Human Algal Blooms, The Philippine Red Tide Experience and Climate Change?

Irma Makalinao MD MA FPSCOT FPPS

Professor and Chair of Pharmacology and Toxicology

College of Medicine

University of the Philippines Manila

13th International Conference of the Pacific Basin Consortium

20 -22 November 2009

Telethon Institute for Child Health Research, Perth Western Australia

Clupeotoxic Fishes

Herklotsichthys quadrimaculatus

Atherinomorus lacunosa

SArdinella sirm

Toxic Crabs

Atergatia floridus

Zosimus aeneus

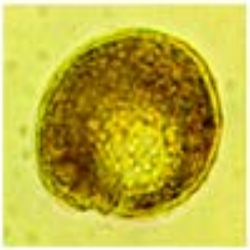
Toxic Snails

Turbo marmorata

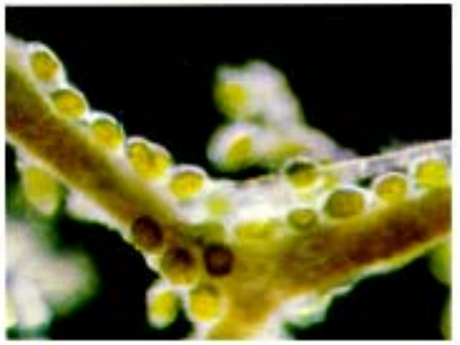
Turbo argyrostoma

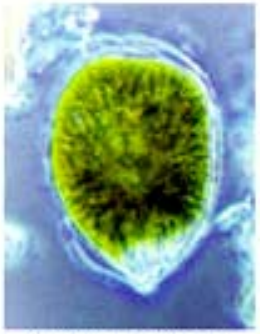
Tectus niloticа maxima

Toxic Benthic Dinoflagellates



Gambierdiscus toxicus





Ostreopsis lenticularis

Ostreopsis siamensis

Prorocentrum lima

Prorocentrum concavum

Ichthyo-toxic Fish

The problem of ciguatera is of paramount importance in public health terms

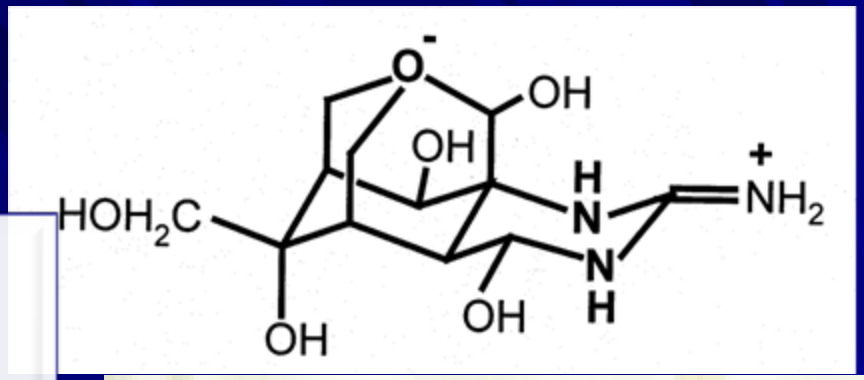
Tetrodotoxin

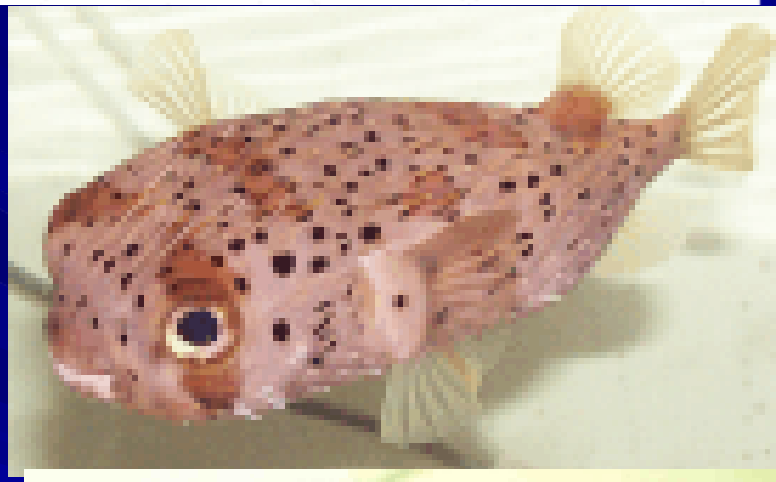
Source:

- Gonads, liver, intestines, and skin of about 80 species of puffer fish, blowfish or fugu

Toxicity characteristics:

- Toxin causes paresthesia and paralysis through interference with neuromuscular conduction
- Similar to saxitoxin





http://www.cfsan.fda.gov/cgi-bin/bbbglos?Tetrodotoxin

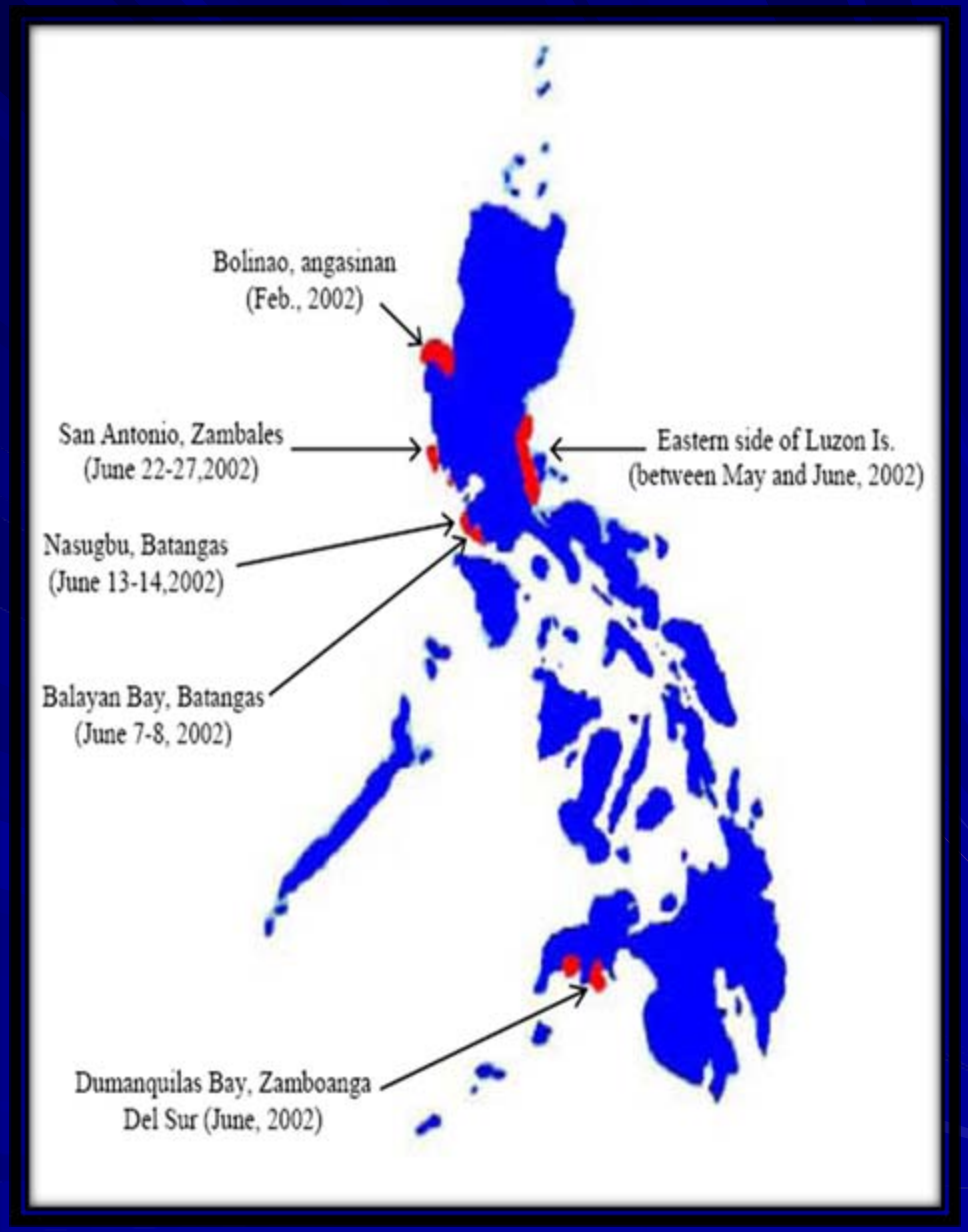
Water discoloration in Balayan Bay due to blooms of *Cochlodinium polykrikoides last June 9,2002*

(Photo by F. A. Bajarias, BFAR)

Fish Kills in the Philippines

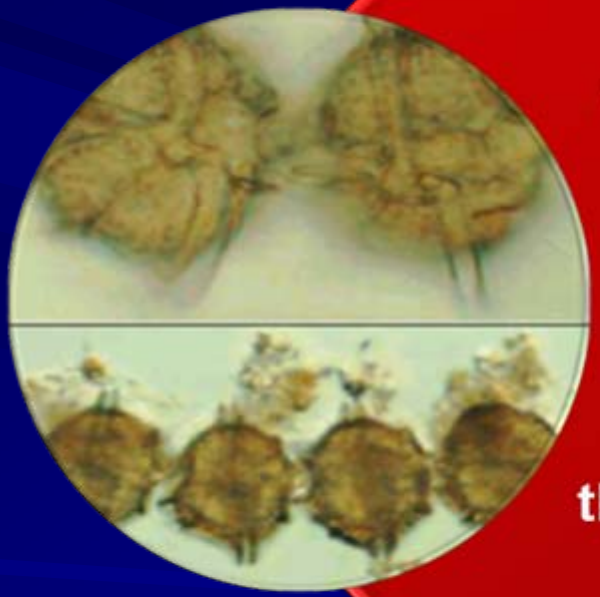
Fish mass mortality associated with algal blooms in 2002

- attributed to blooms of *Prorocentrum minimum, Cochlodinium polykrikoides and Alexandrium sp occurred in various localities in Luzon Island.*



Juan R. Relox, Jr. and Fe Farida A. Bajarias
Marine Biotoxins Monitoring Unit-Fisheries Resources Management Division
Bureau of Fisheries and Aquatic Resources, 860 Quezon Ave., Quezon City, Philippines

Early Recognition of Human Health Impact of Red Tide Poisoning



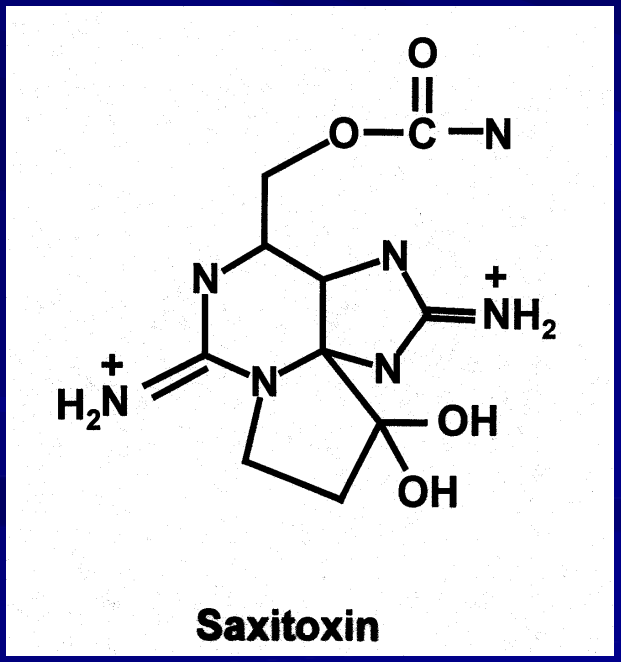
" A more serious human hazard arises in the problem of paralytic shellfish poisoning (particularly in North America and Japan). Certain species of *Gymnodinium and Gonniaulax (e.g. Goniaulax catenella and G. tamurensis) bloom in inshore waters and shellfish which feed on the flagellates* may not be killed but concentrate the poison in their digestive glands.

When these shellfish are eaten they can cause serious illness or death. This toxin is thermostable and survives cooking and even canning. It produces vomiting, facial paralysis, later extending to the limbs, and death in severe cases from respiratory paralysis"

DODGSON R,. W. (1928). Report on mussel purification. *Fish. Invest., Lond. Ser. 11,*

Saxitoxin and Paralytic Shellfish Poisoning

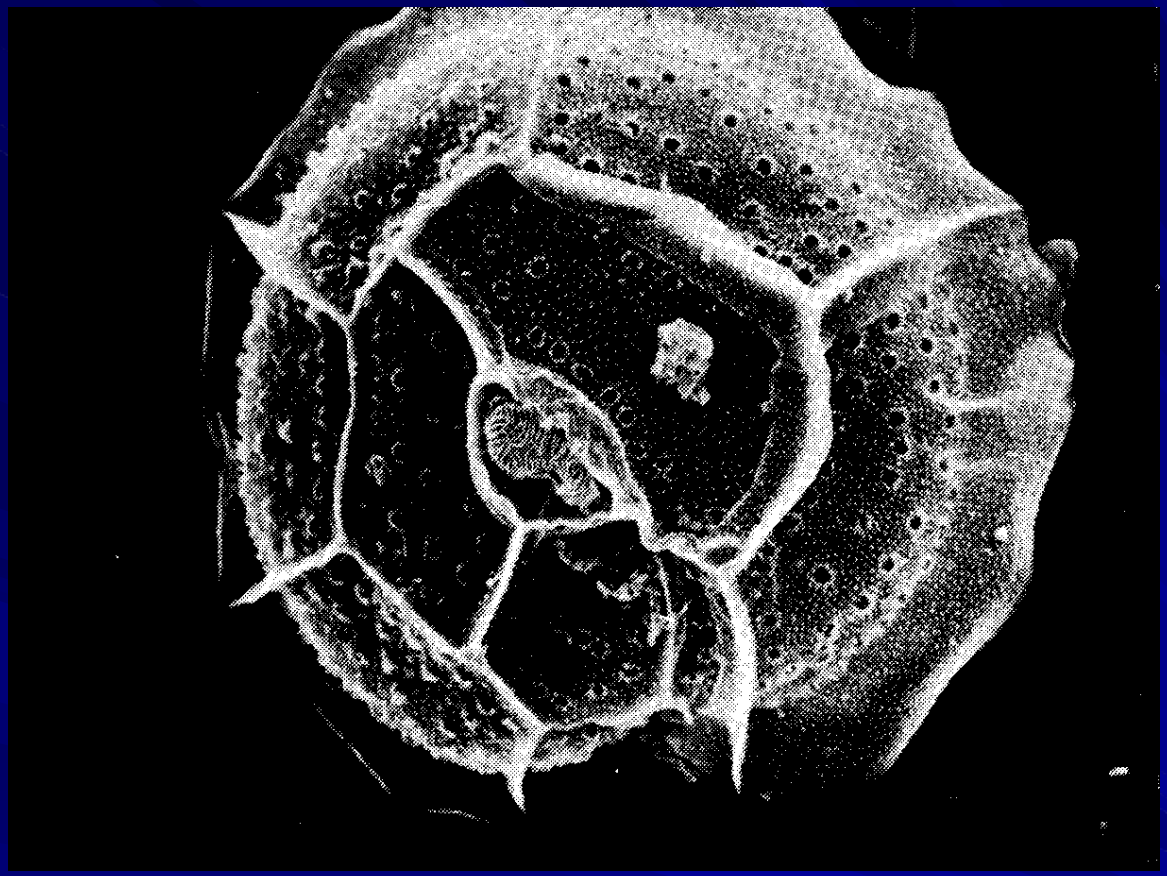
- Acts in a similar manner to Botulinum toxin



Saxitoxin

A nutritious meal of mussels can cause illness and even death when algal toxins are present.

http://www.whoi.edu/redtide/foodweb/shellwedolunch.html#mussels



Pyrodinium bahamense var compressum – a dinoflagellate first described from the Bahamas Atlantic Ocean Plate in 1906

From a paper by Rhodora Azanza , Marine Science Institute, College of Science, University of the Philippines Diliman entitled Contributions to Bloom Dynamics of Pyrodinium bahamense var compressum : A tToxic Red Tide c Causative Organisms (Science Diliman 1997)

The geographical distribution of toxic red tide in the Philippines

From 1883 to 2002

Reported cases 2124

DIED 120

WIDESPREAD RED TIDE INTHE PHILIPPINES by Elsa F. Furio, Cielito L. Gonzales and Yasuwo Fukuyo

The Philippine Red Tide Experience

- Coastal Phenomena that has started in 1980's to present time
- Economic loss was significant
  - In the 1983 Outbreak approximately 2.2 million peso
  - In the !988 Outbreak approximately 17 million pesos lost in a 4 day period in commercial fisheries including a decline by 40% of normal price of seafood commodities

The Red Tide Interagency Task Force

First meeting in 1983 resulted in a joint ban on the harvest of shellfish by the Department of Health and the Department of Agriculture with the Bureau of Fisheries and Aquatic Resources as the Lead Agency

In 1988, the Interagency Committee on Environmental Health created the Red Tide Task Force through Executive Order 489

- Departments of Health, Agriculture, Environment and Natural Resources, Interior and Local Government, Education, Science and Technology, Philippine Coast Guard and Philippine Information Agency

Red tide phenomena in Brunei Darussalam

- "Since the first recorded occurrence in 1976, the coastal waters of Brunei Darussalam have been sporadically subjected to the effects of red tide. The 1976 incident overwhelmed the nation which had no previous experience of red tides. Subsequently, a routine was established to monitor the red tide phenomenon. This included plankton monitoring and shellfish toxicity testing, measures which helped to prevent or mitigate adverse human impacts and economic losses to the fishing industry."
- A Red Tide Action Plan is currently in force in Brunei Darussalam. It is a contingency plan for red tide vigilance, monitoring and management, and will serve to reduce the negative impacts of red tides.

Objectives of the Red Tide Task Force

- Toxicological surveillance of the shellfish within the country
- Ensuring public health and safety
- Evaluation of ecological factors affecting red tide
- Applying preventive and protective measures to safeguard the fishing industry

At present the Marine Biotoxin Unit of the Bureau of Fisheries and Aquatic Resources is in-charge of active monitoring of harmful algal blooms

BFAR Monitoring System

- Regular sampling stations have been established with regular alerts available online
  - However BFAR recognized the Need for Application of Satellite Data in Red Tide Monitoring however there are budget constraints
- Parameters for toxicity
  - Level of toxicity in the shellfish meat
    - Regulatory Limit in the Philippines 40 micrograms of Saxitoxin Equivalent per 100 grams of shellfish meat using the mouse bioassay techniques
  - Presence of the toxic dinoflagellates causing Red Tide Poisoning

Republic of the Philippines
Department of Agriculture
Bureau of Fisheries and Aquatic Resources
PCA Compound, Elliptical Road, Diliman, Quezon City
Tel. Nos. 929-95-97 * 929-80-74

Shellfish Bulletin No. 24
Series of 2009
30 October 2009

Based on the latest laboratory results of the Bureau of Fisheries and Aquatic Resources (BFAR) and Local Government Units (LGUs), shellfish collected at **Dumanquillas Bay in Zamboanga del Sur; Sorsogon Bay and Juag Lagoon in Matnog, Sorsogon; Bislig Bay in Bislig City, Surigao del Sur and Murcielagos Bay in Zamboanga del Norte and Misamis Occidental** are still **positive** for paralytic shellfish poison that is beyond the regulatory limit.

All types of shellfish and *Acetes sp.* or alamang gathered from the areas as shown above are NOT SAFE for human consumption. Fish, squids, shrimps, and crabs are safe for human consumption provided that they are fresh and washed thoroughly, and internal organs such as gills and intestines are removed before cooking.

The following areas continue to be **FREE from toxic red tides**: coastal waters of Cavite, Las Piñas, Parañaque, Navotas, Bulacan and Bataan in Manila Bay; coastal waters of Alaminos, Anda, Bolinao and Wawa, Bani in Pangasinan; Masinloc Bay in Zambales; coastal waters of Milagros and Mandaon in Masbate; Inner Malampaya Sound in Taytay and Honda Bay in Palawan; coastal waters of Pilar, President Roxas, Pontevedra, Panay, Roxas City, Ivisan and Sapian in Capiz; coastal waters of Pontevedra, in Negros Occidental; Irong-irong, Maqueda and Villareal Bays in Samar; Ormoc, San Pedro, Cancabato and Carigara Bays in Leyte; Biliran waters in Biliran Province; Hinatuan and Lianga Bays in Surigao del Sur; Balite Bay in Mati, Davao Oriental; and coastal waters of Kabasalan in Sibuguey Bay, Zamboanga Sibugay.

SIGNED
MALCOLM I. SARMIENTO, JR.
DIRECTOR

GININTUANG MASAGANANG ANI
for Modern Agriculture

Multisectoral Partnerships to mitigate impact of HAB on health and environment

- Role of Non-governmental organization for effective dissemination of information at the level of the community
- Technical expertise of the Poison Control Specialists in the treatment of patients and prevention of poisoning
- International partners and collaborators such as Japan in providing for better monitoring and surveillance

Human Algal Blooms and Weather Patterns

In 1997 (an El Niño year), the pattern for *Pyrodinium* cell density/occurrence in the bay observed from 1994 to 1997 was not experienced in Manila Bay (Azanza et al. 1997). This shows the major role of the weather system in regulating the environment and consequently, the bloom of this organism. It has been hypothesized earlier that red tides, including those caused by *Pyrodinium*, could increase in intensity and duration during or after an El Niño phenomenon (Maclean 1989; Usup and Azanza in press). However, these claims need to be further substantiated.

Azanza R. Science Diliman (1997) 9:1 & 2, 1-6

Human Algal Blooms and Weather Patterns

Pyrodinium bahamense var. *compressum* seems to undertake a life strategy suited quite well for many coastal areas in Manila Bay. The organism's vegetative cell stage usually undertakes division to produce the blooms/red tides in the water column during the months of the southwest monsoon. On the other hand, physico-chemical conditions during the northeast monsoon favor the dormancy of cysts formed from previous blooms and hence, red tides of the organisms are generally not expected or experienced. This pattern could, however, be disrupted during major climatological changes, such as an El Niño year. Areas where there are higher concentrations of their cysts are the most prone to *Pyrodinium* blooms.

"Although our awareness of the sea has been rapidly growing, our knowledge of toxic factors in marine organisms lags far behind our knowledge of toxins elaborated by terrestrial organisms. Less than 1 percent of toxic marine organisms has been examined for their chemical properties and pharmacological activities. We need to expand our research effort in this area and increase our basic knowledge of toxic marine flora and fauna in order to utilize marine resources more efficiently."

(K. Hashimoto and N. Fusetani from Laboratory of Marine Biochemistry University of Tokyo