Barb
General introduction to EARTH and to C-MORE (center for microbial oceanography: research and education)

Microbes are not all bad – they are essential and critical

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Marine microbes are beneficial and important – probably responsible for every other breath that you take!
But, today the topic will be Harmful Algal Blooms (HABs)

This research started with a research project in high school (1989 Bellarmine High School Marine Chemistry Project)
Nice comparison between 1989 and 2003 research techniques

Harmful Algal Blooms

Proliferation or bloom of a marine algae
Common name is 'red tide' but they are not all red and have nothing to do with tides!
- Some great photos of blooms of different kinds and types

Two modes of harmful impacts
- Non-toxic effects:
  - Brown tides: *Aureococcus anophagefferens* – a small Pelagophyte alga
- Toxic effects:
  - Many different species and impacts on humans
    - Azaspiracid shellfish poisoning (ASP)??

Karenia brevis (NSP)
- Motile dinoflagellate – bloom reports have doubled in the last 30 years!

Pseudo-nitzchia australis
- Diatom - Amnesic shellfish poisoning (ASP)

Alexandrium fundyense (PSP)
- Motile dinoflagellate that can form cysts that are long lasting and that emerge when conditions are beneficial.

Increasing number of HAB's in the last 30 years – actual increase or better identification/reporting?
- Possible mechanisms for more HABs
  - Better dispersal?
  - More researchers/identification
  - More aquaculture
  - Globalization – better/more efficient transport

Nutrient enrichment

Questions:

Phytopia gives students an opportunity to experiment with some of the variables often associated with blooms – but it is important to also ensure that the students know that it is a model.

When the blooms are occurring (given the distribution maps in the talk), are they occurring at the same time? – NO, they occur at all different times and it is difficult to predict or identify what is going on.

How do we detect specific microbial populations?

Water samples – microscope
DNA – sequencing
Chemistry – chemical analysis
Optics – spectrophotometer (density but not species)
Indirect – effects on ecosystem
Observation – satellite, plane images

PSP monitoring – extract and feed to mice. Dead mice = PSP presence, but this is not a great way to track this as it really only identifies presence/absence and is usually after bloom peaks. The numbers of cells/liter and PSP presence in mussels appear to be tightly correlated. But what was the trigger for the bloom? Nutrients? Not quite clear – there is some correlation between the two.

Inorganic phosphate concentration and the bloom: if there isn't enough phosphate, the cells make Alkaline phosphatase to enable them to utilize inorganic phosphate – if there is enough phosphate, then they don't need the enzyme…

And don't forget Whyville and the virtual WHyville Oceanographic Institution (WHOI).

Question:

Graph showing PO4 and cells/ml correlation in 1999. There is an odd inverse relationship depicted near the end of July – there is an initial peak of PO4 followed by a bloom and a drawdown of PO4, but then PO4 goes up again and the bloom diminishes – WHY? Generation time 1-2 days – maybe a delay there, different limiting nutrients.