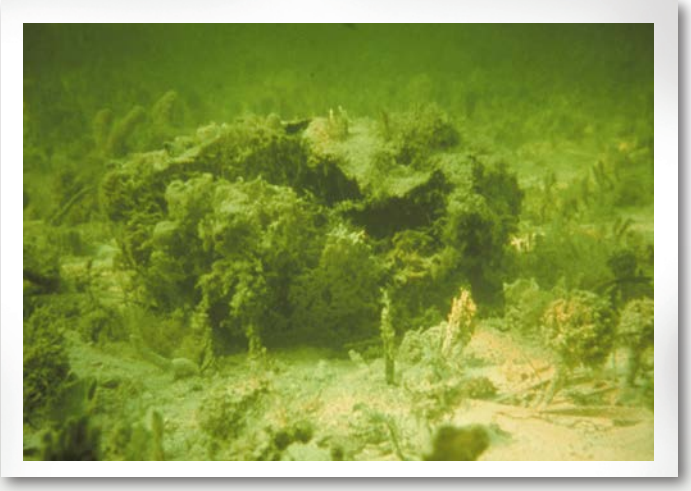
Phytoplankton Blooms in Florida Bay

Florida Keys National Marine Sanctuary

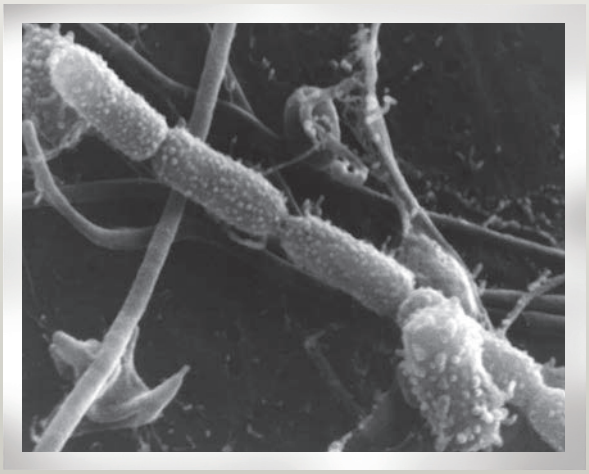
Florida Bay Algae Blooms Cause Widespread Concern

Marine, estuarine and fresh bodies of water sometimes experience phytoplankton or algae blooms. Blooms are sudden population explosions of microalgae or blue-green bacteria living in the water column. The phytoplankton blooms observed in Florida Bay in the early 1990s were highly visible, publicized events that drew concern from anglers, citizens, resource managers and scientists. Pea-green soupy bloom water developed in the north central bay at about the same time as the unprecedented die-off of many acres of seagrass in the area. Loss of turtle grass (*Thalassia testudinum*) habitat meant the loss of important nursery grounds for fish and other invertebrates. Shortly thereafter, bloom waters flowed southward, settling over hardbottom communities, where they contributed to the death of loggerhead sponges, a favorite hiding place for commercially valuable spiny lobsters. Almost immediately, it seemed important to know more about the cause of the blooms and possible impacts on Florida Bay's ecology.



A dying sponge in bloom water in Florida Bay in the early 1990s.
Photo: Florida Fish and Wildlife Conservation Commission

Scientists from nearby academic institutions and government agencies launched studies to learn about the conditions that led to the blooms and their effects on the ecosystem. They soon determined that the bloom in the north central bay was caused primarily by a species of cyanobacteria, *Synechococcus elongatus*. Cyanobacteria, also called blue-green bacteria, are among the hardiest and oldest organisms on Earth. They date back in the fossil record 2.8 million years and differ from microalgae in that they are only a fraction of the size and have a much simpler cell structure.



A microscopic view of a cyanobacteria, *S. elongatus*.
Photo: Florida Fish and Wildlife Conservation Commision

Seagrass Die-off and Drought Conditions Fueled Blooms

The conditions that triggered the north central bay blooms in the early 1990s have been difficult to assess, but scientific studies and long-term monitoring results have helped unravel much of the mystery. In the late 1980s, when many acres of turtle grass in the north central bay died simultaneously, large amounts of nutrients were released into the water column upon decomposition. Scientists now know that decomposing seagrass was one nutrient source fueling the bloom. Another source was the organic matter trapped in the sediments beneath the seagrass plants on the seafloor. When the plants died, these sediments floated up from the bottom, releasing the nutrient-rich organic matter into the water column. Once dissolved in the water column, the nutrients could be used by cyanobacteria for growth, thus compounding the bloom and further stressing the seagrass by reducing the sunlight reaching them.

http://floridakeys.noaa.gov/

National Marine Sanctuaries

S. elongatus Thrives in High Salinities

During the late 1980s, South Florida had been experiencing drought conditions, which drove Florida Bay salt levels (salinities) much higher than usual–even twice that of oceanic seawater. Unlike most phytoplankton species, *S. elongatus* was able to thrive in these extreme conditions. This unusually competitive species flourishes in low light conditions and very high salinities. In many instances, lack of phosphorus limits phytoplankton growth, but this species has a superior ability to compete for even small amounts of phosphorus. *S. elongatus* can also regulate its buoyancy, allowing it to take advantage of nutrients released from the sediments near the seafloor. The bloom observed in southern Florida Bay beginning in 2007 is reminiscent of the earlier blooms and is also largely caused by *S. elongatus*.

Bloom water in Florida Bay is green on this satellite image taken in 2007.
Photo: MODIS Land Rapid Response Team

Western Bay Blooms Caused by Different Species

Waters in western Florida Bay also experienced phytoplankton blooms throughout the 1990s. Western Bay blooms were caused by species of diatoms—microalgae that contain yellow-brown pigments and have thin, glass-like shells. Diatom populations in western Florida Bay experience blooms under the right combination of nitrogen, phosphorus and silicon, a mineral needed to grow the diatom shell. The onset of the western bay diatom blooms appeared to be related to the input of river water from land-based sources, especially from Shark River Slough on Florida's southwestern coast, and from the long-shore current that moves water along the coast south toward Florida Bay.

Blooms Can Flow from the Bay to the Reefs

Blooms have also been observed flowing through the passes between the Keys from the bayside to the ocean side, where they may cover nearshore reefs for varying periods of time. Generally, the turbid conditions produced by blooms are not favorable for corals and other marine animals that thrive in relatively clear, low-nutrient waters. Aerial observations of the blooms in the 1990s showed that when blooms reached the ocean side, they sometimes dissipated relatively quickly. At other times, bloom waters were carried north with the Florida Current or south with the long-shore current before breaking apart.

Scientists Monitor Water Quality and Blooms

Much of what is known about blooms has been learned from monitoring water quality and conducting experiments on bloom species. Florida International University scientists have been tracking phytoplankton blooms and water quality in Florida Bay, the Florida Keys National Marine Sanctuary and adjacent waters for many years. They collect monthly data about water temperature, salinity, turbidity, nutrients and the concentration of chlorophyll-a, a plant pigment that provides an estimate of the density of phytoplankton blooms. Water quality reports, including chlorophyll-a maps, are available at http://serc.fiu.edu/wqmnetwork. Funding for this monitoring has been provided by the U.S. Environmental Protection Agency (EPA) through the Water Quality Protection Program for the Florida Keys National Marine Sanctuary and by other agencies.

The Florida reef tract is located on the ocean side of the Florida Keys.
Photo: Florida Keys National Marine Sanctuary

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