

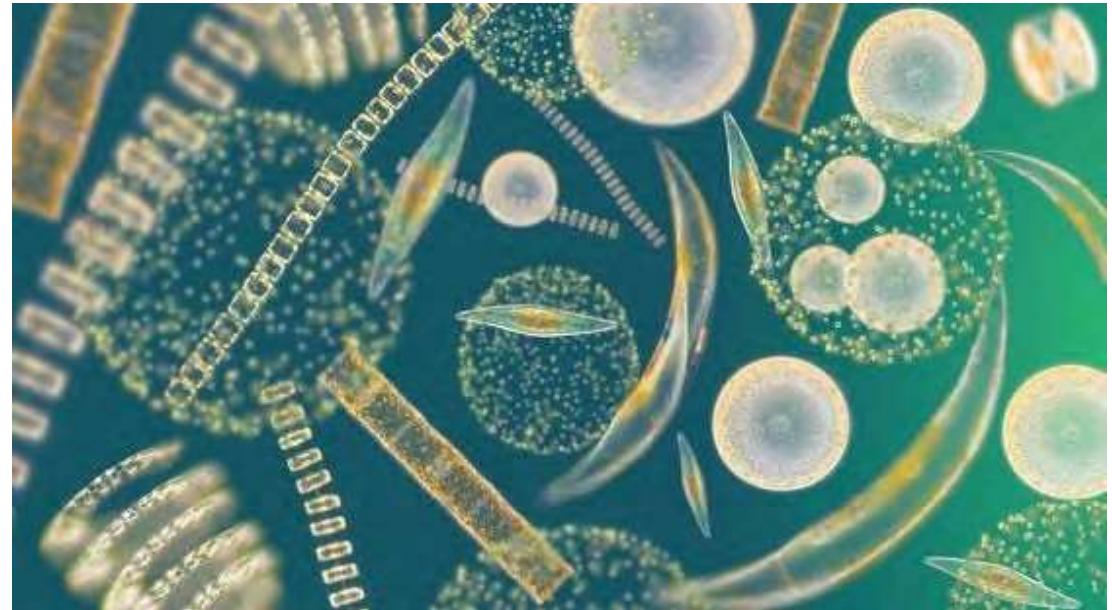
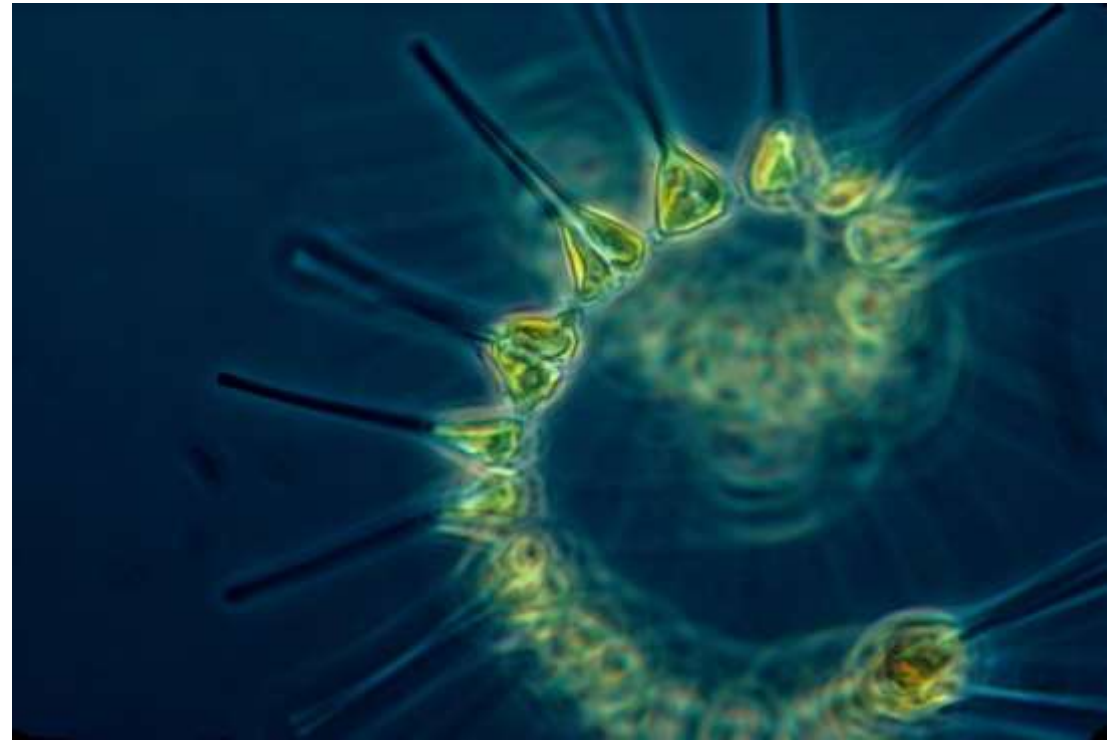


From Fieldwork to Prediction: How scientists forecast Red Tide events

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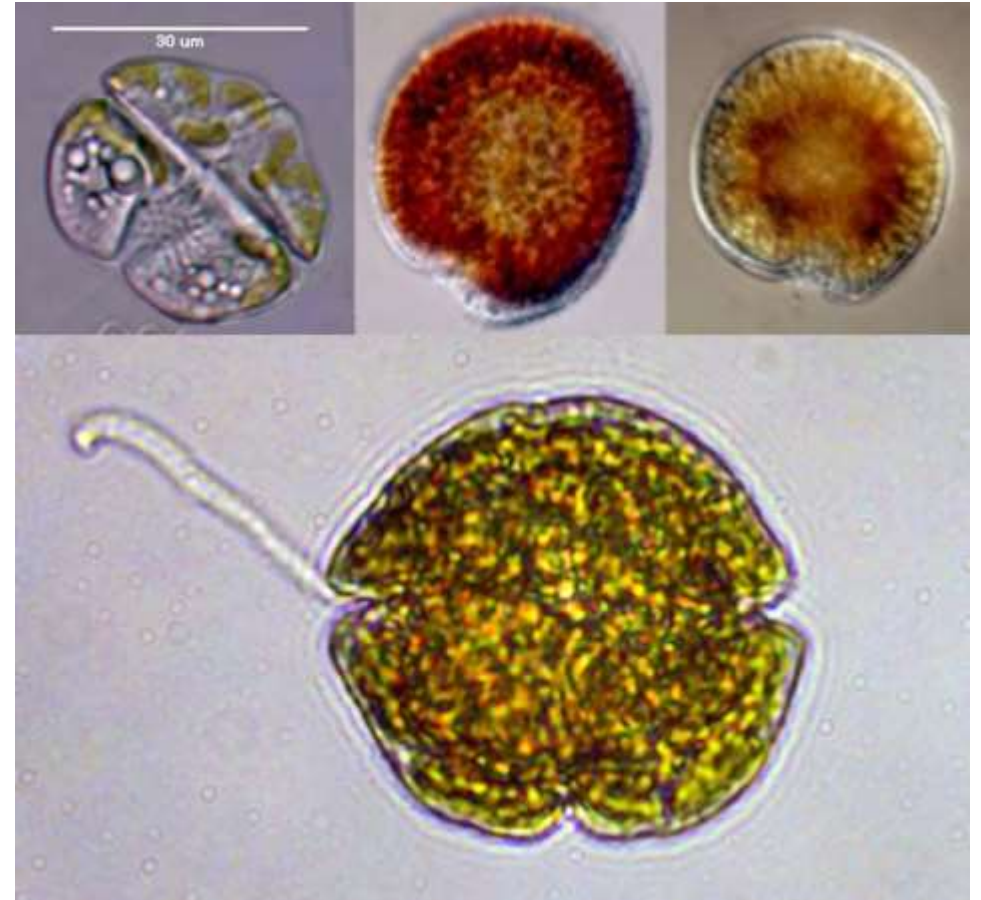
Phytoplankton

- Single celled plants
- Live in fresh and salt water
- “Grass of the sea”, first step of the food chain
- Food for many animals, from whales to anchovies



Harmful Algal Blooms

- When phytoplankton grow and reproduce quickly, they can change the color of the water or form a scum on the surface.
- When the cells die, the decomposing matter removes oxygen from the water.
- Some phytoplankton produce toxins that can be retained in the cells or released into the water.
- Toxins can accumulate in shellfish, fish and other biota.
- Both the toxins and the low oxygen be a health hazard for humans and animals.



What are the risks to health?

- Eating contaminated shellfish or fish
 - Amnesic shellfish poisoning (domoic acid: damages neurons in brain and causes gastrointestinal symptoms, loss of short term memory)
 - Paralytic shellfish poisoning (saxitoxin: gastrointestinal symptoms, loss of coordination, tingling, confusion, slurred speech)
 - Neurotoxic shellfish poisoning (brevetoxin: vomiting, diarrhea, slurred speech)
 - Diarrhetic shellfish poisoning (okadaic acid: diarrhea, vomiting, cramps)
 - Ciguatera fish poisoning (ciguatoxin, others: gastrointestinal symptoms, headaches, hallucinations, numbness, vertigo)
- Toxins can be picked up via drinking water, swimming, breathing spray, consuming contaminated shellfish, and other forms of contact

Where do they occur?



- Neurotoxic shellfish poisoning
- Paralytic shellfish poisoning
- Ciguatera
- Brown Tide
- Pfiesteria Complex
- Farmed Fish Kills
- Amnesic shellfish poisoning

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What causes HABs?

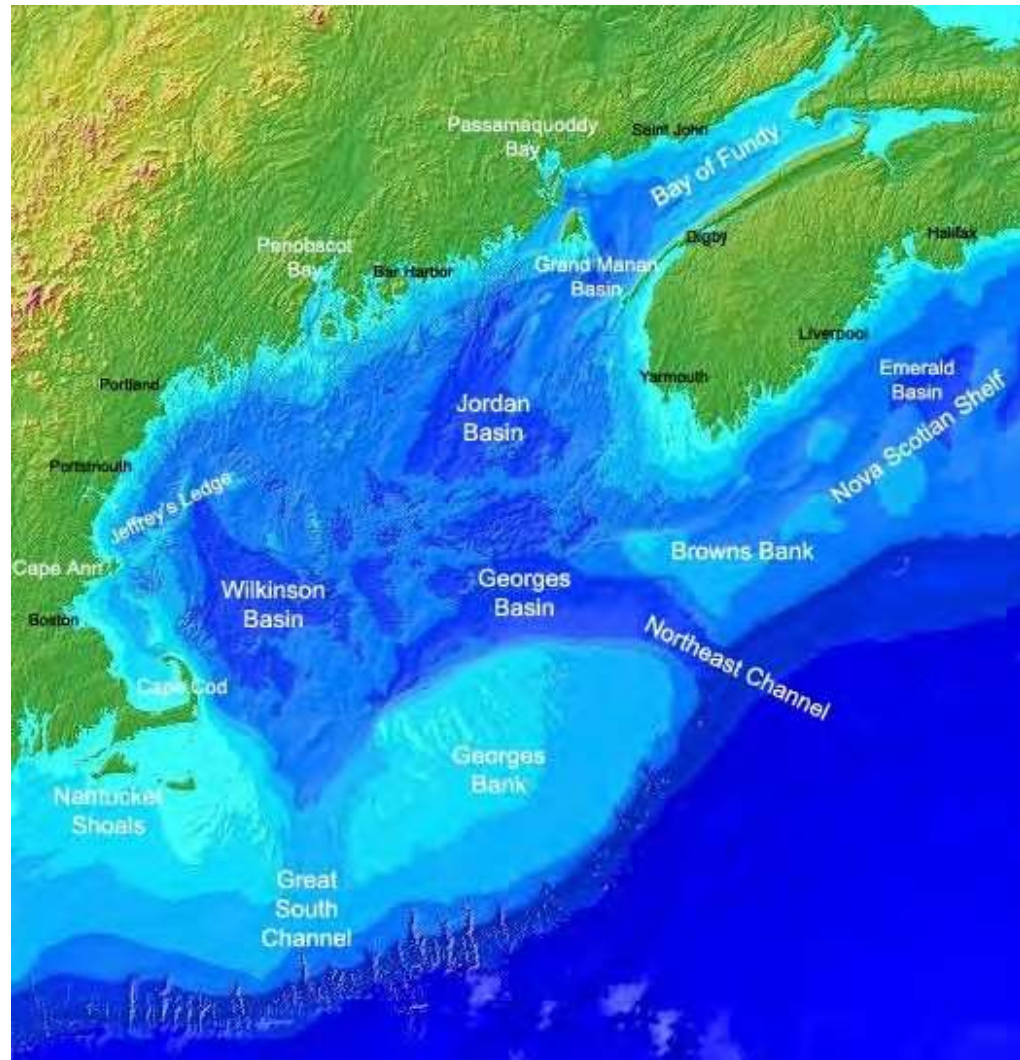
- Phytoplankton occur naturally in marine and freshwater
- Conditions can cause population explosions (blooms)
 - Warm temperatures
 - Sunlight
 - Ocean circulation
 - Too much nutrients
 - Combination of factors



What can we do?

- To stop HABs from occurring?
 - Lakes, bays, and ponds: control nutrients, balance system
 - Oceans: ?
- To limit impacts on people?
 - Educate
 - Better monitoring
 - Forecast
 - Partner to distribute information about coming events

Gulf of Maine

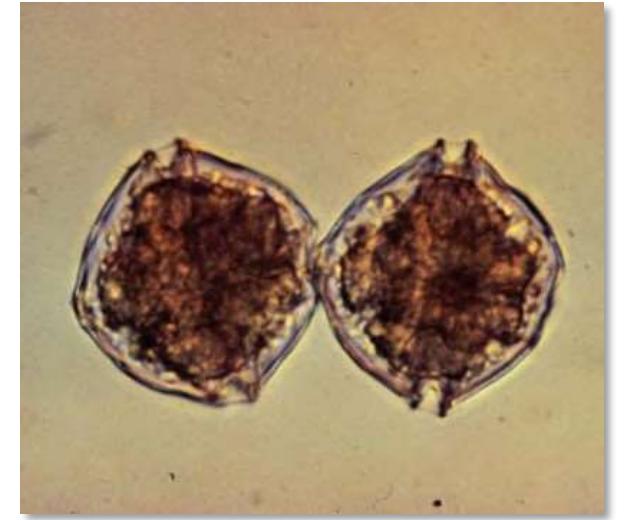


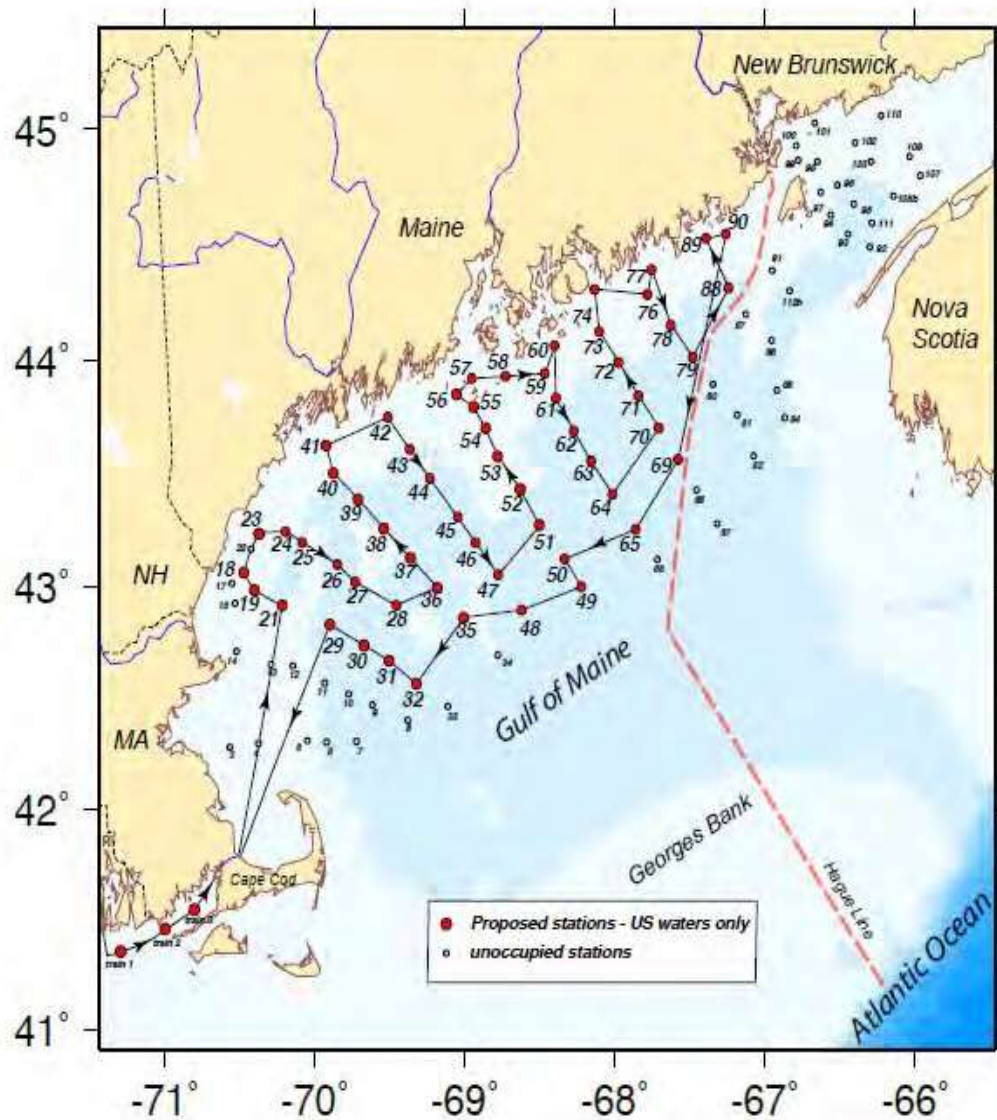
- Important shellfisheries, both commercial and recreational
- Red tide events cause the closure of the shellfish beds, sometimes for the entire year
- Risk of paralytic shellfish poisoning
- Forecasts allow the beds to be closed and opened to protect human health, while still allowing the fishery to exist



How do you create forecast?

- Study the species (*Alexandrium catenella*) and learn what triggers it to bloom
- Create a model that uses environmental variables to predict when and where the species will occur and in what abundance
- Collect data from the field, from satellites and from monitoring stations to create predictions.
- Work with managers to provide them the information they need in a format they can easily use.

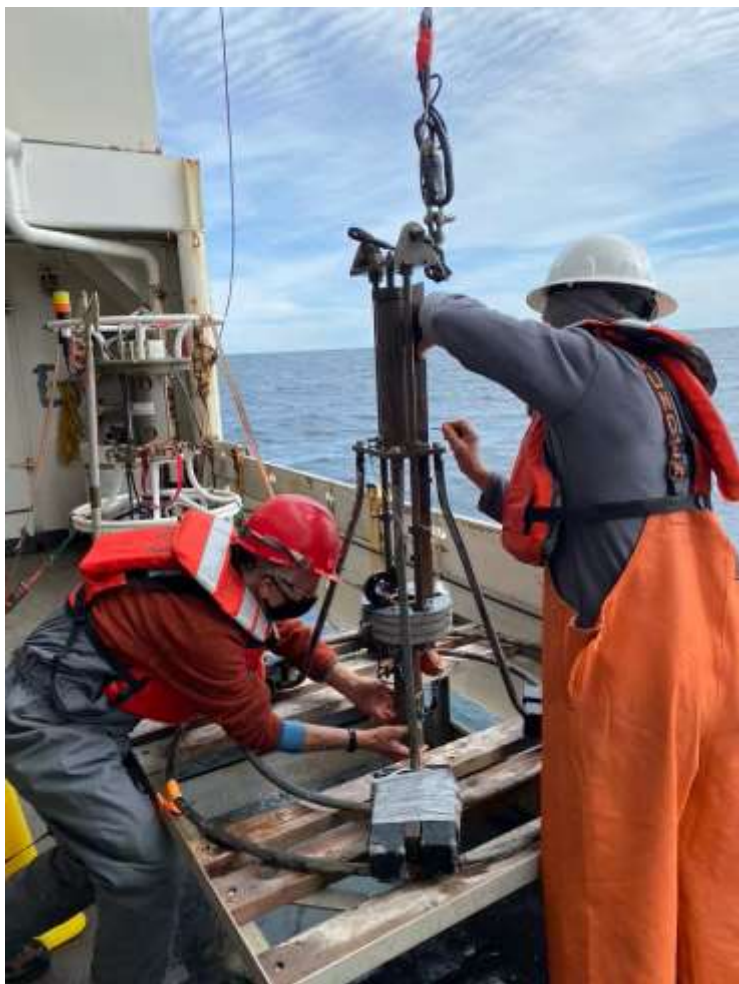




- NOAA vessel Henry B. Bigelow
- Launched Sept 2005
 - 208 ft long fisheries research vessel

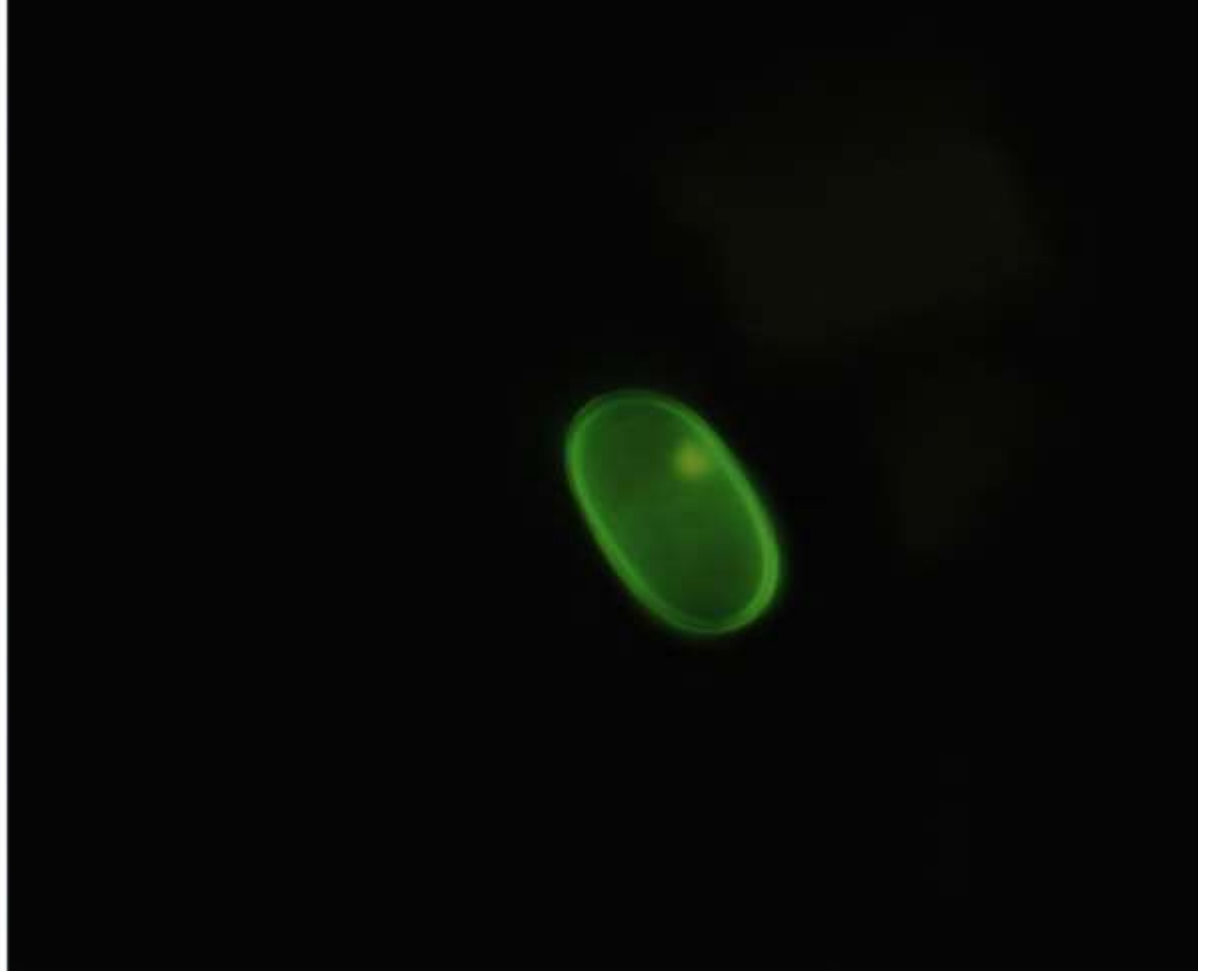


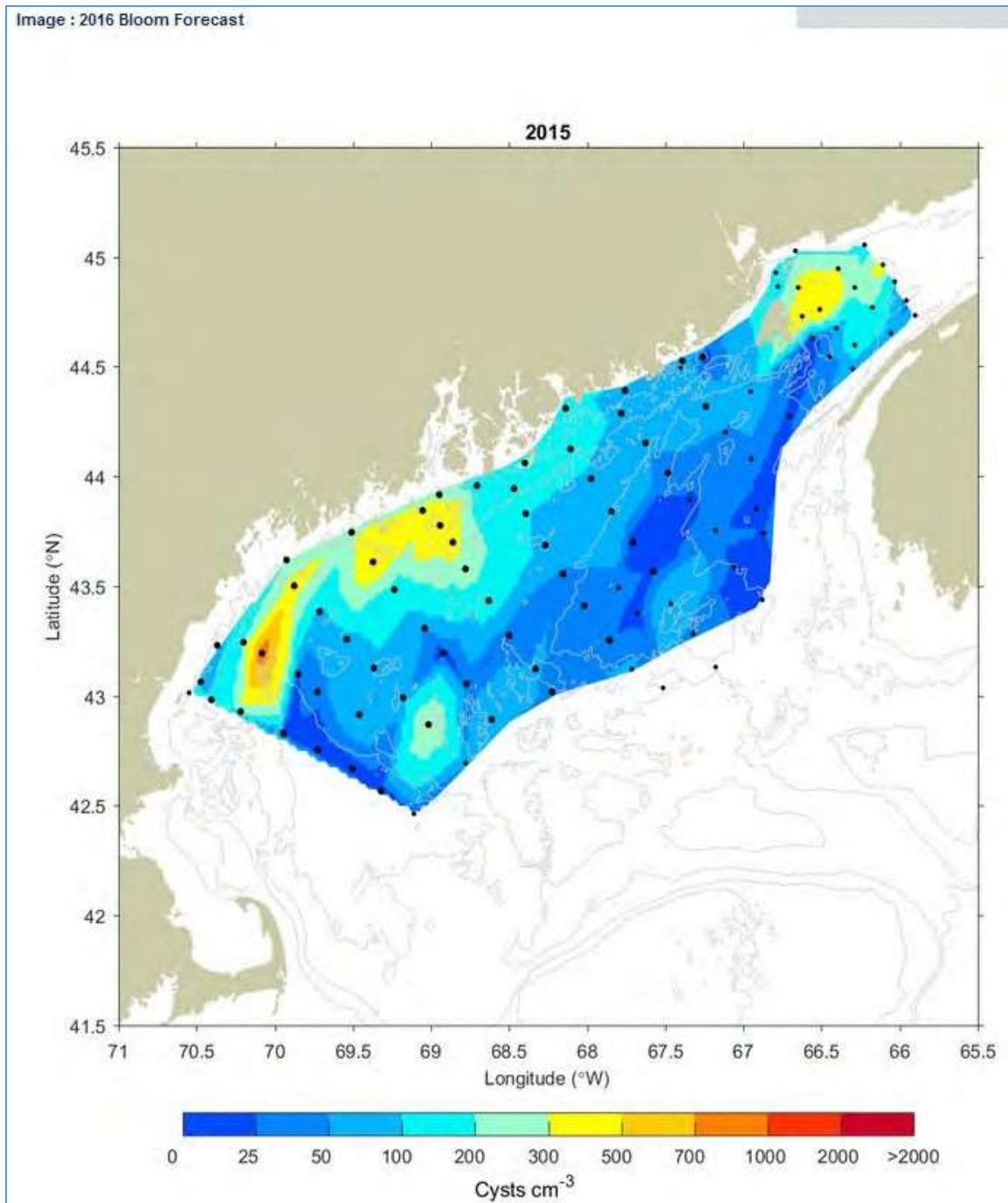
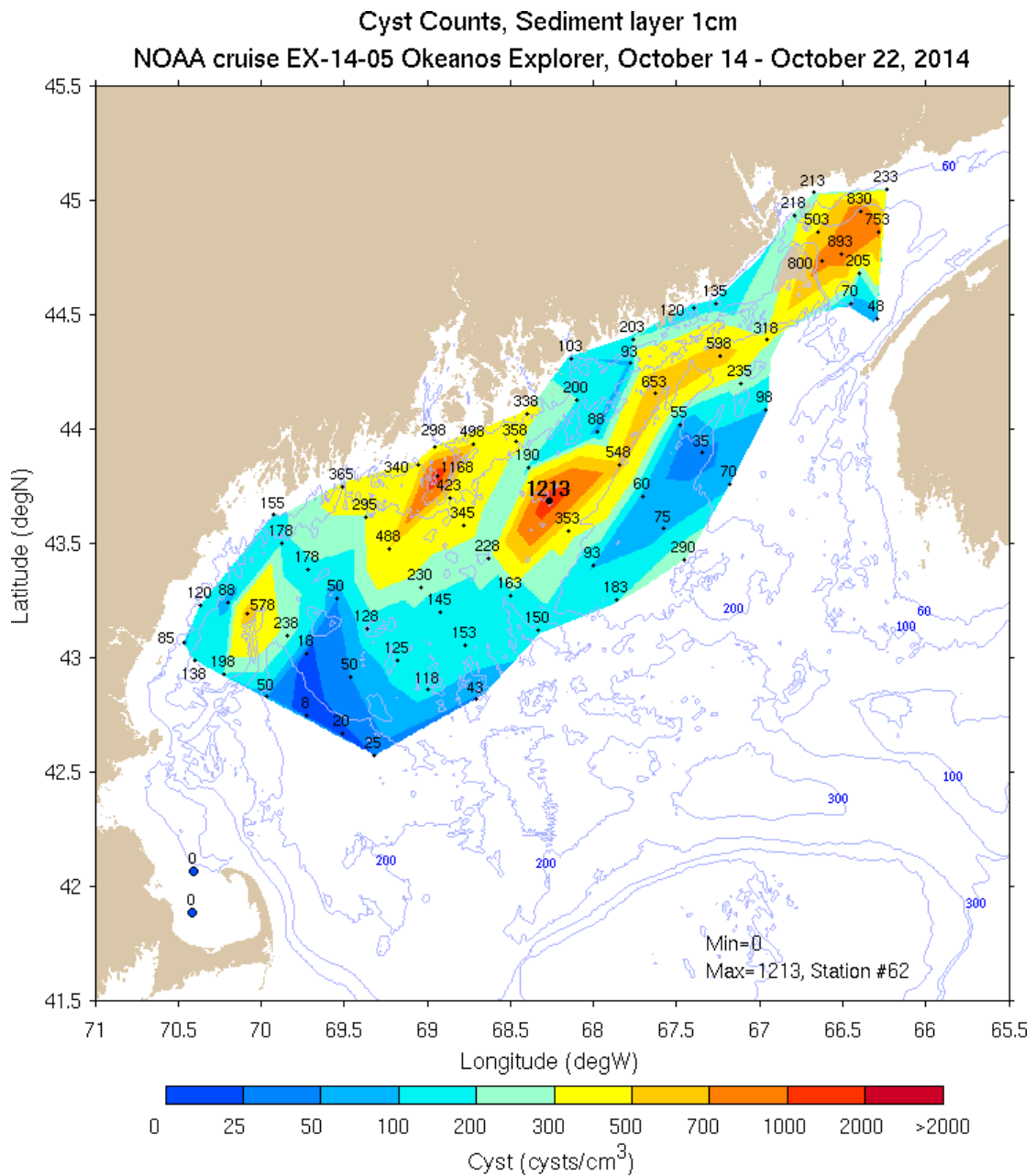












2020 bloom outlook:

<https://coastalscience.noaa.gov/news/low-to-moderate-bloom-predicted-for-gulf-of-maine-red-tide-2020/>

Low to Moderate Bloom Predicted for Gulf of Maine Red Tide in 2020

📅 Published on: 05/21/2020

Research Area(s): [Stressor Impacts and Mitigation](#) / [Harmful Algal Bloom Detection and Forecasting](#)

Region(s) of Study: [Waterbodies / Atlantic Ocean](#); [U.S. States and Territories / Maine, Massachusetts, New Hampshire](#)

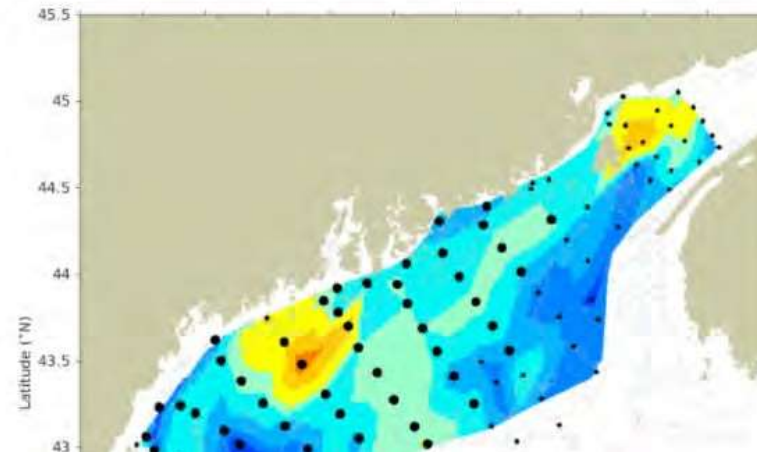
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Researchers with NOAA's National Centers for Coastal Ocean Science and the Woods Hole Oceanographic Institution are [predicting a low to moderate red tide](#) for the Gulf of Maine this summer, continuing the pattern of smaller blooms observed in the region over the last few years.

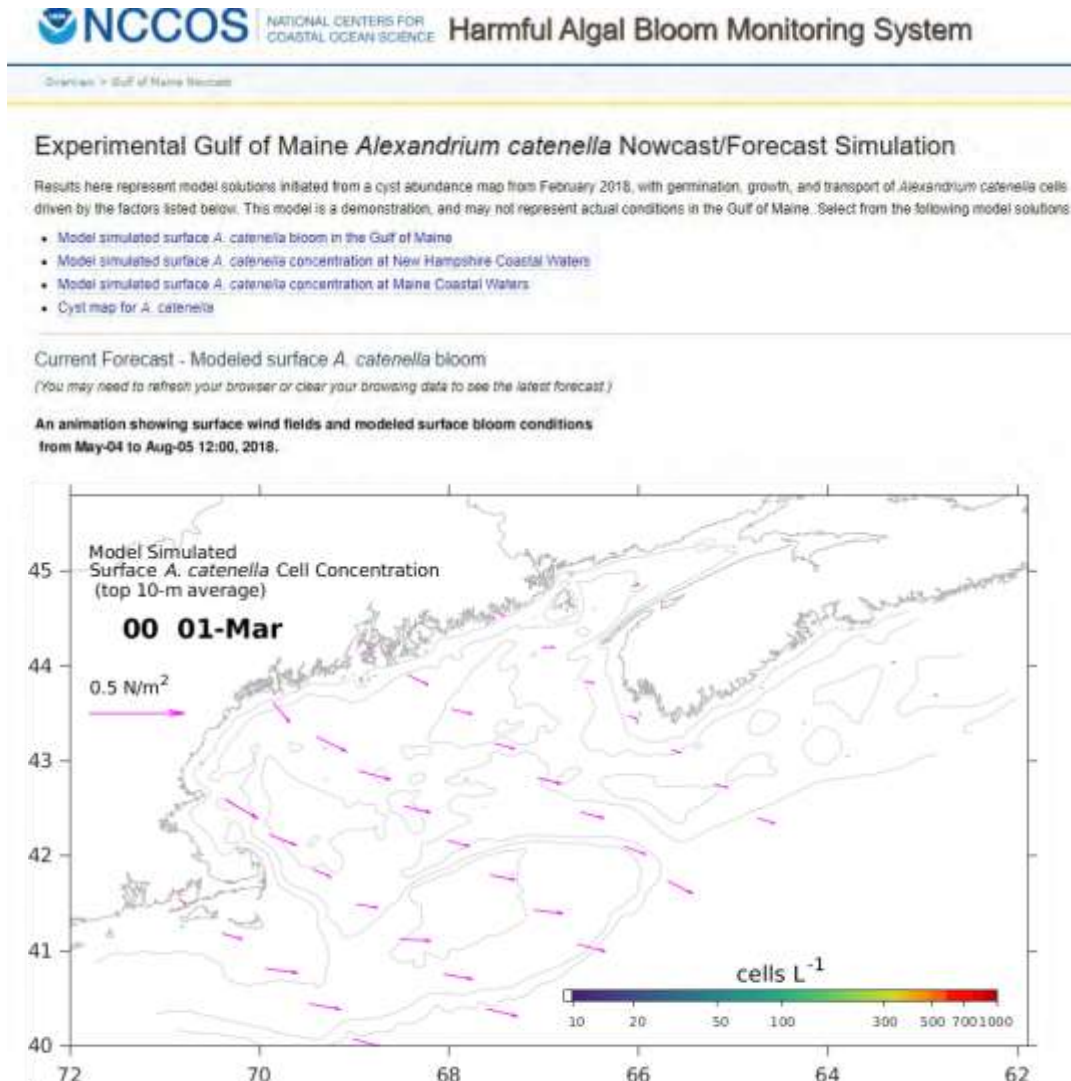
Gulf of Maine red tide, caused by the algae *Alexandrium catenella*, produces a toxin that can accumulate in shellfish, which can result in serious or even fatal illness in people who eat contaminated shellfish. The magnitude and severity of *Alexandrium* blooms, and the subsequent need for shellfish harvesting closures to protect human health, vary considerably from year to year and between decades. Shellfish toxicity was severe and widespread from 1978 to 1988 and again from 2003 to 2009, but has been lower since then. The causes of the decadal variations are the subject of ongoing research.

NCCOS and its partners produce a yearly red tide forecast for the Gulf of Maine that helps state shellfish managers gauge the severity of the season's harmful algal blooms before they occur. The forecast is based on data collected about *Alexandrium's* dormant stage, when it exists as seed-like cysts in ocean sediments before growing in the spring into the swimming cells that can produce red tide. Scientists can estimate the size of red tides in the spring and summer by counting the number of cysts in bottom sediments the preceding fall.

In October 2019, aboard NOAA Ship *Gordon Gunter*, researchers collected the data needed to map the presence of red tide cysts in the gulf, and to predict the size of the red tide in 2020. The cyst abundance for Fall 2019 ranked 11 out of 16 years of cyst sampling, resulting in a low to moderate red tide prediction for Summer 2020. Throughout this



Products for a bloom season- *Experimental weekly Nowcast/Forecast*



<https://products.coastalscience.noaa.gov/hab/gomforecast.aspx>

Will be archived as 'historical 2020' once 2021 Nowcast/Forecast is online.

<https://nccos-coastalscience-products-web-staging.azurewebsites.net/hab/gomforecast2019.aspx>

Distributed via WHOI NortheastPSP listserv.

- Provided hindcast and real-time forecast of surface atmospheric conditions, and *A. catenella* cell concentrations in the Gulf of Maine
- Model simulated surface *A. catenella* concentration at Maine and New Hampshire Coastal Waters
- Model outputs were served on NOAA cloud server (in netcdf format).