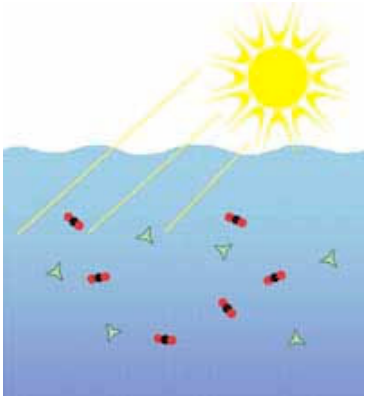
Toxic and Harmful Algal Blooms
"Building a Bloom"

What is an algal bloom? An algal bloom is a rapid increase in the number of algal cells such that the algae dominate the planktonic community.

What causes an algal bloom? That question isn't as easy to answer. Like land plants, algae need certain things to grow – water, carbon dioxide, sunlight and nutrients. Carbon dioxide is plentiful in the marine environment, but sunlight and nutrients can be scarce. Sunlight is available near the surface of the water, so algae grow readily when they can remain near the surface. Nutrients are abundant in areas of run-off where water flows over land and picks up minerals that are then carried to the sea. Nutrients are also plentiful in areas where cool, deep, nutrient-rich waters are brought to the surface due to upwelling, tides or wind-driven mixing. When the algal cells get everything they need to grow, they can divide very rapidly and potentially create a bloom.



Of course, it is a little more complicated than just getting sunlight and nutrients. Phytoplankton live in a very dynamic environment. The ocean is always moving and algae and nutrients move with it. Not only can regional circulation patterns affect the nutrient concentrations in the water, but they can also actually physically concentrate or disperse algal cells. In addition, many algal species thrive under only certain temperature and salinity conditions.

And finally, for algae to bloom successfully, there must be a limited number of grazers in the area. After all, if there were enough grazers to keep the algal population under control, there wouldn't be a bloom.

Visit http://www.bigelow.org/hab/cause.html to see some common HAB species and to learn about their optimal growth conditions.

After reading about all that can affect the occurrence of an algal bloom, you might think that it would be rare for all of the conditions to be right and for a bloom to occur. Take a look at the maps in NOAA's 1998 State of the Coast Report (http://state-of-coast.noaa.gov/bulletins/html/hab_14/figure_1.html). You can see by the red markers on the maps that observations of reported harmful algal blooms are increasing in frequency.

Visit http://www.bigelow.org/hab/location.html to see what types of HABs occur in different areas of the U.S.

Why are the reports of HABs increasing? Scientists have offered numerous explanations. One possible explanation is that we are introducing exotic species through ballast water and aquaculture. The exotic species may be able to thrive in the new area, but may not have a grazer in that area to keep its population under control. A second possible explanation is that certain algae are inhibiting grazers, so the grazers are physically unable to control the algal population. Another possible explanation that has been proposed is that our global climate changes are creating conditions that favor the blooms. It has also been suggested that human activity has played an integral role in an increase of harmful algal blooms by increasing the amount of pollution and nutrients released into the environment, by degrading habitat, and by modifying water flow. Lastly, it has been proposed that the frequency of blooms is not increasing, but that we have developed better detection and monitoring methods so we are noticing more of the blooms that have always been occurring.

Of course, as you have probably already realized, it is possible that every single one of the proposed explanations is correct at some level. One thing that scientists are doing now is studying what factors are contributing to the causes of different blooms.