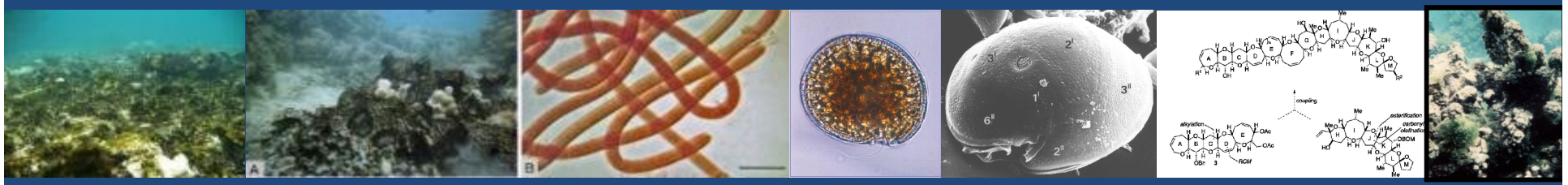
ICRI 25th General Meeting

9th – 12th Nov 2010

Millenium Hotel, Apia, Samoa

CIGUATERA

A threat to food security and livelihoods in the Pacific



SPC Secretariat of the Pacific Community

Being Yeeting

Fisheries Scientist

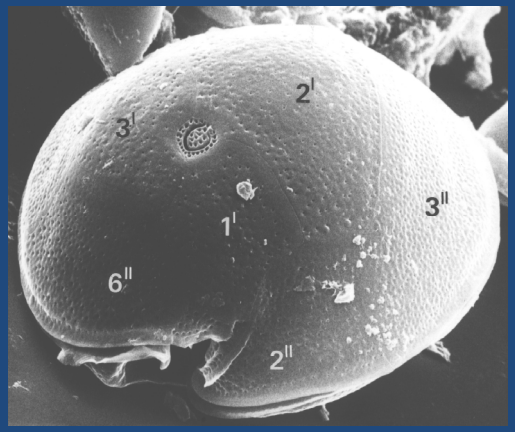
Coastal Fisheries Program

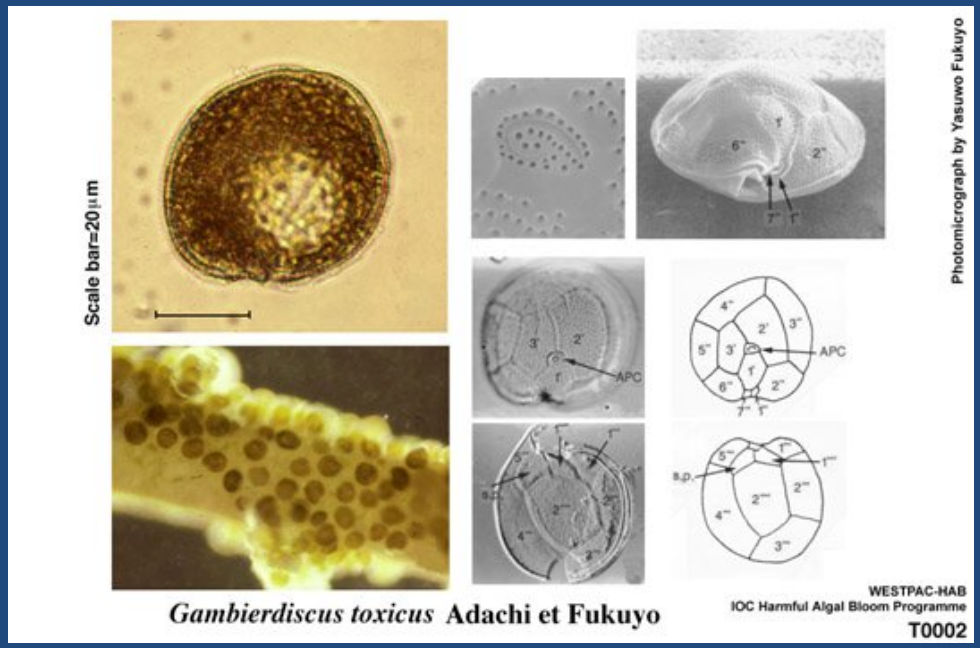
What is Ciguatera?

A form of poisoning effected from the consumption of reef fish that have been infected with ciguatoxins

Cause:

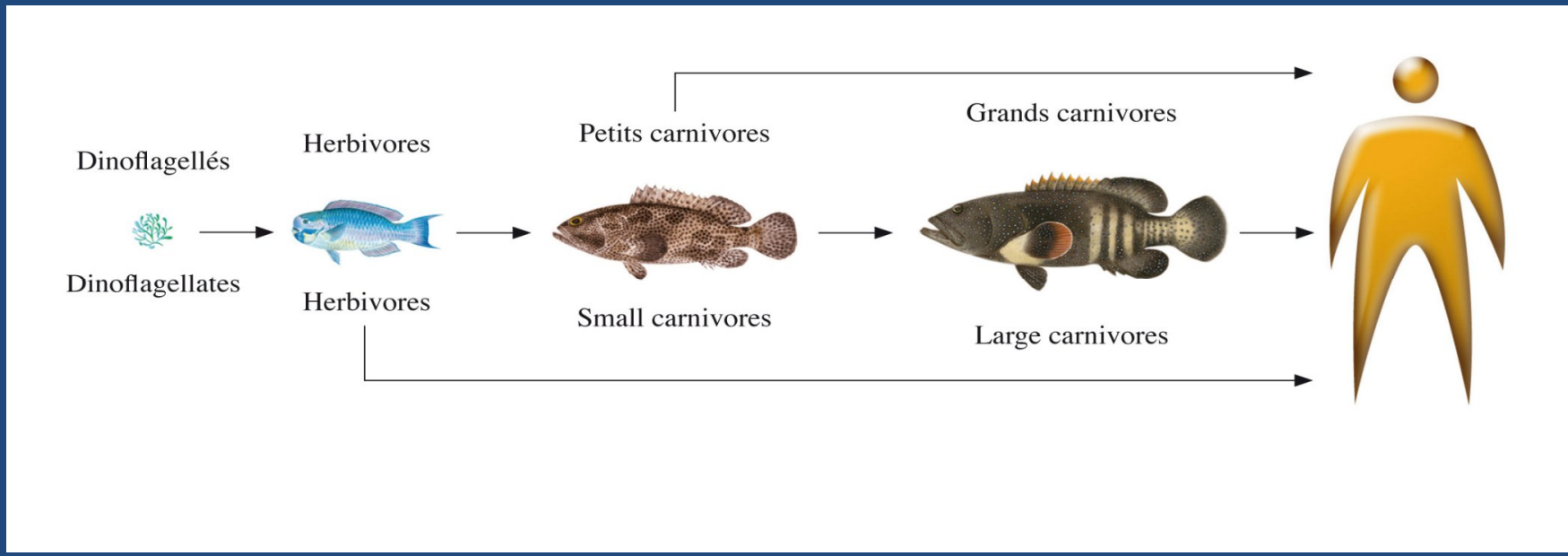
Naturally occuring toxin producing dinoflagellates , *Gambierdiscus sp.*





Transfer of Ciguatoxins

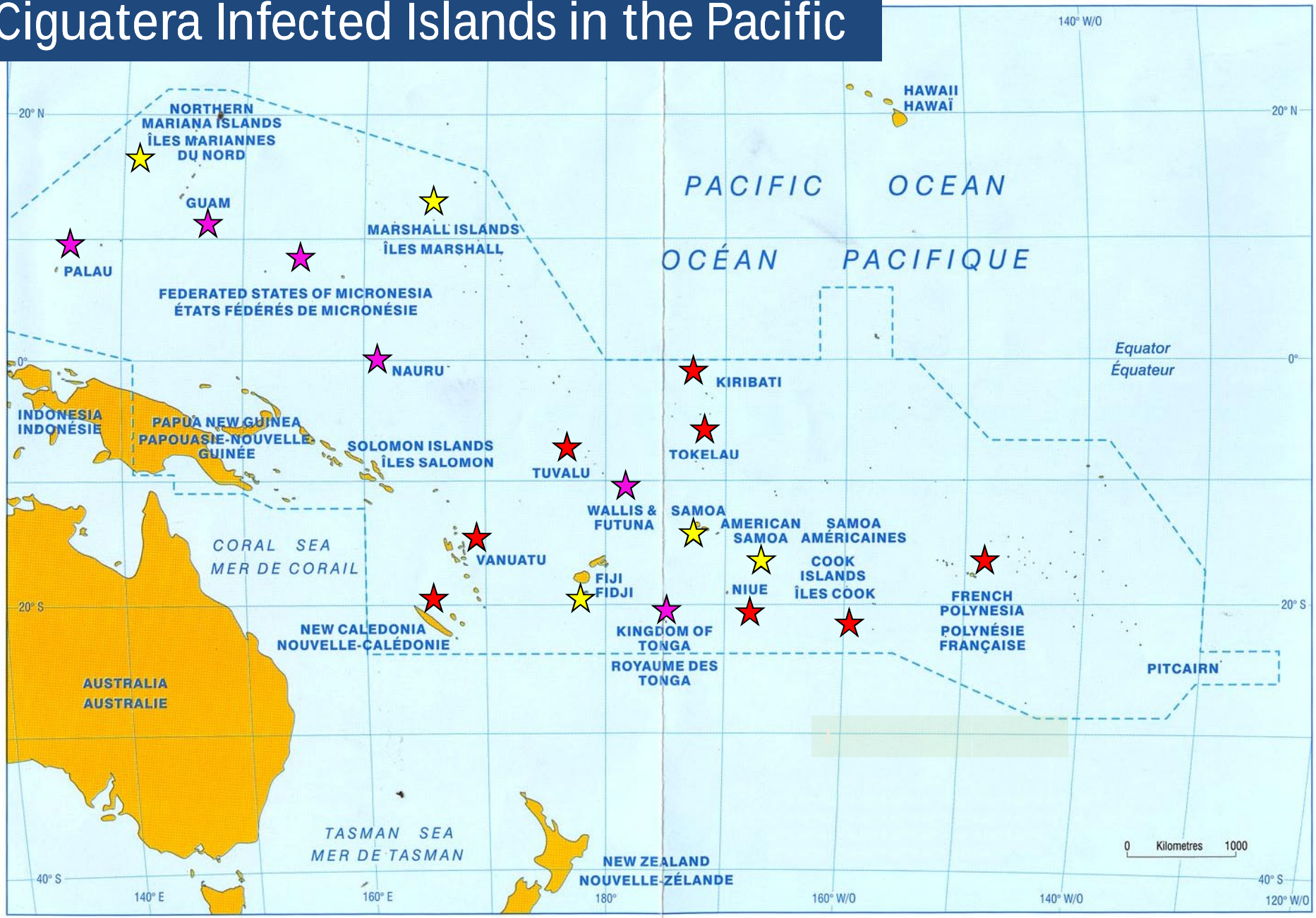
- Ciguatoxin producing dinoflagellates (*Gambierdiscus spp*.) hosted by marine algae are passed up the marine food web and are eventually ingested by humans
- During this transfer, bioaccumulation of the toxins occur thus becoming concentrated when it gets to humans



Symptoms

- Neurological – heat/cold reversal sensations
- Aching in Joints
- Gastrointestinal effects
- Vomiting
- Sweating
- Last up to a year

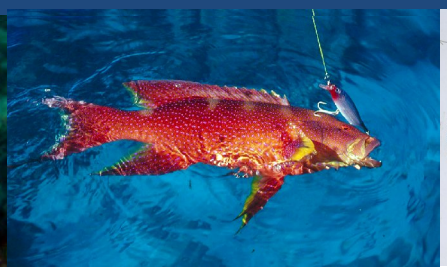
Ciguatera Infected Islands in the Pacific



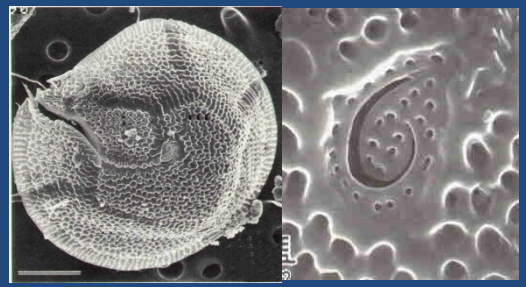
★ High: 10+ per 1,000 ★ Med: 2-9 per 1,000 ★ Low : 1-2 per 1,000

Status of Ciguatera in the Pacific

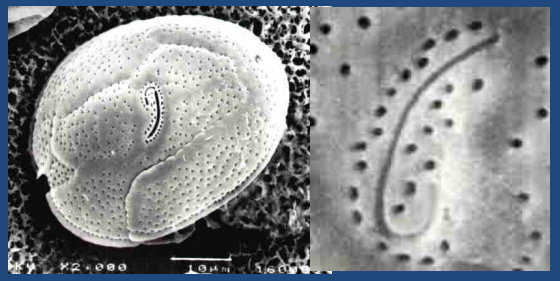
- Widespread throughout the Pacific
- Very patchy distribution
- Spreading to new reef areas => Increase in no. of cases
- Infection of new fish species
- Lack of good long term monitoring
- Lack of reliable way of testing fish

Different species of *Gambierdiscus* spp?

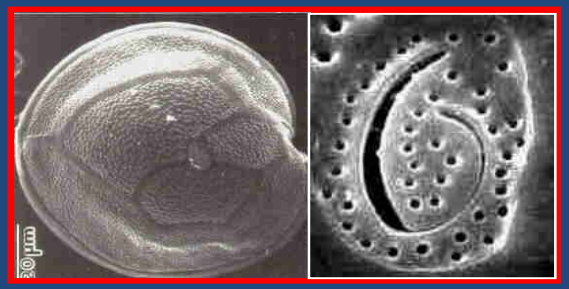


G. belizeanus

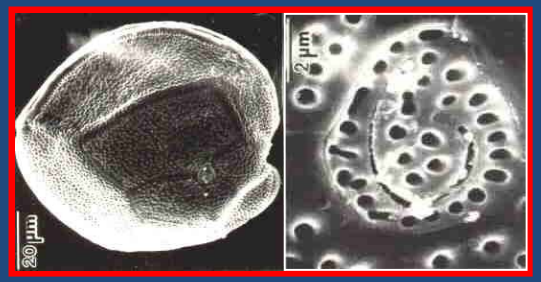


G. yasumotoi

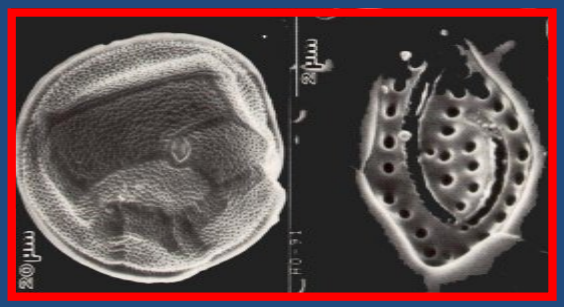
Polynesian species



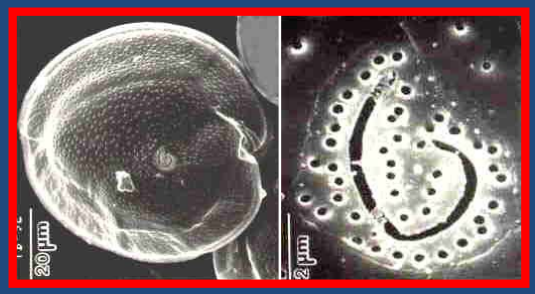
G. toxicus



G. australes



G. pacificus



G. polynesiensis

Which *Gambierdiscus* spp?

Species	Ciguatoxicity
G. toxicus	–
G. pacificus	+
G. polynesiensis	++++
G. australes	+

What is the CTX origin in Indian Ocean and Caribbean Sea?

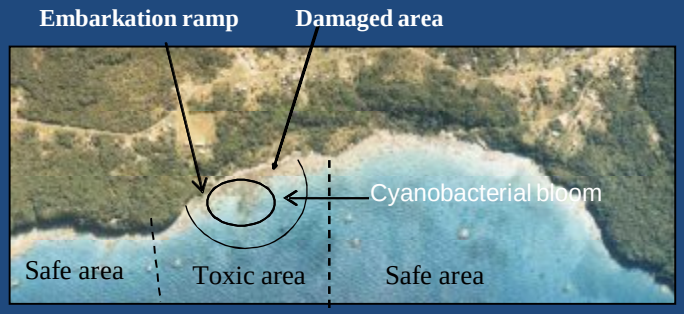
Chinain et al., J Phycol, 1999

Ciguatera Shellfish Poisoning

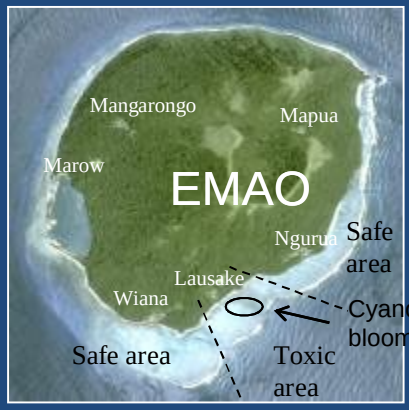
Collaboration between IRD, ILM and SPC

- Ciguateric area
- Human impacted areas
- Herbivorous and molluscivorous fishes mainly involved with molluscs and sea urchins
- Symptom: more severe with rapid onset of burning of mouth and throat
- Close correlation with the presence of benthic Oscillatoriales cyanobacteria

Areas where human poisonings with marine invertebrates were observed



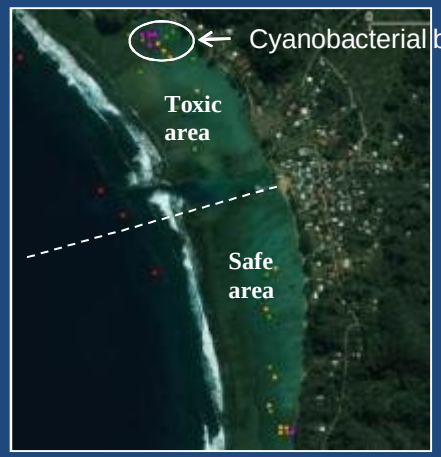
Hunëte (Lifou, Loyalty islands, New Caledonia)



Lausake (Emao, Vanuatu)

In each island:
Reports of human poisonings by marine invertebrates (giant clams or other bivalves, echinoderms, gastropods,...)
Clear demarcation between toxic area (highly damaged) and safe area

Rairua (Raivavae, Australes, French Polynesia)



Avera (Rurutu, Australes, French Polynesia)

Marine benthic cyanobacteria

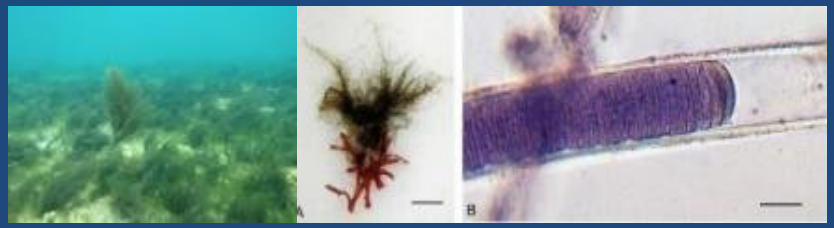
Lifou : *Hydrocoleum lyngbyaceum, H. glutinosum, Oscillatoria bonnemaisonii*, *Phormidium laysanense*

Hydrocoleum lyngbyaceum

Raivavae : *O. bonnemaisonii, Lyngbya majuscula, Leptolyngbya* spp.

Oscillatoria bonnemaisonii

Emao : *H. glutinosum*, *Anabaena* sp., *Symploca hydnoides*, *Lyngbya polychroa*



Lyngbya majuscula

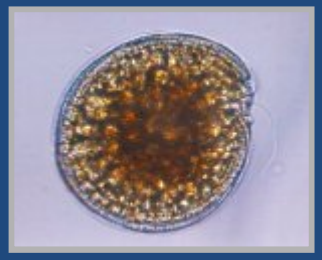
Rurutu : *H. majus, Aulosira achauislandii,*
Oscillatoria sp., *Leptolyngbya* spp.

Findings

- Marine benthic cyanobacteria can be toxic
- The toxins in cyanobacteria samples and giant clams from Lifou, Raivavae, and Emao and in sea urchins from Rurutu were ciguatoxin-like
- Can produce neurological toxins (anatoxin-a, ciguatoxin-like) or paralyzing toxins (saxitoxin, curare-like, or even palytoxin as pelagic cyanobacteria)
- Very similar to Ciguatera Fish Poisoning proposed name ‘Ciguatera Shellfish Poisoning’

New toxic food chain

Ciguatera Fish Poisoning



Bloom of *Gambierdiscus*

Toxins accumulation (fishes)

Disturbances and coral mortality

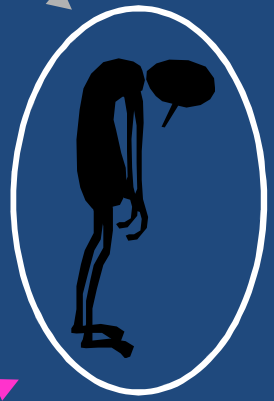
?

?

Bloom of cyanobacteria

?

Toxins accumulation (marine invertebrates)



Human poisonings

Ciguatera Shellfish Poisoning

Case Study: Marshall Islands

Lae Atoll (pop: 143) and Ujae (pop:425)

- 70% subsistence fishing
- Poor agricultural resources
- Lacking medical services
- Fish poisoning not known before WWII
- Peaked in 1987, 70-80% of population infected
- Evidence of coral bleaching in infected reef areas
- Increased nos. fish species infected - 2 to >10
- *Gambierdiscus sp.* found (200-300 cells/100g host algae)
- Fish species infected:

(1945) → (1987+) → (1990+) → (1999+..)
mullets → parrotfish → grouper → coral trouts/snappers

Case Study: Niue

- 12 % of population infected
- *Gambierdiscus sp.* and Cyanobacteria found
- Fish Species infected - drummerfish, parrotfish, squirrelfish
- Infected fish from Alofi wharf area

Human Induced:

High disturbance area - wharf development

Human Induced:

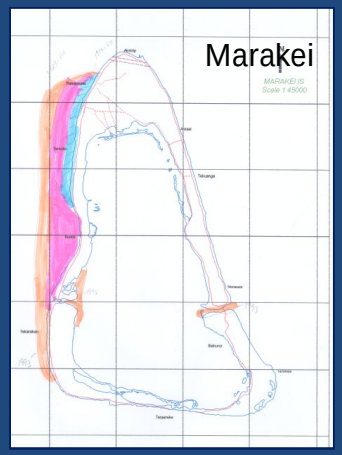
Ballast water and dumping from ships

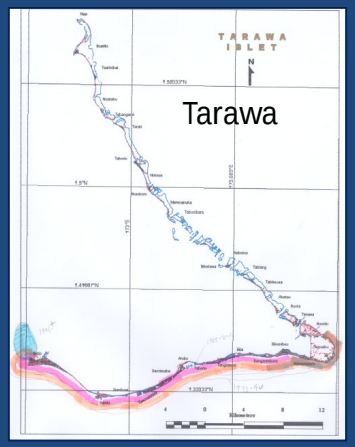
Natural:

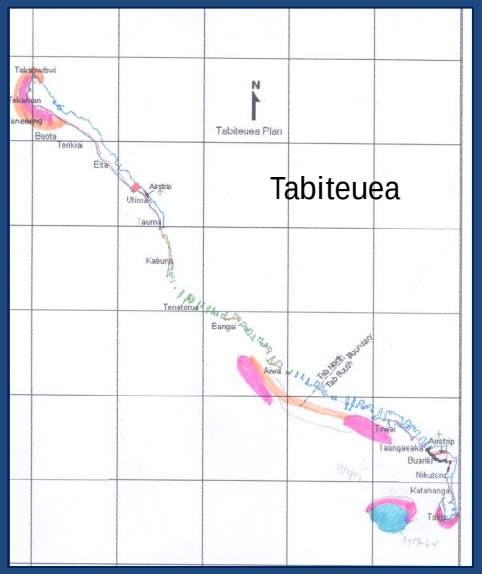
- Cyclone Heta 2004
- Prolonged period of high Sea Surface Temperature
- Algal bloom in 2000

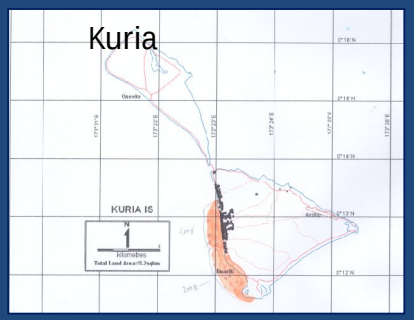
Case Study: Kiribati

- Highest incidence of fish poisoning
- Infected areas are around populated areas
- Extension of infected areas is evident
- New outbreaks in hotspots of high SST - Climate change?



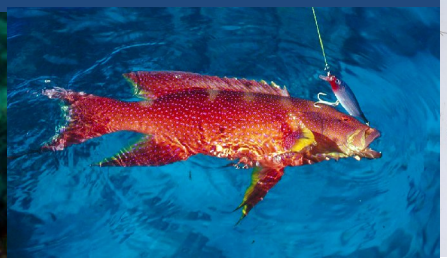






Socio-Economic Impact

- Loss of food and main protein source
- Loss of income for local fishers (domestic market)
- Loss of opportunity for export (Live Reef Food Fish Trade)
- Change in diet
- Increased health related costs
- Loss of productivity from infected working population



Challenges and Issues

- Poor understanding and knowledge of ecology of ciguatera
- Dealing with microscopic organisms - Nonvisual - communities difficult to comprehend
- Lack of long term monitoring
- Lack of technical capacity - need of training
- Lack of resources (funding and research facilities)
- Unavailability of practical tests for checking fish




Take home messages

- Ciguatera is increasing and spreading in the Pacific
- Ciguatera can limit availability of fish protein (food security) and income opportunities (livelihoods) to Pacific Island fishing communities
- Ciguatera needs to be monitored over the long term to understand it better and to manage it
- Maintaining healthy coral reefs can help as a way of controlling the spread of ciguatera