MINISTERIAL CONFERENCE ON FISHERIES COOPERATION AMONG AFRICAN STATES BORDERING THE ATLANTIC OCEAN

CONFERENCE MINISTERIELLE SUR LA COOPERATION HALIEUTIQUE ENTRE LES ETATS AFRICAINS RIVERAINS DE L'OCEAN ATLANTIQUE

HARMFUL ALGAL BLOOMS (HABs)

Dr Amadou TALL
CONSULTANT

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- What are HABs?
- What are algal blooms and how it look like?
- Public health problems associated with HABs
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WHAT'S AN ALGAE?

- **Algae:** **unicellular** chlorophyll- containing organisms referred to as **plants** by some and **protists** by others.
- Found everywhere: seas, rivers, lakes, soils; in **snow** and **ice.**
- **4,000 known species of microscopic algae, and approximately 300 phytoplanktons identified with periodic explosions or cause blooms (dinoflagellates, diatoms, haptophytes, and some silicoflagellates**

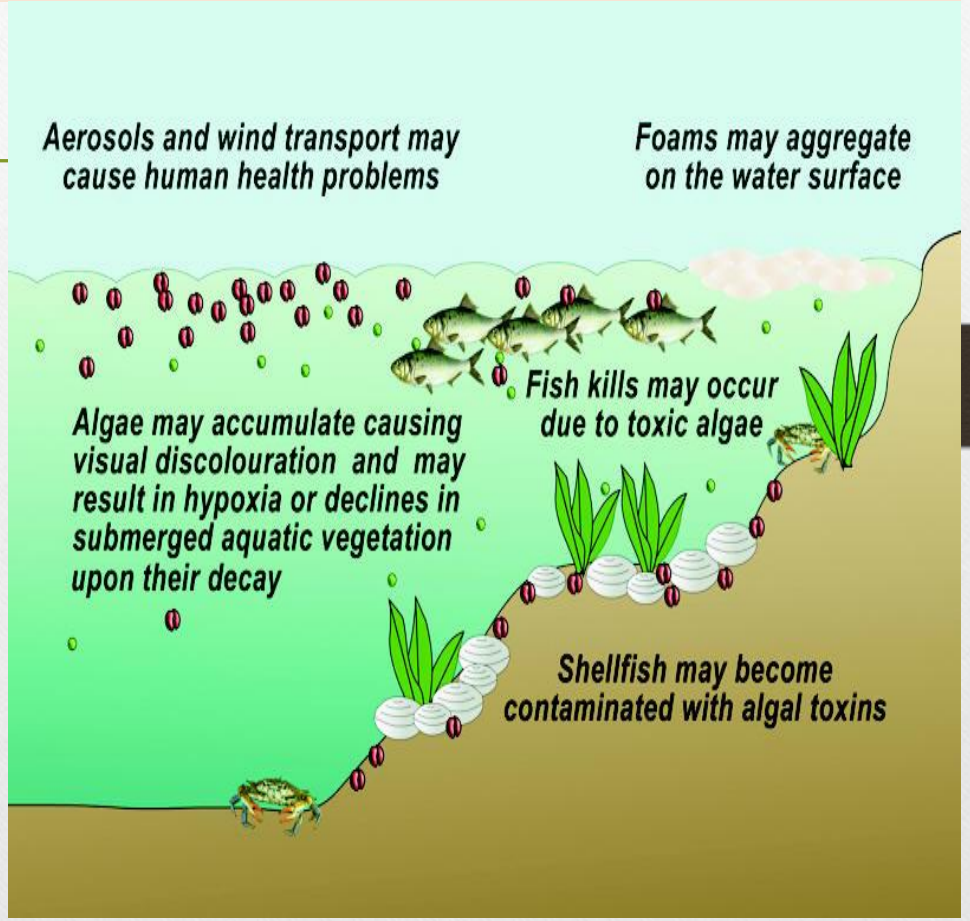
WHAT ARE HABs?

A broad classification of HABs distinguishes two groups of organisms:

-toxin producers: contaminate or kill organisms, including **marine mammals, birds and humans**,

-high-biomass producers: **clog the gills**, destroy the aesthetics of beaches, **or deplete oxygen** in water when cells die & decompose; causing **anoxia** and indiscriminate kills of marine life after reaching dense concentrations.

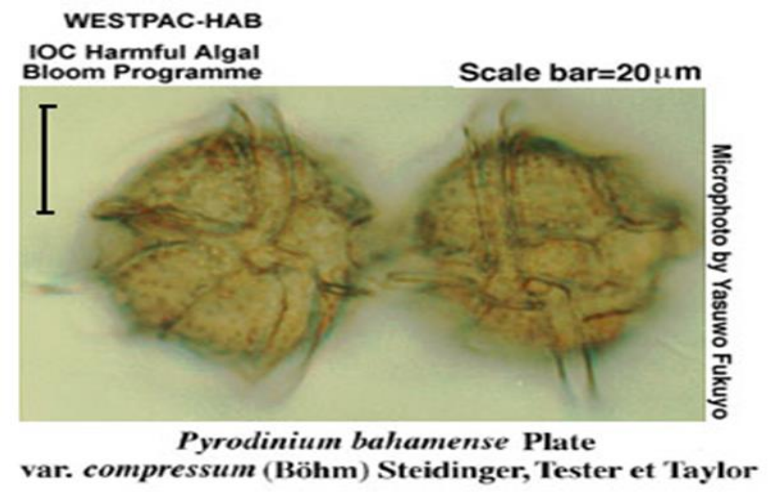
Some **HABs have characteristics of both**.

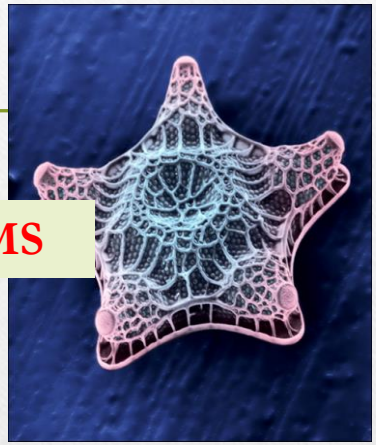


WHAT ARE ALGAL BLOOMS?

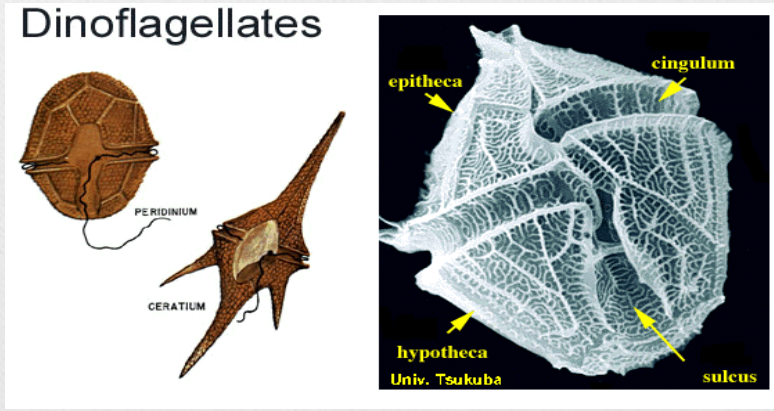
- **Red tides/algal blooms, bloomings : naturally occurring** with rapid increase in the **population of algae** in a water system.
- **Blooms look like reddish-brown to greenish-yellow floating debris, and may extend for several miles.**
- **Blooms result from:** Sunlight, **Climate Change;**, Slow-moving water, **nutrient enrichment**; **intense upwelling, land run-off or other sources.**
- There is no officially recognized **threshold** level as to what is defined as a bloom

HARMFUL ALGAE
toxins = biotoxins





DIATOMS



HOW BLOOMS LOOK LIKE?

Algal bloom (akasio) by Noctiluca spp. in Nagasaki

Cyanobacteria blooms are often called blue-green algae. Algal blooms may occur in freshwater as well as marine environments

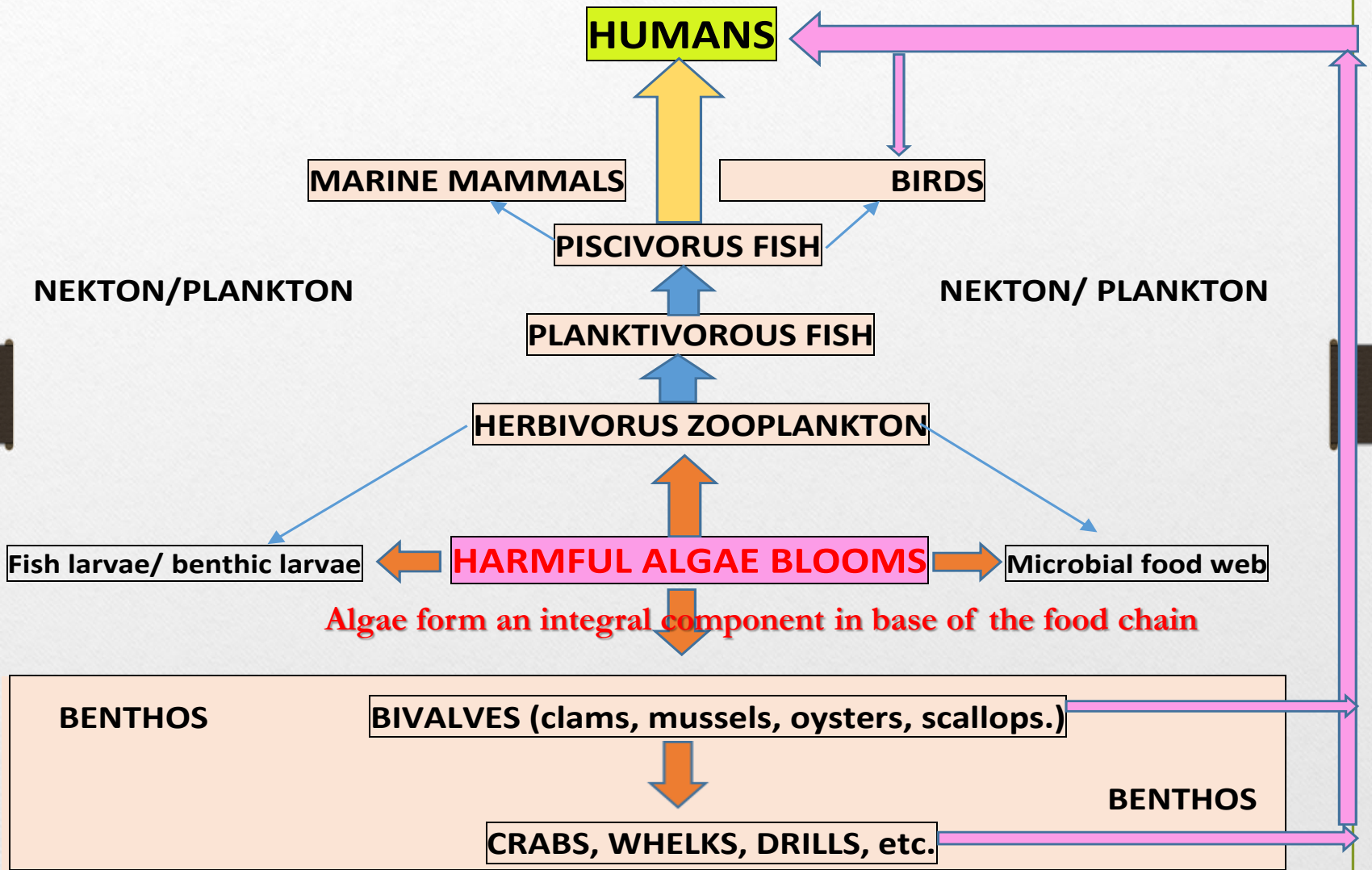
An example of foam produced during a *Phaeocystis* bloom in the North Sea. This material is unsightly and bothersome to coastal residents, but it also can coat fishermen's nets, causing fish avoidance.

Noctiluca scintillans At night, water can have an appearance of sparkling light due to the **bioluminescence** of dinoflagellates

HOW BLOOMS LOOK LIKE?

Olive green discoloration of the waters of **False Bay (RSA),** by G. mikimotoi - **faunal mortalities**, and **NSP** and **aerosol toxins** causing skin and respiratory irritations to **humans**. Courtesy: G.C. Pitcher. 30 tons Abalone killed.

ECOLOGICAL OF ALGAL TOXINS



KNOWN AND SUSPECTED TOXIC DINOFLAGELLATES

- Alexandria (Gonyaulax) tamarense
- Alexandria catenella (PSP)
- Amphidinium carterae
- Dinophysis acuta
- D. acuminata
- D. norvegica
- Cochlodinium polydridoides
- Gambierdiscus toxicus (Ciguatera)
- Gyrodinium estuariale
- Gymnodinium
- Gymnodinium breve (NSP)
- *Pyrodinium bahamense*
- *Pfiesteria piscicida*
- *P. shumwayae*
- *Prorocentrum micans (Hydrogen Sulfite poisoning) "black tide"*

KNOWN AND SUSPECTED TOXIC BLUE-GREEN ALGAE

- Anacystis
- Anabaena circinalis
- Anabaena spp.
- Anabaenopsis
- Aphanizomenon sp.
- Nodularia spumigena
- Cylindrospermopsis raciborskii
- Hapalosiphon
- Lyngbya
- *Microcystis spp. (heptotoxin & neurototoxins)*
- *Nodularia*
- *Nostoc*
- *Phormidium*
- *Planktothrix*
- *Schizothrix*
- *Trichdesmium*
- *Umezakia*

KNOWN AND SUSPECTED HARMFUL AND/OR TOXIC DIATOMS

- Chaetoceros convolutus
- C. concavicornis
- C. danica
- **Pseudo-nitzschia australis (ASP)**
- P. multiseries
- P. pungens

PUBLIC HEALTH PROBLEMS ASSOCIATED WITH HABs

Illness	Causative organism	Toxin produced	Symptoms
Amnesic shellfish poisoning (ASP) Discord in 1987 in Canada	**Pseudo nitschia spp. Seen in bivalves, sardines, anchovies**	**Domoic acid, neurotoxin**	headache, dizziness, disorientation, vision disturbances, causing short-time memory loss, brain damage and death in severe cases. Gastro intestinal disorders
Ciguatera poisoning (Gigua .P)	**Gambierdiscus toxicus, Prorocentrum sp., Ostreopsis ; Coolia monotis, theadimium sp. Amphidinum cartera**	**Ciguatoxins, maitotoxin**	**Diarrhea, nausea, vomiting, abdominal pains, neurologic disfunction, muscular aches, dizziness, anxiety, sweating, numbness**
Diarrhetic shellfish poisoning (DSP)	**Dinophisis**	**Okaidic acid**	**Diarrhea, nausea, vomiting, abdominal cramps and chills**
Neurotoxic shellfish poisoning (NSP)	**Gymnodinium breve**	**Brevetoxin**	Affects both humans and animals through inhalation and ingestion. Dermal contact, such as through swimming in the red tides paresthesia (tingling), reversal of hot-cold temperature sensation, myalgia (muscle pain), vertigo, ataxia (loss of coordination), abdominal pain, nausea, diarrhea, headache, bradycardia (slow heart rate), dilated pupils and as respiratory distress
Paralytic shellfish poisoning (PSP) Pufferfish	**Alexandrium sp. Gymnodinium catenatum, Purodinium bahemense**	**Saxitoxins**	blocking of neuronal sodium channels which occurs in paralytic shellfish poisoning produces a flaccid paralysis that leaves its victim calm and conscious through the progression of symptoms. **Death often occurs from respiratory failure**
Green- algal bloom poisoning (GABP)	**Cyanobacteria**	**Anatoxin-A**	**Loss of coordination, muscular fasciculation, convulsions and death by respiratory paralysis, Kill livestock, wildlife, humans** and cyanotoxin with acute neurotoxic **Very fast death factor**

HABs IMPACT

- **SOUTH AFRICA:**
- **5 million of mussels killed in Eland Bay**
- **30 tons of abalone killed after blooming**
- **60 tons of Rock Lobsters dead following red tide**
- **NAMIBIA:**80% of the Oyster killed in 2010
- **KENYA: 30,000** flamingoes died in 1999, **Lake Bogoria**, Kenya Wildlife Service. (cyanotoxin) also high rate of fish mortalities and turtles in **Kiunga National Marine Reserve,**
- **Japan : US$500 million in cages culture**
- **US: 82 million**

White mussel mortalities-An estimated five million white mussels Donax serra washed onto the beach at Elands Bay on the west coast of South Africa, following a bloom of Alexandrium catenella in March 1980. (Photograph -D.A. Horstman)

MONITORING TOXIC ALGAE & ALGAL TOXINS

- Secchi disks or other means to monitor turbidity of water prior to entry into plant
- Collection- Biomass (Kemmerer bottle)
- Inverted Microscope and Identification Manual
- Early treatment of reservoir to reduce potential for algal blooms
- Enzyme linked immunosorbent assay (ELISA)/HLPC

BLOOMS PREVENTION

- Herbicide usage but some are toxic to aquatic life
- Copper sulfate more effective but affects fish and mammals at level near levels used to control algae
- decrease the overuse of fertilizers in agriculture and dropping the bulk flow of runoff can be effective for reducing severe algal blooms at river mouths, **estuaries**, and the ocean directly in front of the river's mouth.
- Routine test for HAB

CONCLUSIONS

- Red tides are **increasing** worldwide. climate change and human fertilizers (Nitrogenous and phosphorous) are suspected.
- Few countries are aware and monitor HABs (SA, Namibia Kenya, Morocco and Mauritania…)
- **Little known on Social and economic** of HABs impact
- Lack of HABs **experts**, **material and equipment** to identify, detect and control HABs in the continent
- Species of **toxin- producing algae yet to be determined**
- **Lack of funding** for **Biotoxins** Control Plan for Shellfish Harvesting areas

RECOMMENDATIONS FOR COUNTRIES

- Increase awareness of toxin - producing algae
- Implement preventive measures of HABs: e.g. routine monitoring of Lakes and rivers through adoption shellfish harvesting closures to **protect humans and livestock**
- Control fertilizers usage/ monitor water contamination in ponds and cages
- Organize **capacity building** for vets or fish quality control inspectors
- Facilitate funding for QC laboratories equipment for HABs detection of
- Regional collaboration on sampling for monitoring of the HABs
- Monitor link between climate Change and Harmful Algal Blooms

RESEARCH NEEDS

- Develop an African Ecology and Oceanography of HABs Research Program.
- Seek US – Technical Assistance on Monitoring Response for Harmful Algal Blooms Research on waters and shellfish monitoring
- Develop at national and/or sub regional levels a **Biotoxins Control Plan for Shellfish Harvesting**
- Technical assistance for the creation of regional accredited reference laboratories on HABs detection