

# PHYTOPLANKTON BLOOMS: THE BASICS

FLORIDA KEYS NATIONAL MARINE SANCTUARY

## Phytoplankton Population Explosions Cause Algae Blooms

Under certain environmental conditions, canals, lakes, coastal waters and even swimming pools can experience phytoplankton or algae blooms. A bloom takes place when a species of phytoplankton reproduces at a rapid rate, multiplying quickly in a short amount of time. Sometimes more than one species blooms at the same time. Phytoplankton are photosynthetic organisms that live suspended just beneath the water's surface. They use energy from sunlight and raw materials to make their own food through photosynthesis. Microalgae and blue-green bacteria (called cyanobacteria) are two groups of organisms that belong to the phytoplankton community.

Blooms are often visible events. High concentrations of phytoplankton in the water column can cause the water to appear blue-green, green, brown or even red, depending upon the pigments found in the species experiencing the bloom. Pigments are substances in phytoplankton that absorb the sun's energy, which is needed to drive the process of photosynthesis.

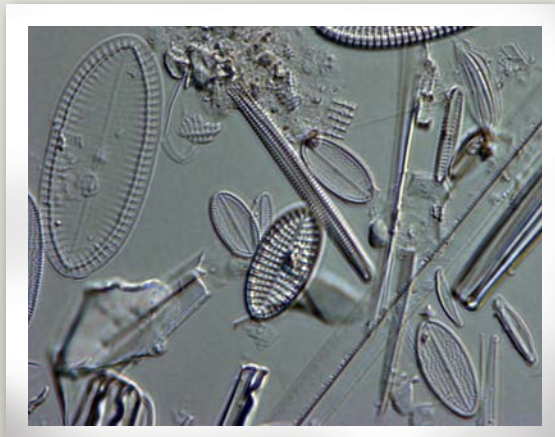


A phytoplankton bloom in northern Florida Bay in the early 1990s.  
Photo: Florida Fish and Wildlife Conservation Commission

## The Right Conditions Are Needed for Phytoplankton Growth

Phytoplankton organisms are capable of absorbing the necessary substances for growth and reproduction directly from the surrounding water. For a species to bloom, environmental factors such as water temperature and salinity must be just right and essential nutrients must be available in the correct amounts. Each phytoplankton species has a different set of favorable conditions that promotes its growth and reproduction.

The two most important nutrients for phytoplankton growth are the elements nitrogen (N) and phosphorus (P), which are found naturally in aquatic environments in various concentrations. Iron, zinc and manganese are also essential, but they are needed only in very small quantities. If any of the necessary nutrients are not available in the right amount for a particular species, growth and reproduction will be limited or non-existent in that species. But, if all conditions are favorable, a bloom will take place.



Different species of phytoplankton shown magnified.  
Photo: Florida Fish and Wildlife Conservation Commission

Many blooms are temporary events that disappear after the source of the nutrients is gone or when conditions are no longer favorable. For example, a bloom may develop after plant fertilizers containing nitrogen and phosphorus are carried into nearshore waters by rainfall runoff. Once the nutrients in the water have been depleted by the phytoplankton organisms, the bloom usually dissipates.

Some animals help limit or reduce phytoplankton populations by feeding on them. Filter-feeding oysters, scallops and sponges consume phytoplankton as they circulate seawater through their bodies, while microscopic crustaceans like copepods graze on phytoplankton in the water column.

<http://floridakeys.noaa.gov/>



## Blooms Can Impact the Ecosystem in Several Ways

When the nutrient source is continuous and conditions remain favorable, blooms may become long-term events that can impact the ecosystem. Sustained blooms can block out or reduce the sunlight reaching seagrasses on the seafloor, which can stress or kill the plants. Since many animals depend on seagrass as habitat and foraging ground, losses can lead to changes in the fish and invertebrate populations. Lower seagrass cover can also reduce water clarity. Without the plants holding the seafloor sediments in place, tiny particles are free to float up in the water, clouding the water column and further reducing the sunlight that reaches seagrasses on the seafloor. The situation can be compounded when sediments become stirred up from the bottom by wind or currents, releasing trapped nutrients and decaying plant material that serve to further fuel the bloom.

Long-term blooms can change the kinds and availability of plants at the base of the aquatic food web. Phytoplankton species serve as a food source for zooplankton—tiny animals that drift in the water column and serve as a food source for larger species. During bloom events, when only certain species are abundant as food sources, animals that feed on the bloom species have plenty of food, while those that feed on other less available phytoplankton may not. Over time, this shift in producers at the base of the food web can affect the zooplankton, fish, birds and other animals in the food web.



Bay scallops are filter-feeders that consume phytoplankton.  
Photo: Florida Fish and Wildlife Conservation Commission



Low dissolved oxygen in the water can lead to fish kills.  
Photo: Florida Fish and Wildlife Conservation Commission

Low dissolved oxygen (DO) levels are sometimes found in bloom waters. Depletion of DO usually takes place during the night when the phytoplankton are using more oxygen than they give off in photosynthesis. Low DO levels can be exacerbated in residential canals and other waters because of limited circulation and exchange. After the bloom is over, the phytoplankton organisms die and undergo decomposition, a process that also removes DO from the water column. During some blooms, fish are seen gasping at the surface for oxygen and this lack of DO can be a direct cause of “fish kills” observed on the scene.

A few species of phytoplankton produce poisons or toxins, which can cause health impacts in humans and animals. These are known as Harmful Algal Blooms, or HABS, and are the focus of much scientific research in coastal waters of the United States. The phenomenon known as “red tide” is an example of a HAB that is sometimes observed in Florida waters. The toxin produced in red tides can cause respiratory irritation in swimmers and marine animals and can make filter-feeding clams and oysters unfit for human consumption.

## Residents Can Help Reduce Runoff and Report Unusual Events

With continued study, scientists and ecosystem managers are working to better understand the dynamics of phytoplankton blooms. Coastal residents and businesses can help prevent the occurrence of some blooms by taking steps to reduce fertilizer runoff into nearshore waters. Although this will not prevent all blooms, it will help keep nearshore waters free of excess nutrients that can lead to bloom events. Residents can also help by reporting unusual events such as fish kills and phytoplankton blooms to Marine Ecosystem Event Response Assessment, or MEERA. The purpose of MEERA is to provide early detection of biological events in the Keys. For more information, visit <http://isurus.mote.org/Keys/meera.phtml>.

