

Harmful Algal Blooms (HABs) and the Chesapeake Bay

Photo: Donglai Gong

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CBNERR Discovery Lab
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VIRGINIA INSTITUTE OF MARINE SCIENCE

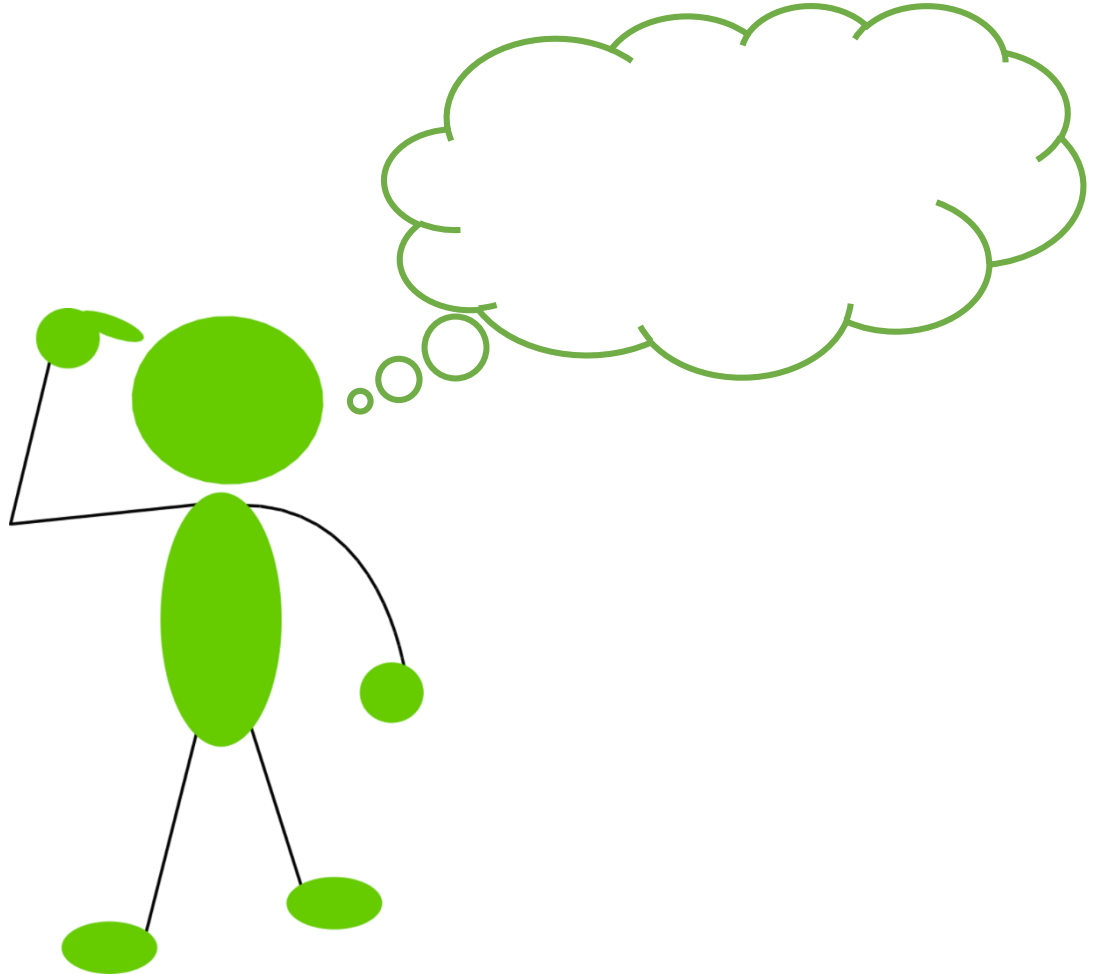
Alexandrium monilatum bioluminescence





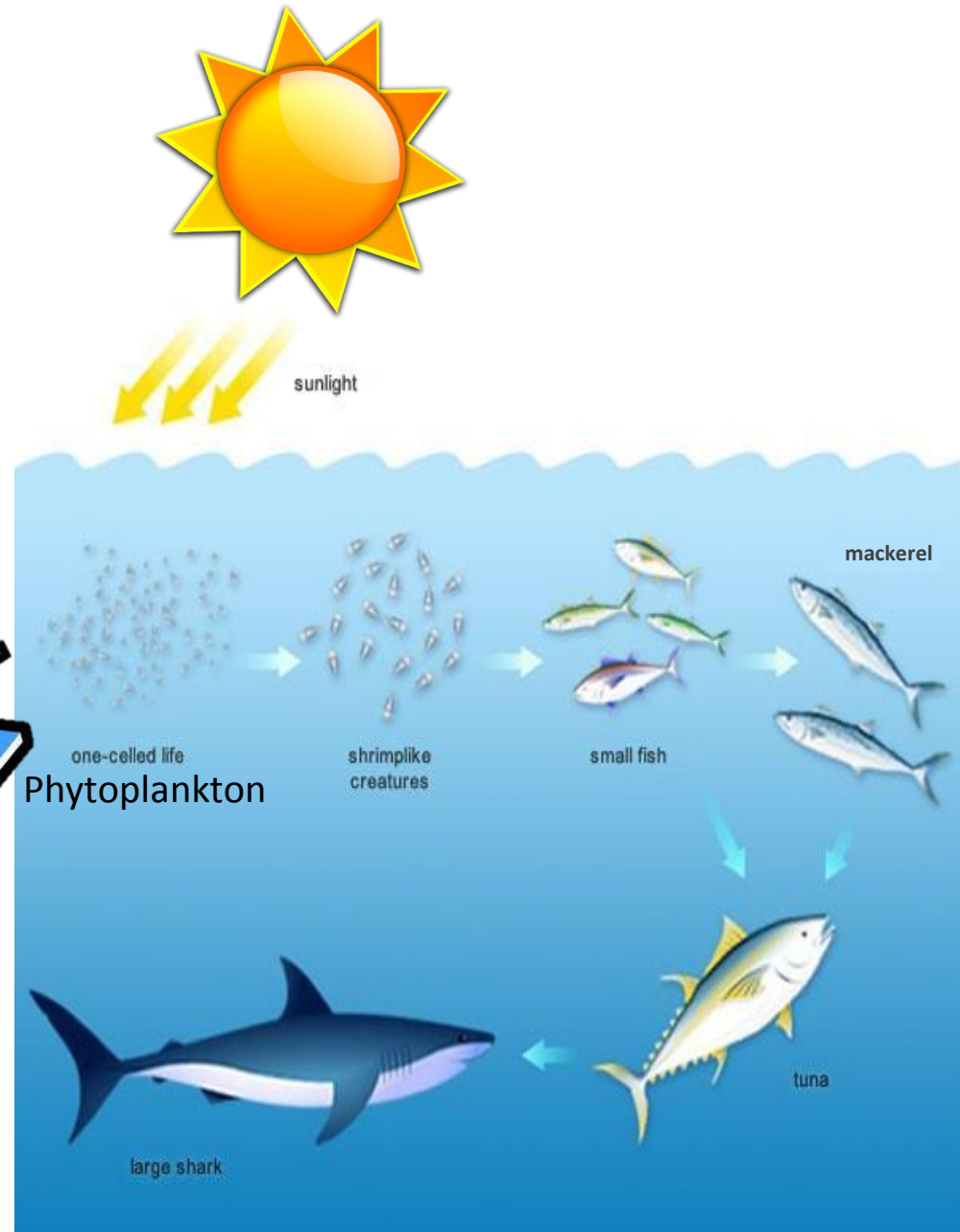
**What happens to
bioluminescent
phytoplankton during
a solar eclipse?**

What do you know about
phytoplankton?

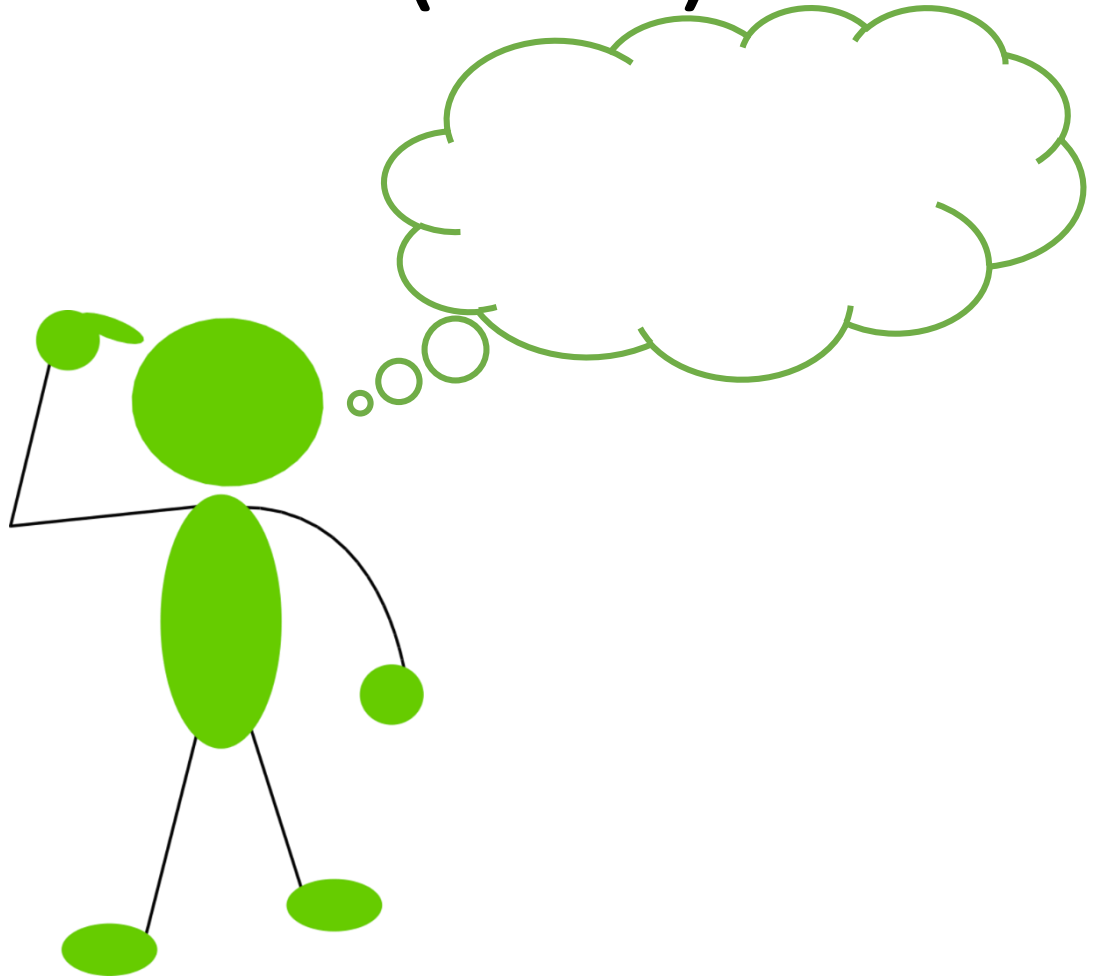


Phytoplankton

- **Microscopic**, usually made up of just one cell
- **Photosynthetic** – get energy from the sun
- Base of the food web in aquatic ecosystems



What do you know about
harmful algal blooms (HABs)?



What is a harmful algal bloom (HAB)?



Bloom of *Noctiluca scintillans*
in Australia

- Also called “red tide” or “brown tide”
- Rapid increase in phytoplankton
- Usually one or a few species
- Lasts days to weeks
- Occur in fresh and salt water
- HABs have a long history...

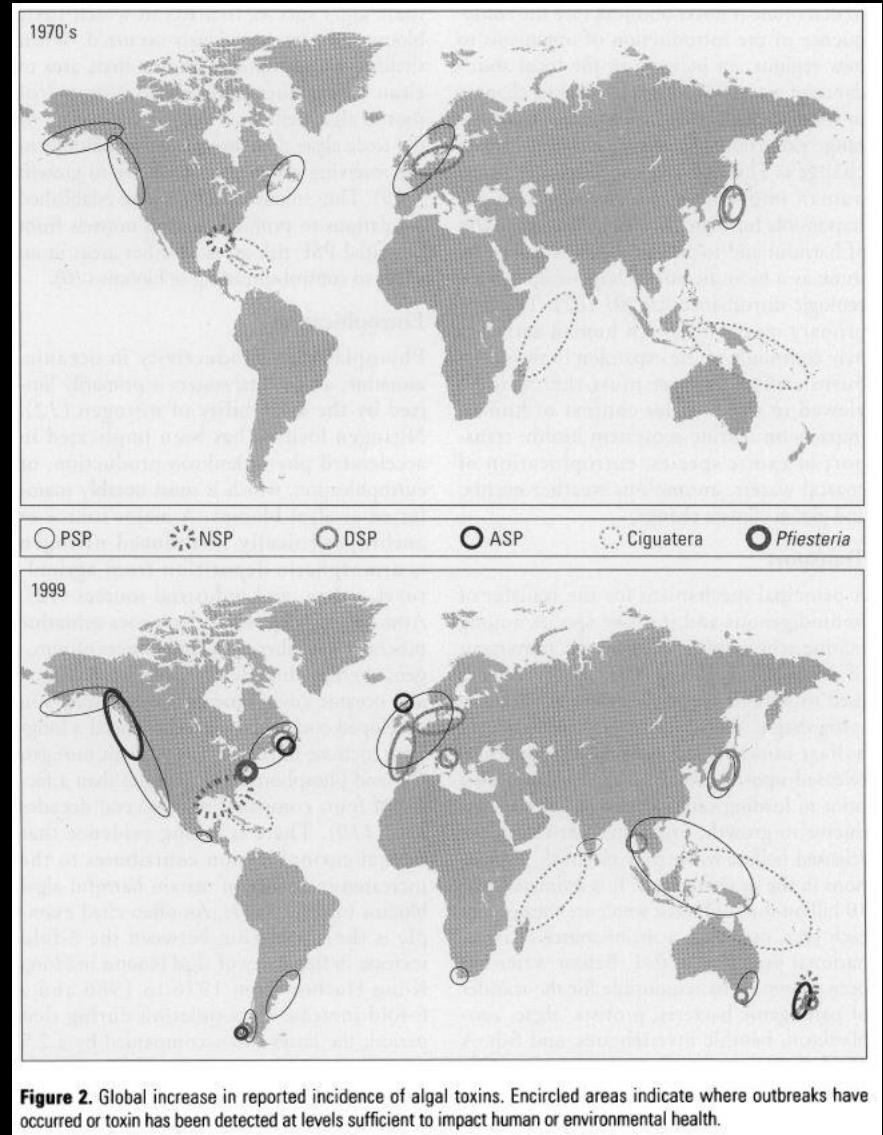
Recent worldwide increase in harmful algal blooms



Range



Frequency



As reviewed in:

Landsberg 2002; Heisler *et al.* 2008; Paerl and Huisman 2008

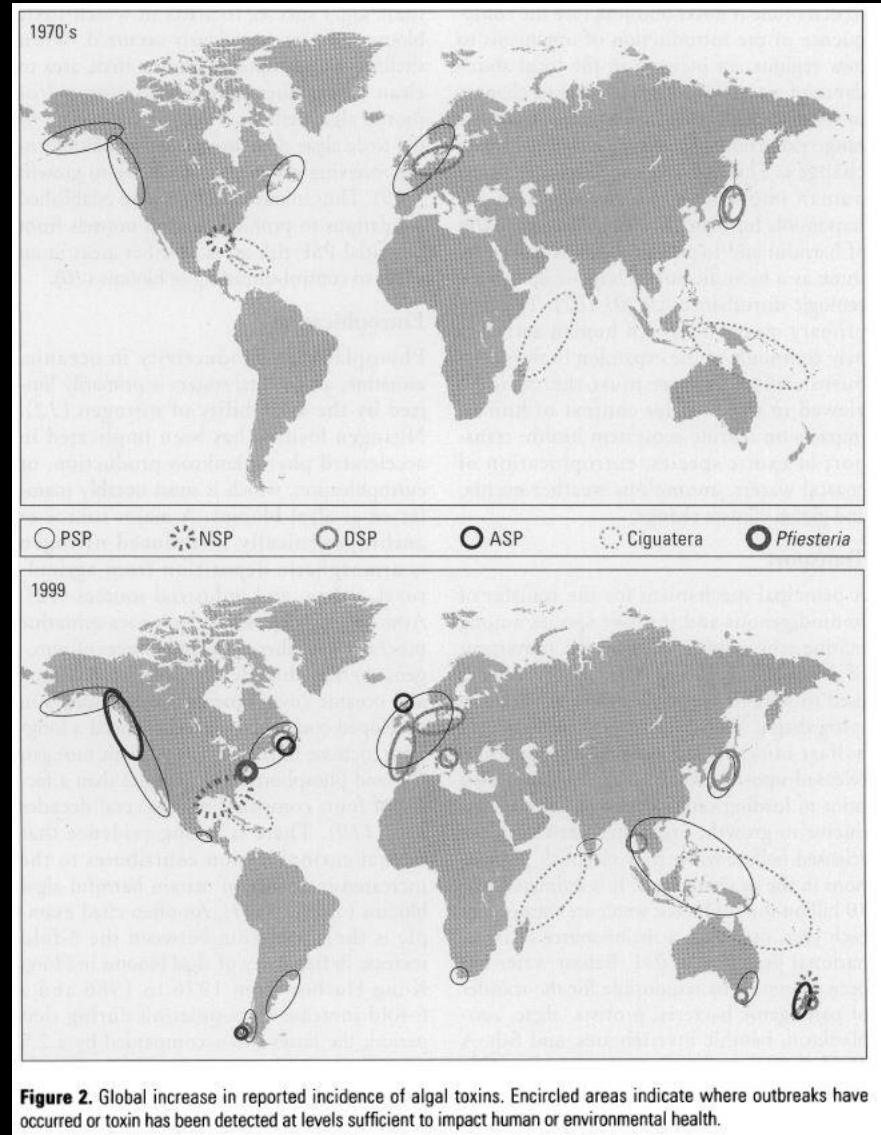
Recent worldwide increase in harmful algal blooms



Water temperatures



Nutrients



As reviewed in:

Landsberg 2002; Heisler *et al.* 2008; Paerl and Huisman 2008

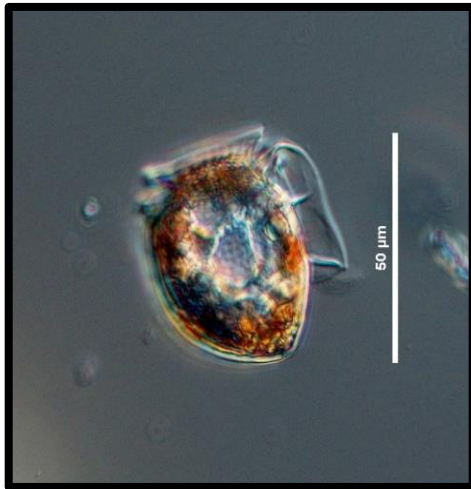
Toxin-producing algae can be found in Chesapeake Bay every year.



Photo: Wolf Vogelbein

Alexandrium monilatum bloom in the York River, 2015

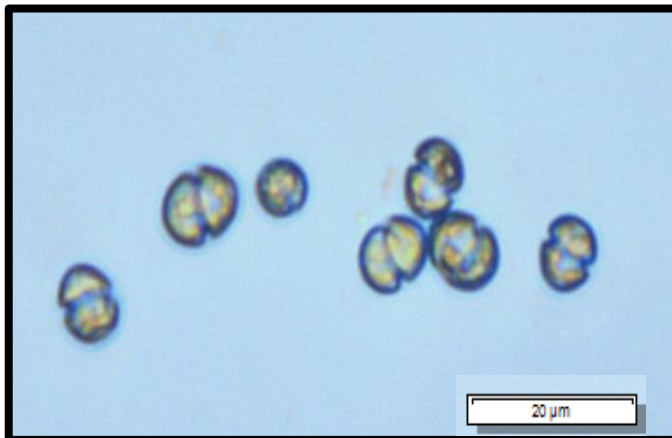
HAB species of the Chesapeake



Dinophysis acuminata



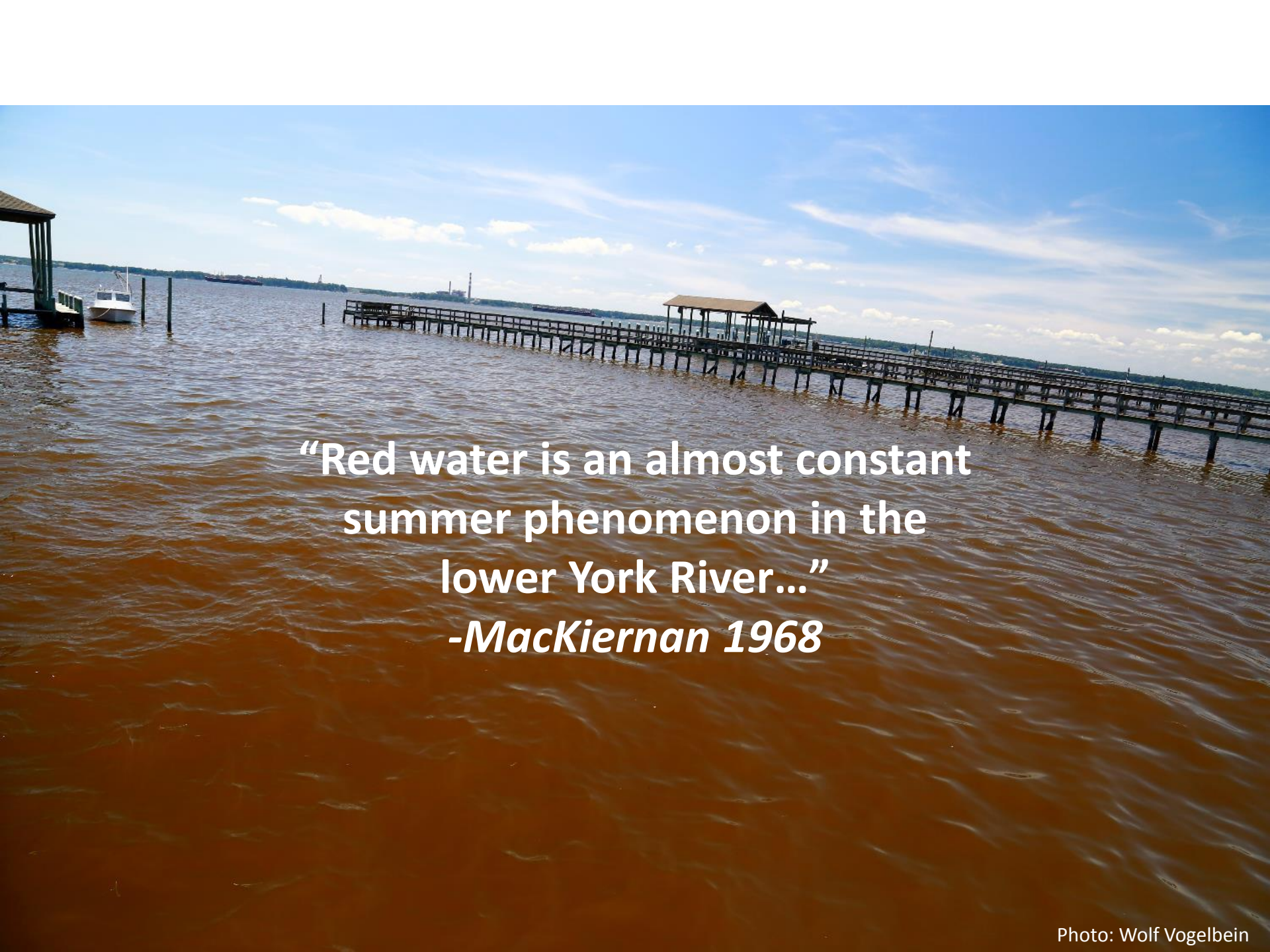
Cochlodinium polykrikoides



Karlodinium veneficum



Alexandrium monilatum



**“Red water is an almost constant
summer phenomenon in the
lower York River...”
-MacKiernan 1968**

How are HABs harmful?

- Dying blooms decompose, using up oxygen in the water
 - ❖ Mortality of aquatic organisms
- Produce toxins
 - ❖ Mortality of aquatic organisms
 - ❖ Human illness



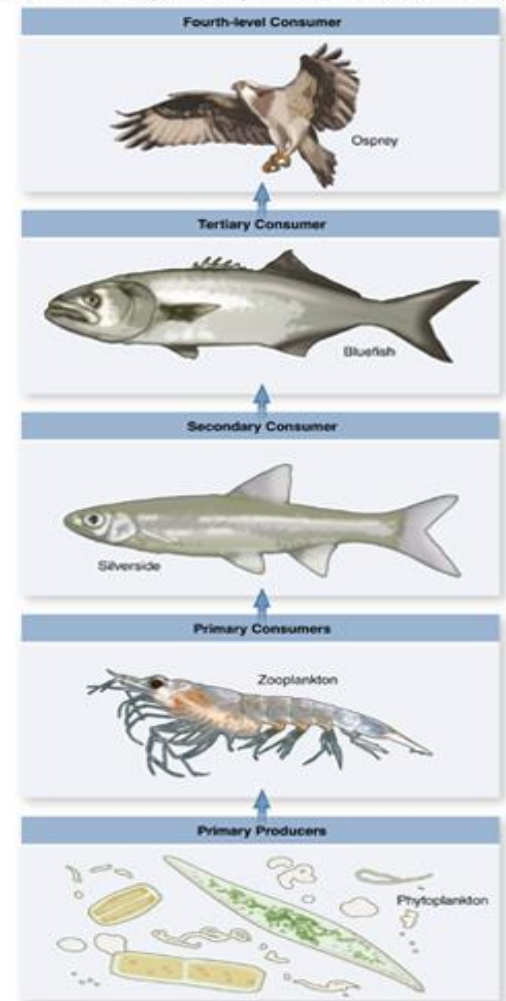
Fish kill in Crystal Lake, Iowa

Biomagnification

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What is **biomagnification**?

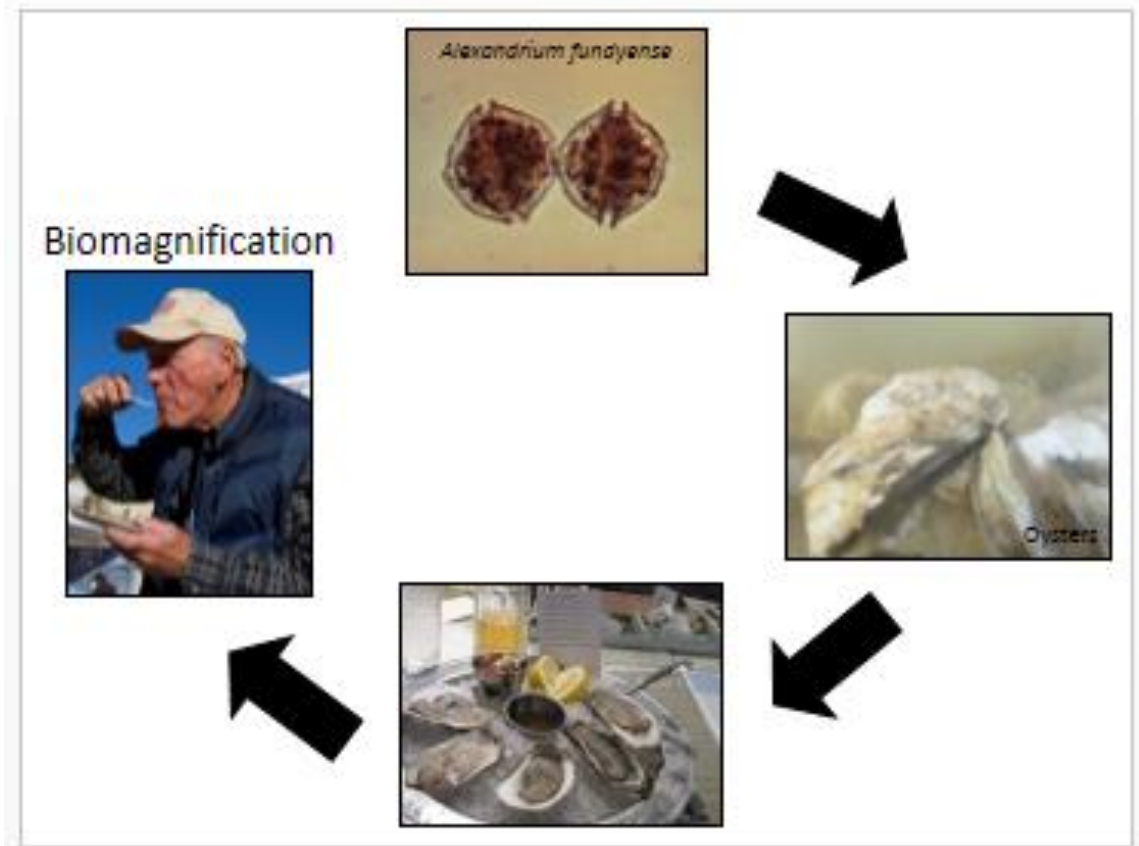
Biomagnification is the phenomenon where toxins end up in higher concentrations in animals higher up the food web due to food web transfer.



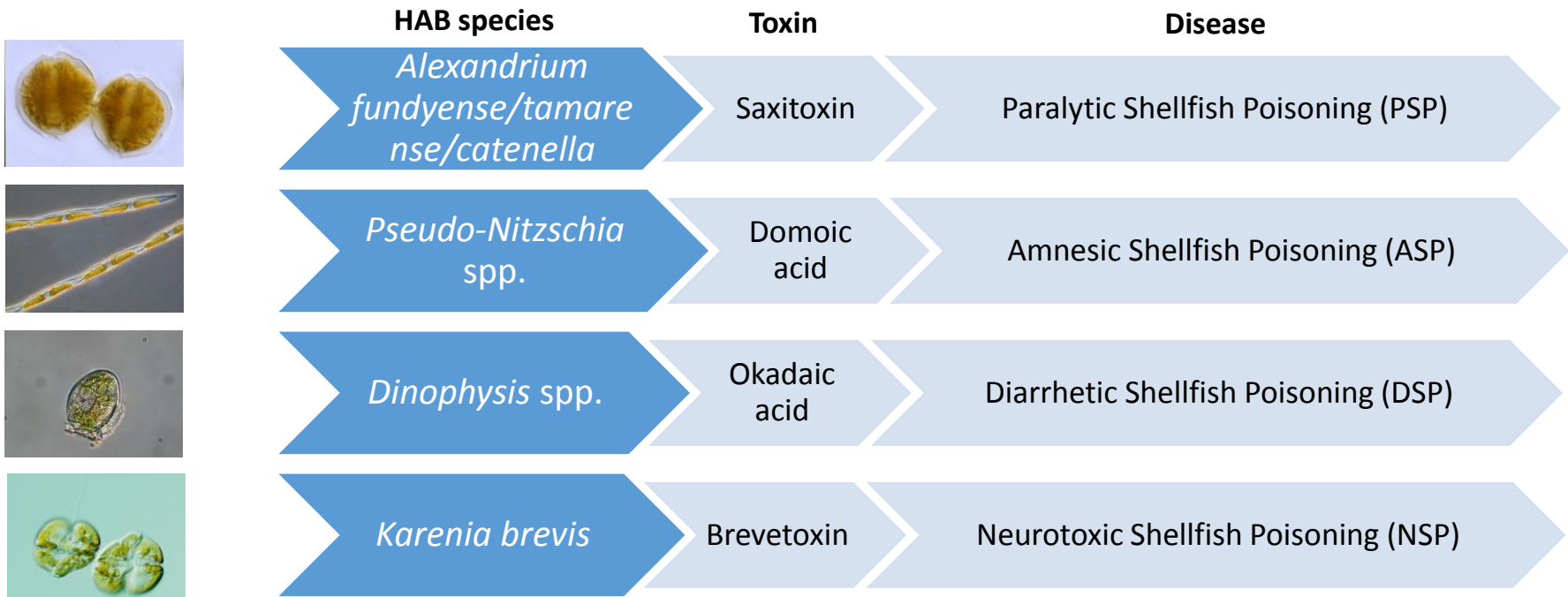
(b)

Biomagnification

- Phytoplankton
- Shellfish
- Humans



Shellfish Poisoning Diseases



How do we keep people safe?

- Monitoring
- Preventative closures



DANGER 

TOXIC SHELLFISH
DO NOT EAT clams, oysters, mussels, or scallops.

Shellfish in this area are unsafe to eat due to biotoxins.

위험! 치명적인 독성 조개류. 먹지 마십시오!
Nguy Hiểm! Nghêu sò bị nhiễm độc. Đừng ăn!
ប្រោះថ្នាក់! សូមកុំទទួលបានសត្វសត្វខ្យងខ្យងរៀងស្រីដែលមានជាតិពុលអាប៊ីតុកស៊ីន!
¡Peligro! Mariscos tóxicos. ¡No comer!
Опасно! Ядовитые моллюски. Не употреблять в пищу!
ອັນຕະនາម! ສັດນ້ຳປະເພດນີ້ເປັນອາຫານທີ່ມີສານເປື້ອ. ຫ້າມກິນ!
危險！有毒的貝類。切勿食用！.....

Always check the shellfish safety hotline:
1-800-562-5632 or
www.doh.wa.gov/shellfishsafety.htm

For more information, contact:

 
360-236-3330

Where can I get more information about local HABs?



Virginia Department of Health > Environmental Epidemiology > Harmful Algal Blooms (HABs)

Contact Us
Beach Monitoring
Vectorborne Disease Control
Waterborne Hazards Control
Zoonoses
Rabies Control
Harmful Algal Blooms (HABs)
Algal Bloom Surveillance Map
HAB Resources
Cyanobacteria
HAB Task Force
What are Harmful Algal

HARMFUL ALGAL BLOOMS (HABS)



HAB Hotline: 1-888-238-6154

NEW - [Click Here to Report a HAB Online](#)

Algae are naturally-occurring microscopic organisms that are found in fresh and salt waters of Virginia and around the world. Many are beneficial because they are major producers of oxygen and food for many of the animals that live in these waters.

Most algae do not harm people, wildlife, or the environment. But some types of algae in Virginia can be dangerous. Algae species in fresh and salt water may multiply rapidly when environmental conditions are favorable for their development. The great number of algal cells in the water results in what is called an algal bloom.

A bloom often (but not always) results in a color change in the water. Algal blooms can be any color, but the most common ones are red or brown and are known as either "red" or "brown" tides. Most algal blooms are not harmful but some do affect fish and humans, as well as other animals like birds and marine mammals. These are known as Harmful Algal Blooms (HABs).

If water is discolored, murky, has an odor, or if there appears to be a film on the water surface, swimming is not advised for humans or pets. Please contact the HAB Hotline to report your observations and so that surveillance of the area can be conducted.



U.S. EPA - Algal Blooms Can Harm Your Health



Freshwater HABs

Cyanobacteria

- Look like blue-green scum on the water's surface or like flaky paint chips in the water
- Can occur in natural or man-made lakes, ponds, and reservoirs
- Can be problematic when blooms occur in drinking water sources (Toledo - Lake Eerie)
- Never let children or dogs play in, or drink, water from a cyanobacteria bloom!

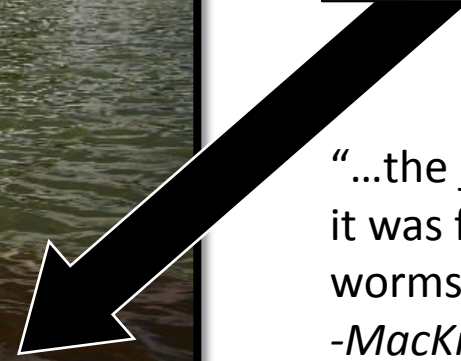


Cyanobacteria bloom in Florida

What would you do to study this bloom?



“...the jar looked like it was filled with tiny worms...”
-Mackiernan 1968



Sarah's Creek 2012

Under a microscope...



Chains of *Alexandrium monilatum*

Video: Bill Jones

GIF: <http://i.imgur.com/dAtcCfH.gif>

What does a harmful algal bloom researcher do?



- Field sampling
- Mapping
- Laboratory studies
- Cell identification
- Molecular and genetic testing
- Chemical testing

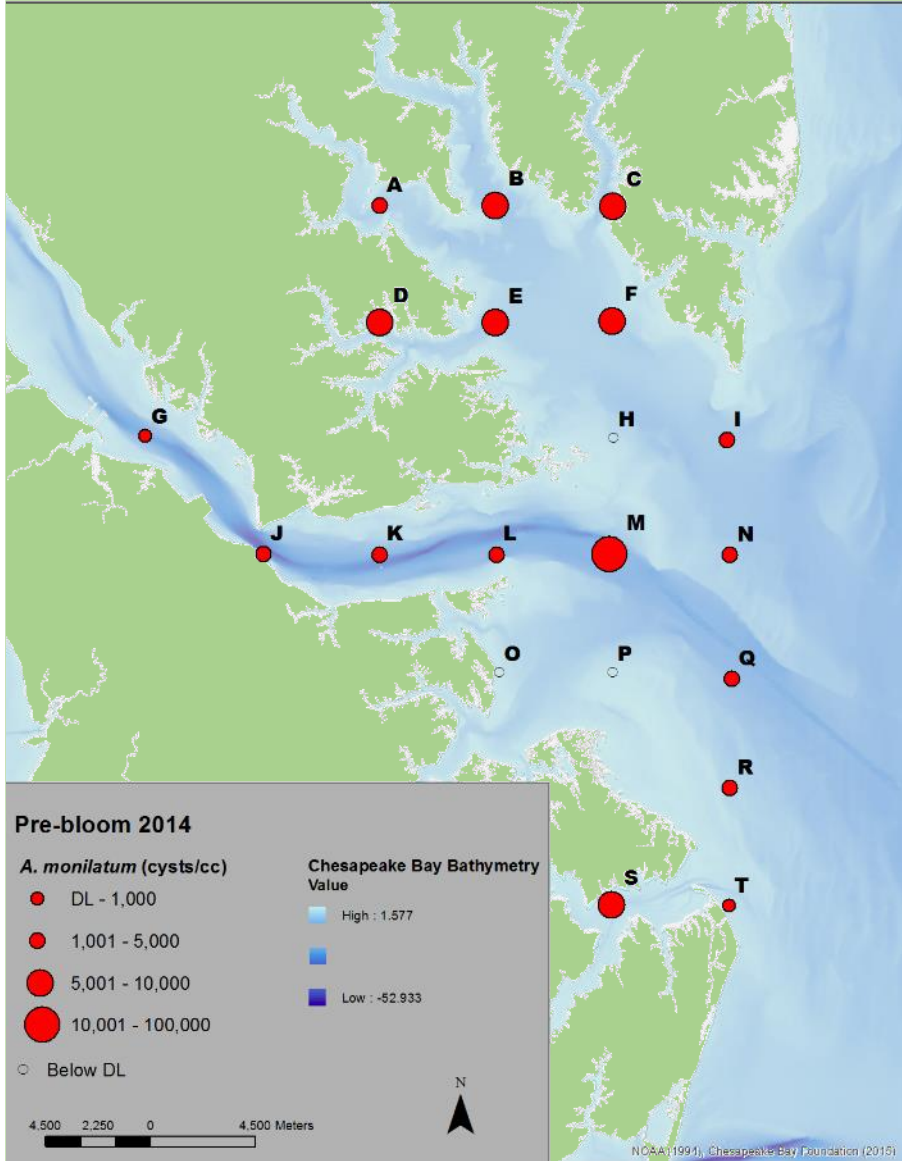




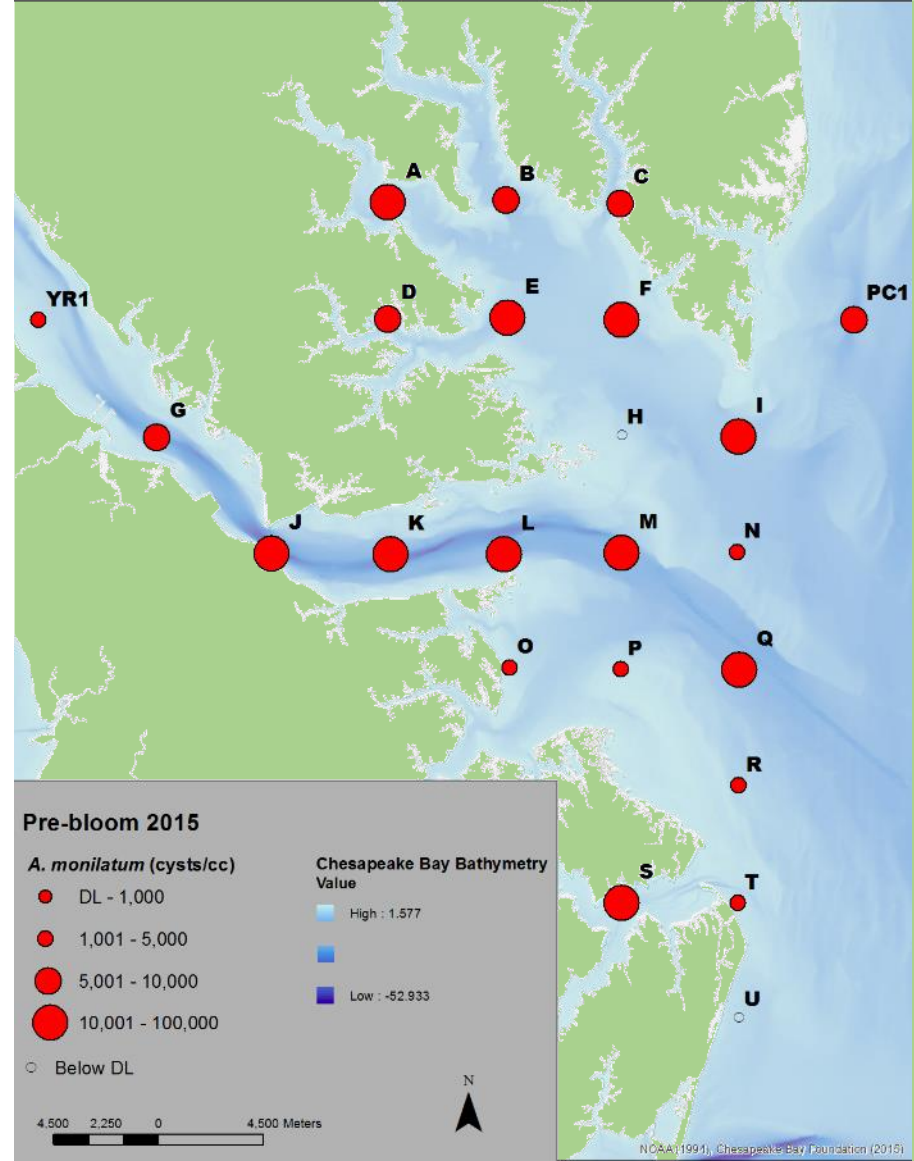
Photo: Donglai Gong

- How does *Alexandrium monilatum* spread from year to year?
- How does it affect oyster health and oyster hatchery production?
- What is the best way to monitor for HABs?
 - Count cells under a microscope
 - Estimate number of cells using molecular methods
 - Quantify the toxins HABs produce

2014



2015

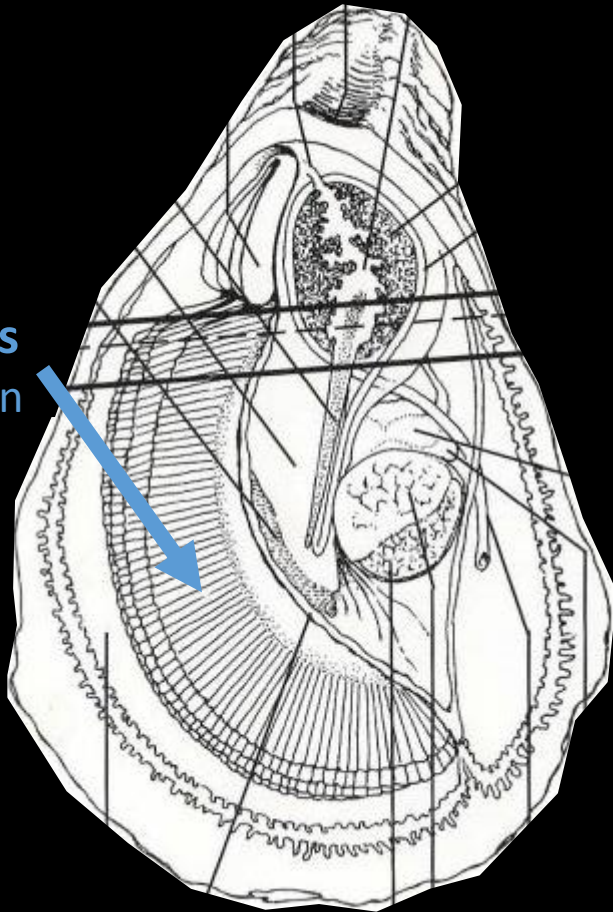


Alexandrium monilatum cyst distribution

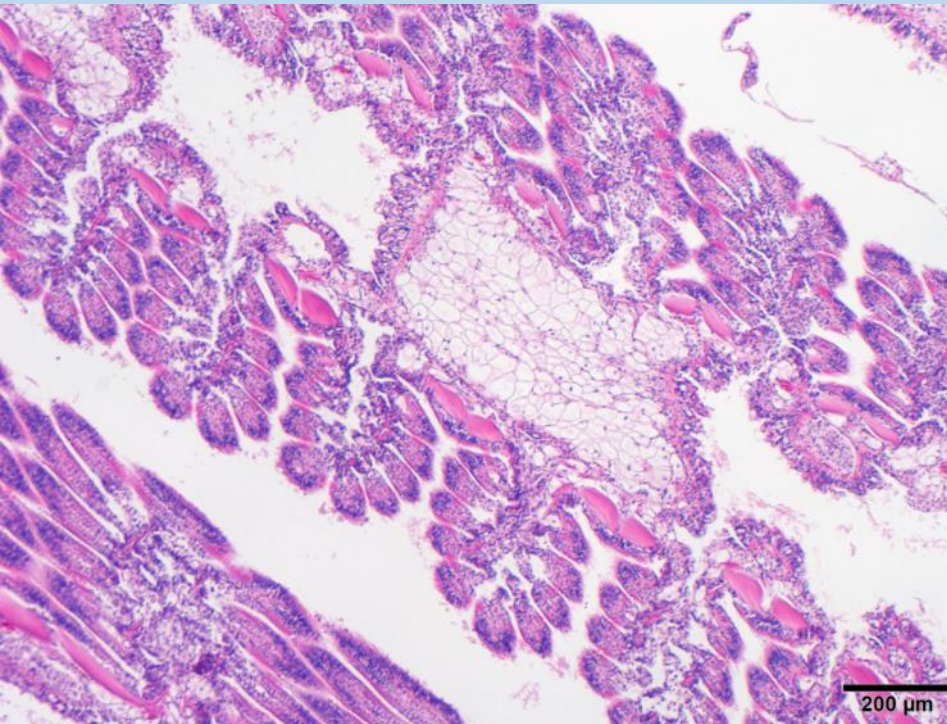
An oyster...

Gills

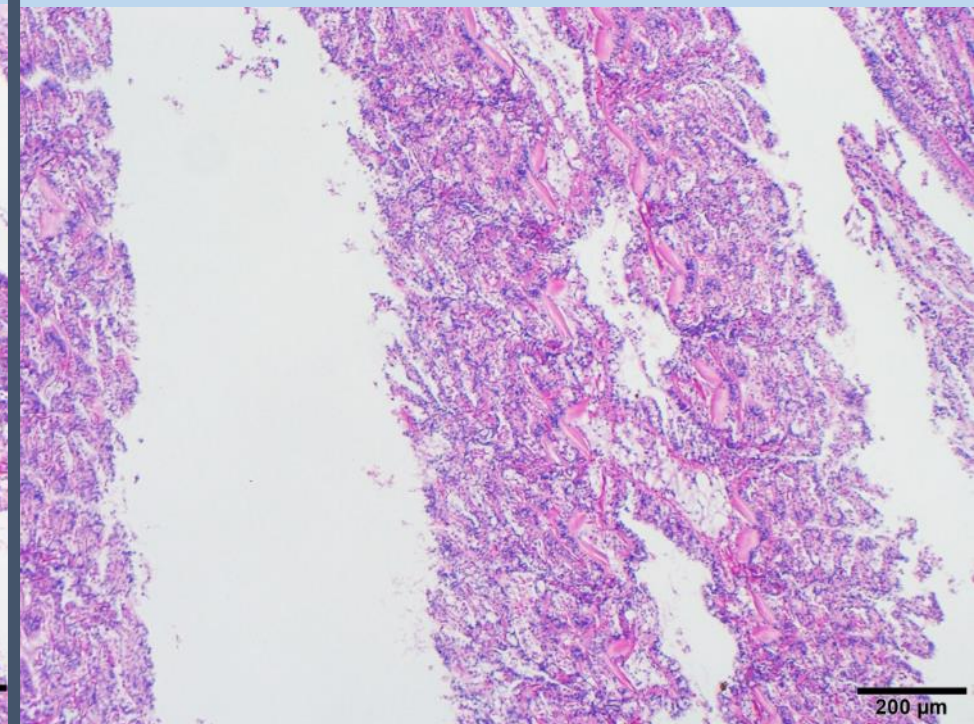
- Respiration
- Feeding



Laboratory exposure of adult oysters to the HAB *Alexandrium monilatum*

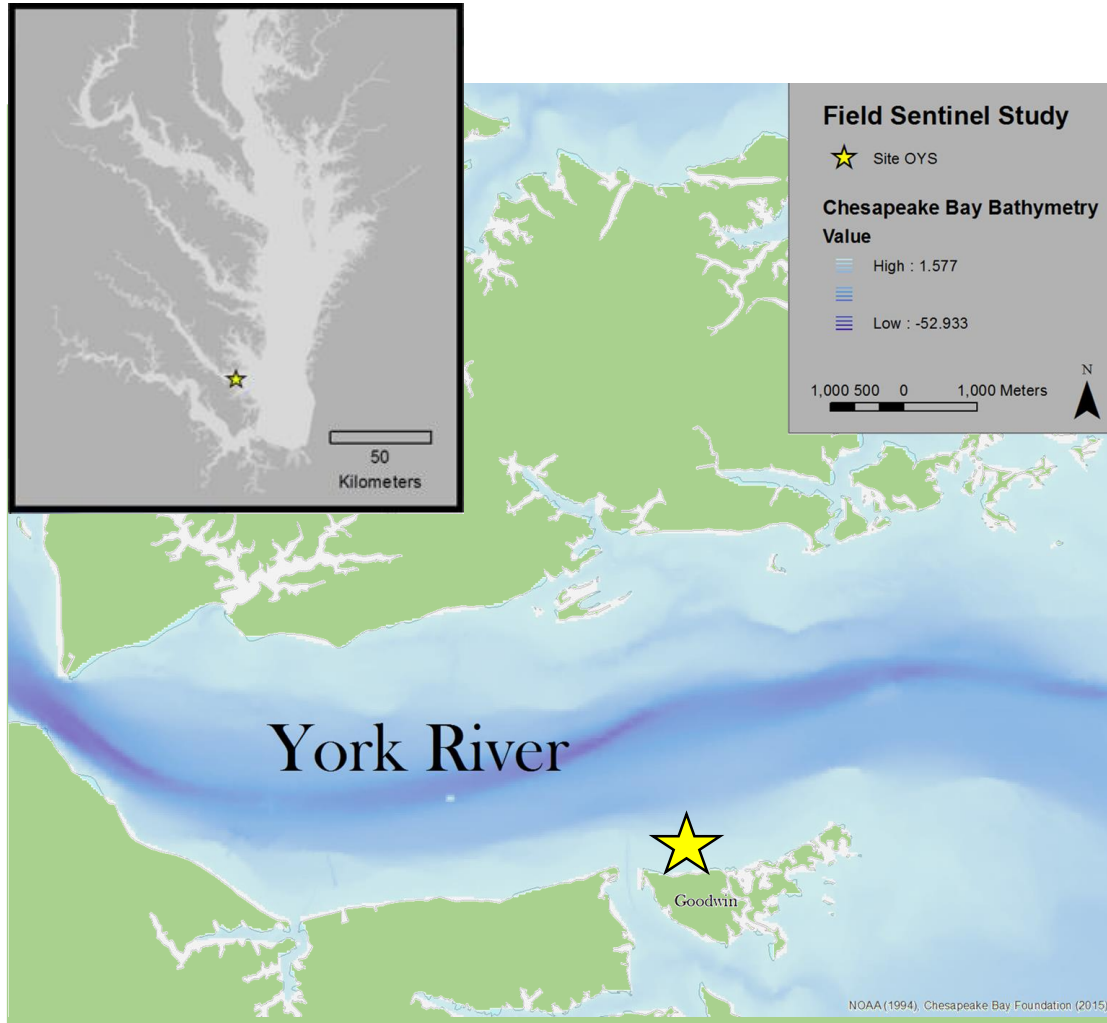


Healthy Gill



Eroded Gill

2015 oyster field study



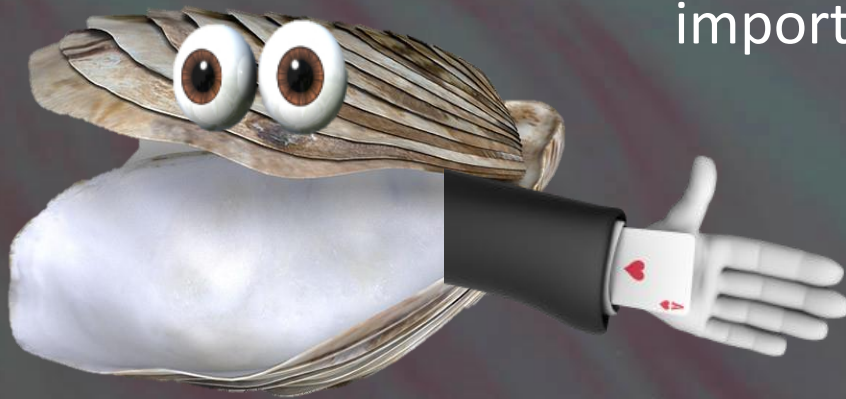
- How do *A. monilatum* blooms impact oysters in the field?
- Oysters sampled for 8 weeks in late summer, overlapping a dense bloom of *Alexandrium monilatum*



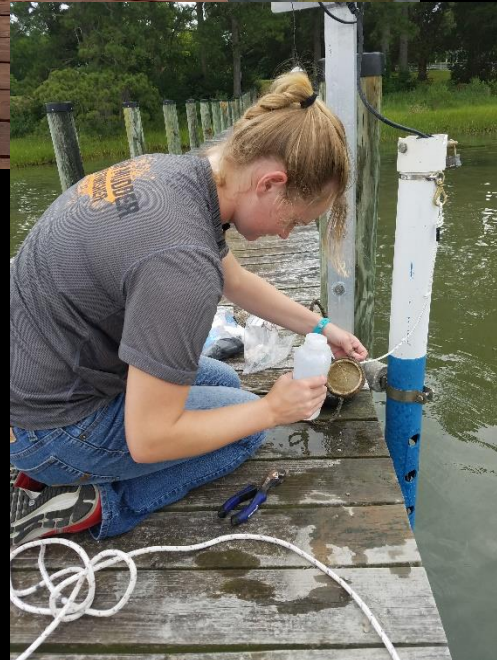
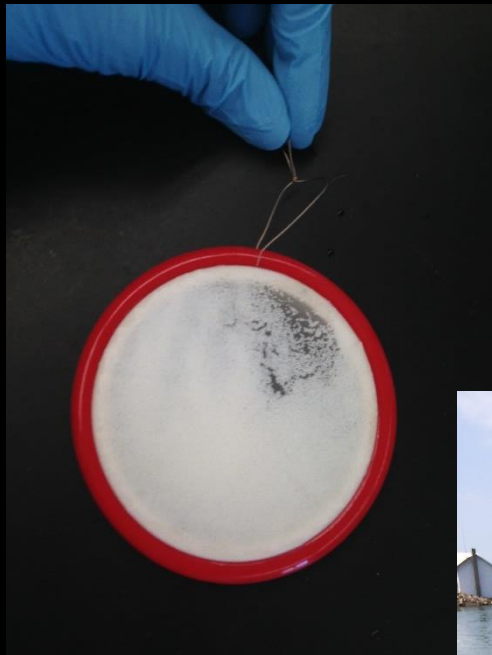
Photo: Janet Krenn

Does *A. monilatum* impact adult oyster health?

- It can, but it doesn't always
- Depends on actual toxin **exposure** and **duration**
- Oyster **avoidance behavior** plays an important role in survival



HAB toxin tracking





Thank you!

Photo: Donglai Gong