*), "Saputu" (*Lethrinus spp.*), "Taiva" (*Lutjanus monostigma*), "Ulafi" (*Scarus ghobban*), and "Umu fatu" (*Pseudobalistes flavimarginatus*) (See Table 1 and Appendix i). A puffer fish, "Hue or Puhi" (*Arothron hispidus*) had also caused fish poisoning but unrelated to ciguatera.

Of eighty four fish poisoning cases recorded between 1986 and 1990, 97% were ciguatera. Among the nine islands that comprise Tuvalu, Nui and Niulakita appear to be free of ciguatera fish poisoning. The rest have been suffering from the disease but Niutao had recorded the highest incidences and is still suffering (Table 2). Table 3 shows that the problem would not ease and it may get worse in the years ahead.

## DISCUSSION

Ciguatera fish poisoning is not new to Tuvalu people. But the seriousness of the problem had not been assessed except for the island of Niutao which had become seriously affected after reef channels were opened up at Muli and Kuli villages in 1989. Kaly *et al* conducted a preliminary assessment of a severe outbreak of ciguatera at Niutao between 1988-1989 (before and after). According to their study they claim that the outbreak of ciguatera which occured prior to the blasting of channels could not primarily be attributed to the cause and that the blasting, however, initially exacerbated the problem by making already poisonous and highly prized reef fish available for consumption (Kaly *et al*, 1989). However, ciguatera fish poisoning medical records to date show that Niutao started yielding as highest incidences from 1989 untill September of 1991. Prior to reef blasting the number of reported cases had been small (Table 2). It should be also noted that many studies have shown that the concentration of the presumed causative organism, *Gambierdiscus toxicus*, is not necessarily linked with an increase in toxin level or the outbreak of ciguatera (e.g. Tebano and McCarthy, 1984; Tebano, 1984; Gillespie *et al*, 1985; Tebano and Lewis, 1990).

During the period of 1988-1991, the highest cases had been reported from Niutao followed by Nanumea (the northernmost island), Funafuti (capital) and Nukulaelae (second southernmost island) (Table 2). Although the number of people on Niutao is less than half of that of Funafuti about half of the cases for all of Tuvalu in 1989 came from Niutao but more than 90% the following years (Table 2) suggesting that the problem here is on the rise.

Classic examples where reef blasting is linked with the onset of ciguatera are Nauru Island and Maiana (Kiribati), Enewetak and Bikini (Tebano, 1991c, Ruff, 1989). Although the factors affecting blooming of the dinoflagellate are generally poorly understood (Yasumoto *et al*, 1979b, 1984) human disturbances such as reef blasting,

bomb testing, war material dumping, ship wreck and sewage disposal had been implicated in triggering the onset and flare up of ciguatera (Ruff, 1989).

The local people are still resorting to traditional testing methods and medicines. These practices have been helping the people of Tuvalu to cope with this prevalent problem for centuries. However, the authencity of their effectiveness and accuracy needs to be looked into.

## SUMMARY AND RECOMMENDATIONS

Ciguatera fish poisoning is a serious problem in Tuvalu particularly on Niutao and Funafuti. A crucial point to remember is that all reefs have the potential to become toxic at any time and any disturbance inflicted on them may contribute and even trigger the onset of ciguatera. Fish species linked with ciguatera in Tuvalu vary from island to island but should be avoided at all times.

Any development which involves reef disturbance should be carefully considered as to how it would affect the marine resource which the islanders depend so much on. The long term adverse effects will significantly affect the health and and socio-economic structure among the Tuvaluan community.

It should also be borne in mind that any one can make false recommendations based on twisted facts and unfamiliarity with the environment. In the case of Niutao it is obvious that it has greatly suffered and it is still suffering from the adverse impact of reef blasting which flared and spread the disease. Similar activities which probably have been planned must be withdrawn in the interest of the people of Tuvalu who will suffer the consequences. Our atoll environment is a fragile ecosystem and any form of human disturbance should be avoided at all costs.

Public education on the factors causing ciguatera fish poisoning is strongly recommended as it would make the public aware of what activities need to be avoided to reduce further incidences. A full study on the toxic areas and fish species for each island needs to be undertaken by the Tuvaluans themselves so as to safeguard the health of the local populace and visitors alike.

REFERENCES

**Bagnis, R., 1973.** Fish Poisoning in the South Pacific. South Pacific Commsission Publications Bureau, 112pp.

**Cooper, M.J., 1964.** Ciguatera and other marine poisoning in the Gilbert Islands. Pacific Science, 18:411-440.

**Faaniu, S., Ielemia, V., Isako, T., Isala, T., Kofe, L., Lafita, M., Lafai, P. et al, 1976.** Tuvalu a History. Fiji Times and Herald Limited, Suva, Fiji.

**Faust, M.A, 1991.** Morphology of ciguatera-causing *Prorocentrum lima* (Pyrrophyta) from widely differing sites. In: Helge Abildhauge Thomsen *et al.* J Phycol 27:642-648.

**Gerd, K., 1961.** The material culture of Tuvalu. Museum fur Volkerkunde Berlin, (Reprint by Suva Printing and Publishing Co. Ltd.

**Gillespie, N., Lewis, R., Burke, J., Holmes, M., 1985.** Proceedings of the Fifth International coral Reef Congress, Tahiti Vol. 4.

**Kaly, U.L, Jones, G.P. and Tricklebank, K., 1989.** Preliminary assessment of a severe outbreak of ciguatera at Niutao, Tuvalu. Zoology Department, University of Auckland, New Zealand.

**Ruff, T.A., 1989.** Ciguatera in the Pacific: A link with military activities. In: Environmental Health. The Lancet, January 28.

**Tebano, T., 1984.** Population density study on a toxic dinoflagellate resposible for ciguatera fish poisoning on South Tarawa Atoll, Republic of Kiribati. Atoll Research and Development Unit, University of the South Pacific, Publication, 46 pp.

**Tebano, T and McCarthy, D., 1984.** Ciguatera fish poisoning and the causative organism in the Gilberts, Kiribati, University of the South Pacific, Kiribati. Institute of Marine Resources, University of the South Pacific, 120pp.

**Tebano, T. and Lewis, R., 1991.** Ciguatera fish poisoning and reef disturbance. Observations on ciguatoxin level in reef fishes at Nei Tebaa Channel, Dai Nippon Causeway, South Tarawa, Kiribati. University of the South Pacific Marine Studies Programme Technical Report No 6., 12pp.

**Tebano, T., 1991c.** A preliminary survey of ciguatera fish poisoning on Nauru. Marine Studies Technical Report No. 8, 10pp.

**Withers, N.W., 1982.** Ciguatera fish poisoning. Ann Rev Med 33:97-111.

**Yasumoto, T., Raj, U., Bagnis, R., 1984.** Seafood poisoning in tropical regions. Laboratory of Food Hygene, Faculty of Agriculture, Tohoku University, Japan, 74pp.

**Yasumoto, T., Inoue, A., Bagnis, R., 1979b.** Ecological survey of a toxic dinoflagellate possibly responsible for the induction of ciguatera. Bull Jap Soc Sci Fish 45(3):395-399.

## ACKNOWLEDGEMENTS

I would like to thank Johnson Seeto for reviewing the manuscript and for the assistance with fish nomenclature, and staff at Princes Margaret Hospital, Funafuti, for providing medical records.

I thank the following persons for their valuable contribution and assistance they gave me me during my short but enjoyable visist to Funafuti.

| | |
|---|---|
| Malaki Tihala | (Fisheries Division) |
| Brian Lubrick | (Fisheries Division) |
| Pafini Nouata | (Director, USP Centre) |
| Lupe Tavita | (USP Centre) |
| Fetagisi Luka | (USP Centre) |
| Maalama Paeniu | (USP Centre) |
| Tupa Kalamelu | (USP Centre) |
| Annie Homasi | (Princess Margaret Hospital) |

I also thank the fishermen and members of the public for the information they provided.

Fakafetai lasi

**Table 1. Toxic fishes obtained from patients records, Princess Margaret Hospital, Funafuti, Tuvalu.**

| Local Name | English Common Name | Island |
|---|---|---|
| Fagamea | Red bass | Funafuti |
| Fagamea | Red bass | Nanumea |
| Loi | Peacock rockcod | Funafuti |
| Loi | Peacock rockcod | Nukulaelae |
| Loi | Peacock rockcod | Nanumea |
| Ono | Barracuda | Funafuti |
| Taiva | Seapearch, one spot snapper | Funafuti |
| Pokapoka | Leatherjacket | Funafuti |
| Kapalagi | Surgeon fish | Niutao |
| Filoa | Long-nosed emperor | Nukulaelae |
| Umu (Umu fatu) | Triggerfish | Nukulaelae |
| Munua | Red large cod | Nukulaelae |
| Ulafi (Ika hole) | Five-banded parrotfish | Nanumea |
| Pone lolo | Surgeonfish | Nanumea |
| Homo | Black surgeonfish | Nanumea |
| Manini | Surgeonfish | Nanumea |
| Hue, puhi | pufferfish | Nanumea |

Table 2. Tuvalu fishing poisoning cases by island from 1987-1991; South Pacific Commission Reports/Health Division Annual Report.

| Island | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|
| Nanumea | 26 | 7 | 11 | 17 | 49 |
| Nanumaga | 15 | 0 | 0 | 0 | 1 |
| Niutao | 0 | 7 | 30 | 136 | 101 |
| Nui | 0 | 0 | 0 | 0 | 0 |
| Vaitupu | 0 | 7 | 2 | 0 | 0 |
| Nukufetau | 0 | 1 | 5 | 0 | 0 |
| Funafuti | 12 | 13 | 8 | 8 | 9 |
| Nukulaelae | 5 | 11 | 6 | 4 | 0 |
| Niulakita | 0 | 2 | 0 | 0 | 0 |
| TOTAL | 53 | 46 | 62 | 165 | 160 |

Table 3. Fish poisoning cases for all of Tuvalu from 1981-1991; Health Division Annual Report.

| 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| 73 | 41 | 24 | 14 | 57 | 70 | 53 | 46 | 62 | 165 | 160 |

**Appendix i. Some common fishes of Tuvalu.**

| Local Name | English Common Name | Species Name |
|---|---|---|
| Ali | Leopard flounder | *Bothus pantherinus* |
| Aseu | Bluefin trevally | *Caranx melampygus* |
| Atule, Salala | Big eyed scad | *Selar crumenophthalmus* |
| Atu | Skipjack tuna | *Katsuwonus pelamis* |
| **Fagamea (fakamea)** | **Red bass** | ***Lutjanus bohar*** |
| Fapuku | Spotted grouper | *Epinephelus maculatus* |
| **Filoa** | **Long-nose emperor** | ***Lethrinus elongatus*** |
| Gatala | Marbled cod | *Epinephelus microdon* |
| Gatala liki | Honey-comb rockcod | *Epinephelus merra* |
| Gatala | Grouper | *Epinephelus microdon* |
| **Homo** | **Black surgeonfish** | ***Acanthurus mata*** |
| **Hue, Puhi** | **Pufferfish** | ***Arothron hispidus*** |
| Iai | Queenfish, leatherskin | *Scomberoides lysan* |
| Isave | Flying fish | *Cypselurus cyanopterus* |
| Isave | Flying fish | *Cheilopogon spp. & others* |
| Kailo | Large-eye bream | *Monotaxis grandoculis* |
| Kaivete | Goatfish | *Mulloidichthys vanicolensis* |
| Kamai | Rainbow runner | *Elegatis bipinnulatus* |
| Kanase | Bluetail mullet | *Valamugil seheli* |
| **Kapalagi** | **Surgeonfish** | ***Acanthurus xanthopterus*** |
| Laea | Parrotfish | *Scarus spp.* |
| **Loi (Loi uli)** | **Peacock rockcod** | ***Cephalopholis argus*** |
| Maiava | Spinefoot, Rabbitfish | *Siganus punctatus* |
| Malau puku | Soldierfish | *Myripristis violascens* |
| **Manini** | **Surgeonfish** | ***Acanthurus spp.*** |
| Masimasi | Dolphinfish | *Coryphaena hippurus* |
| Mataele | Rockcod | *Cephalopholis aurantius* |
| **Matu** | **Silverbiddy** | ***Gerres oyena*** |
| **Munua** | **Red large cod** | ***Cephalopholis sonnerati*** |
| Nanue | Topsail drummer | *Kyphosus cinerascens* |
| **Ono** | **Great barracuda** | ***Sphyraena barracuda*** |
| Paala | Wahoo | *Acanthocybium solandri* |
| Palu | Pale snapper | *Etelis radiosus* |
| Palugatala | Curvebanded grouper | *Epinephelus morrhua* |
| Palu malau | Red snapper | *Etelis spp.* |
| Palu malau loa | Long tail red snapper | *Etelis coruscans* |
| Palu matu | Amberjack | *Seriola rivoliana* |
| Palu malau puku | Short-tailed red snapper | *Etelis carbunculus* |
| Palupalu segaloa | Red jobfish | *Aphareus rutilans* |
| Palu savane | Banded flower snapper | *Pristipomoides zonatus* |
| Palusega | Small-tooth jobfish | *Aphareus rutilans* |
| **Pokapoka** | **Unicornfish, leatherjacket** | ***Naso unicornis*** |

| | | |
|---|---|---|
| **Pone lolo** | **Surgeonfish** | ***Ctenochaetus striatus*** |
| Pula | Lunar-tailed cod | *Variola albimarginatus* |
| Pusi | Moray eel | *Gymnothorax fimbriatus* |
| **Saputu** | **Sweetlip** | ***Lethrinus spp.*** |
| Taea | Paddle tail | *Lutjanus gibbus* |
| Tafauli | Black trevally | *Caranx lugubris* |
| Tagau | Red tail snapper | *Lutjanus fulvus* |
| **Tagafa** | **Humphead Maori wrasse** | ***Cheilinus undulatus*** |
| **Taiva** | **Seapearch, one spot snapper** | ***Lutjanus monostigma*** |
| Takua, kasi | Yellowfin tuna | *Thunnus albacares* |
| Tanutanu | Thumbprint emperor | *Lethrinus harak* |
| Taona | Double headed parrotfish | *Bolbometopon muricatus* |
| Teu | Dusky trevally | *Caranx sexfasciatus* |
| Tinoulua | Great trevally | *Caranx ignobilis* |
| Tonu | Big-spot coral trout | *Plectropomus spp.* |
| Tute | Garfish | *Hyporhamphus dussumieri* |
| **Ulafi (ika hole)** | **Five-banded parrotfish** | ***Scarus ghobban*** |
| Ulua | Giant trevally | *Caranx ignobilis* |
| Ulua | Bluefin trevally | *Caranx melampygus* |
| Ume | Long-snouted unicorn | *Naso unicornis* |
| **Umu** | **Small triggerfish** | ***Rhinecanthus rectangulus*** |
| **Umu fatu** | **Large triggerfish** | ***Pseudobalistes flavimarginatus*** |
| Utu | Green jobfish | *Aprion virescens* |
| Valu | Dogtooth tuna | *Gymnosarda unicolour* |

**Potentially toxic species in bold letters.**

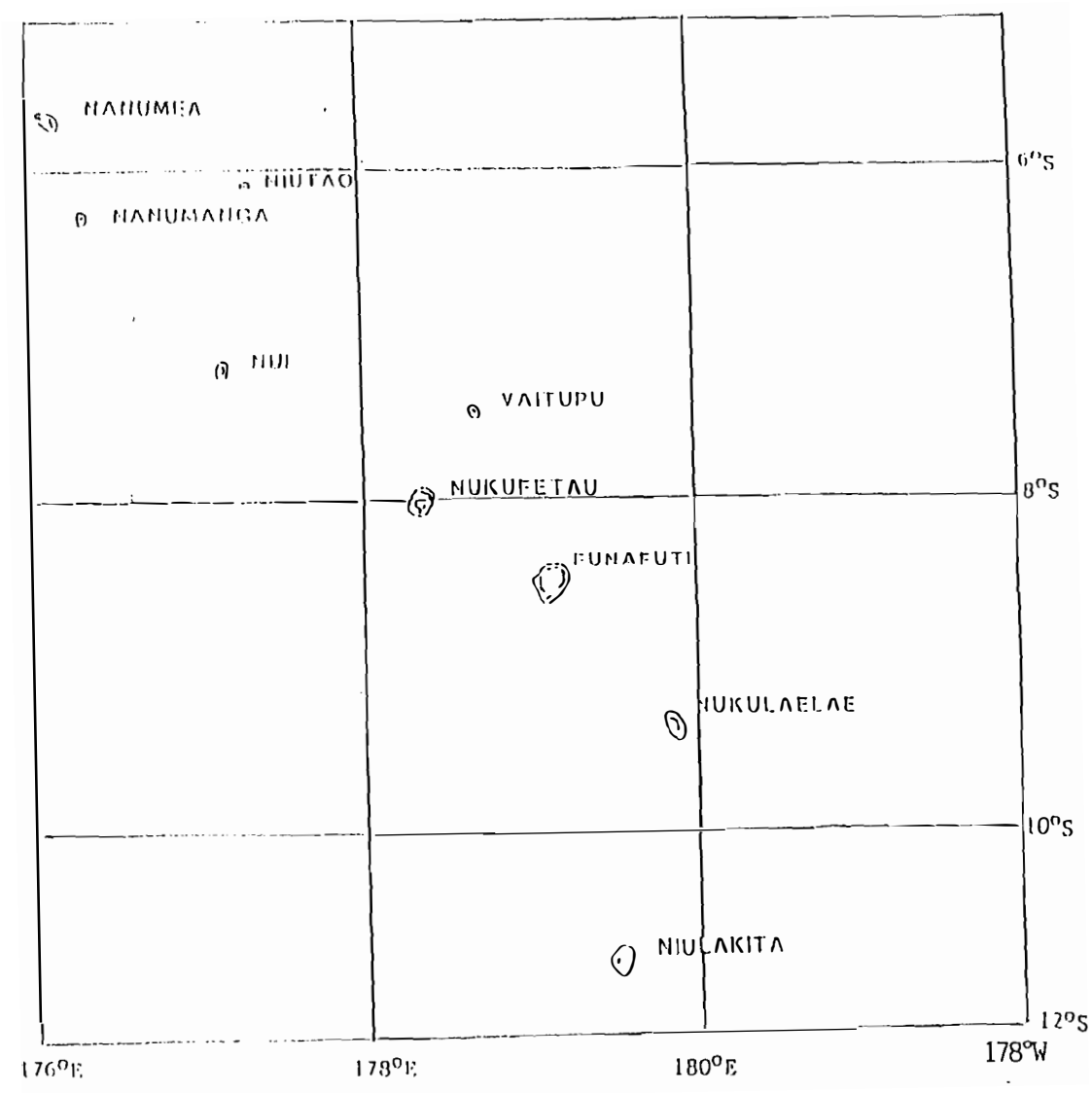



**Figure 1. Map of Tuvalu Islands.**