TAHOE: STATE OF THE LAKE REPORT 2008

BIOLOGY

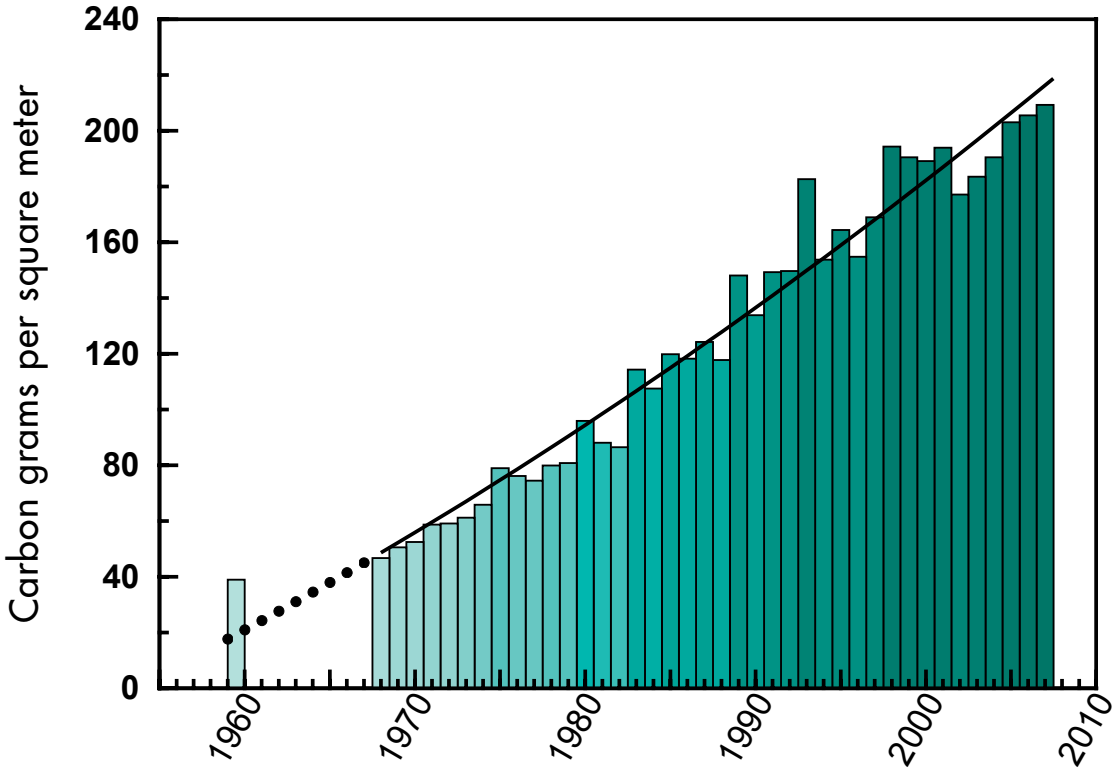
UCDAVIS
TAHOE ENVIRONMENTAL
RESEARCH CENTER

BIOLOGY

Algae growth (primary productivity)

Yearly since 1959

Primary productivity is a measure of the rate at which algae produce biomass through photosynthesis. It was first measured at Lake Tahoe in 1959, and has been continuously measured since 1968. Primary productivity has steadily increased over that time, probably promoted by changes in the lake's nutrient load, light environment and algae species. In 2007, primary productivity was 209.3 grams of carbon per square meter.

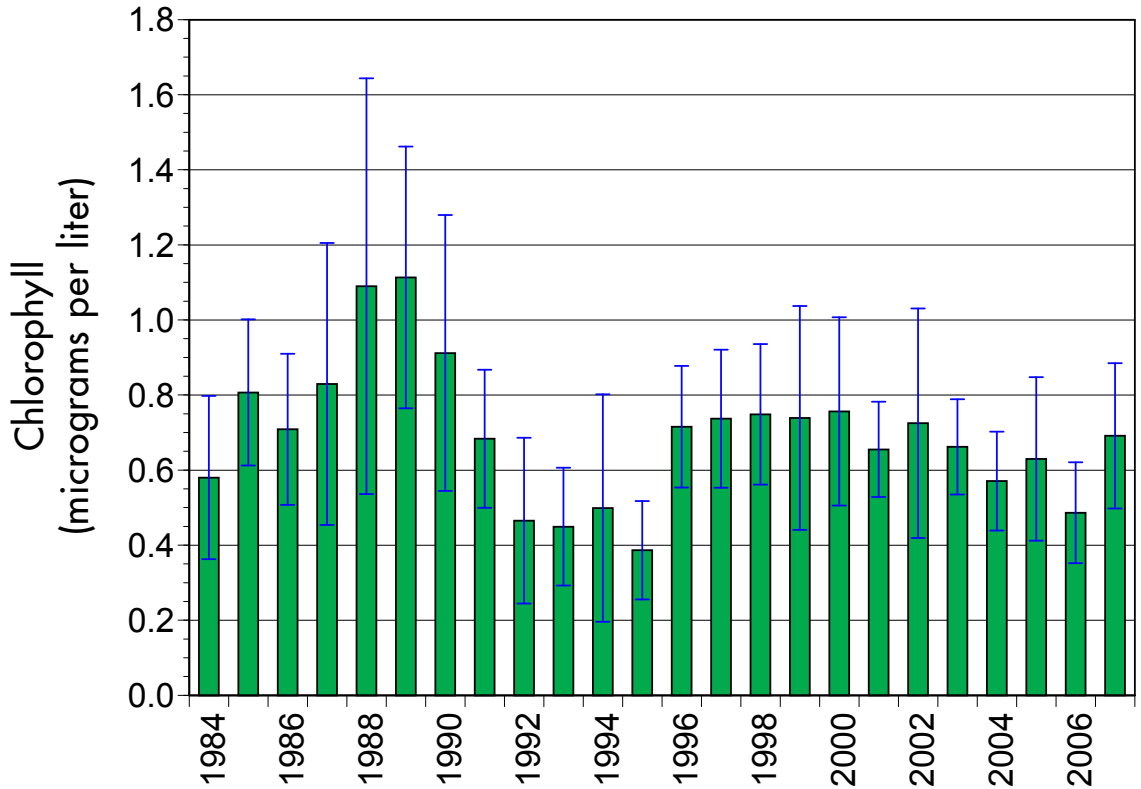


BIOLOGY

Algae abundance

Yearly since 1984

The amount of free-floating algae (phytoplankton) in the water is determined by measuring the concentration of chlorophyll *a*. Though algae abundance varies annually, it does not show a long-term increase. Since measurements began in 1984, the annual average has been 0.69 micrograms of chlorophyll *a* per liter of water (or 0.69 parts per billion). The annual average value for 2007 was 0.69 micrograms per liter, the same as the long-term average.



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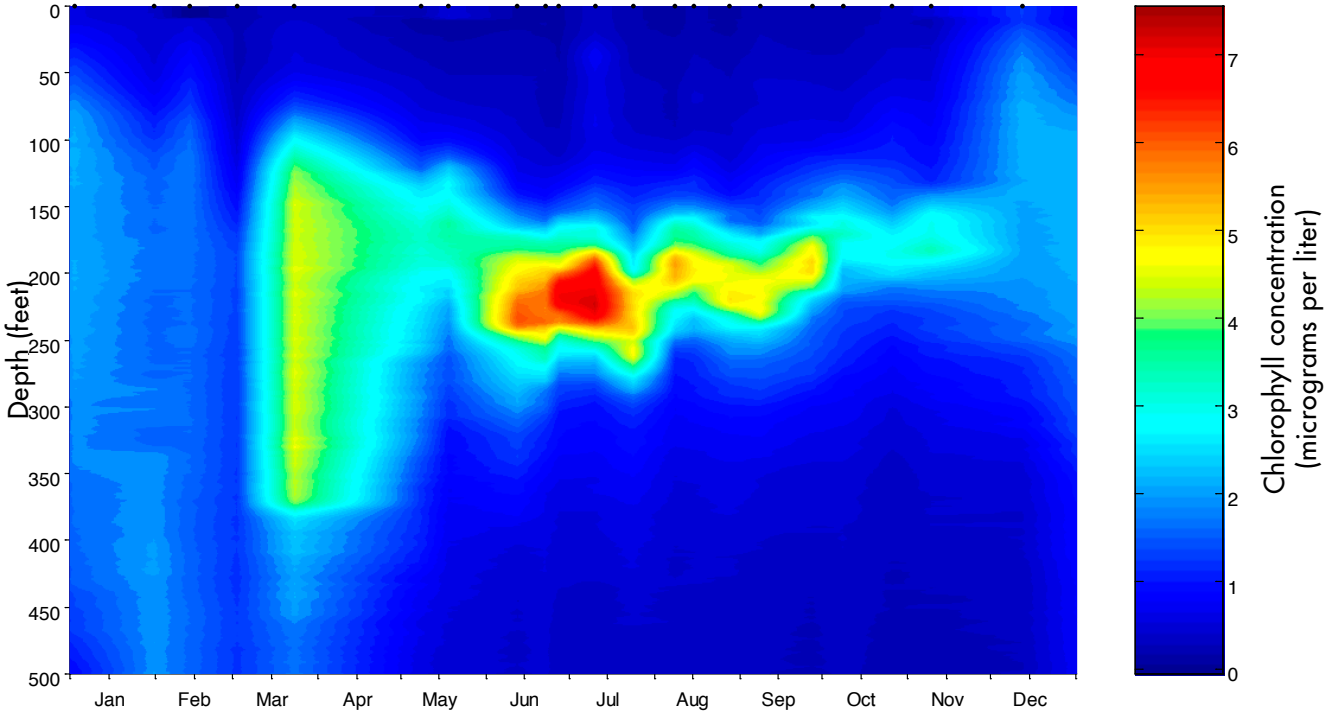
Algae concentration by depth

In 2007

The highest concentrations of algae (as measured by chlorophyll *a* concentration) occur in summer between the 100 and 200-foot depths. This discrete layer, known as the deep chlorophyll maximum, forms in spring and persists until winter mixing redistributes algae. This layer is below the Secchi depth (Figs. 11.1 and 11.2), and does not influence lake clarity until winter mixing relocates chlorophyll into the range of the Secchi disk (50 to 80 feet).



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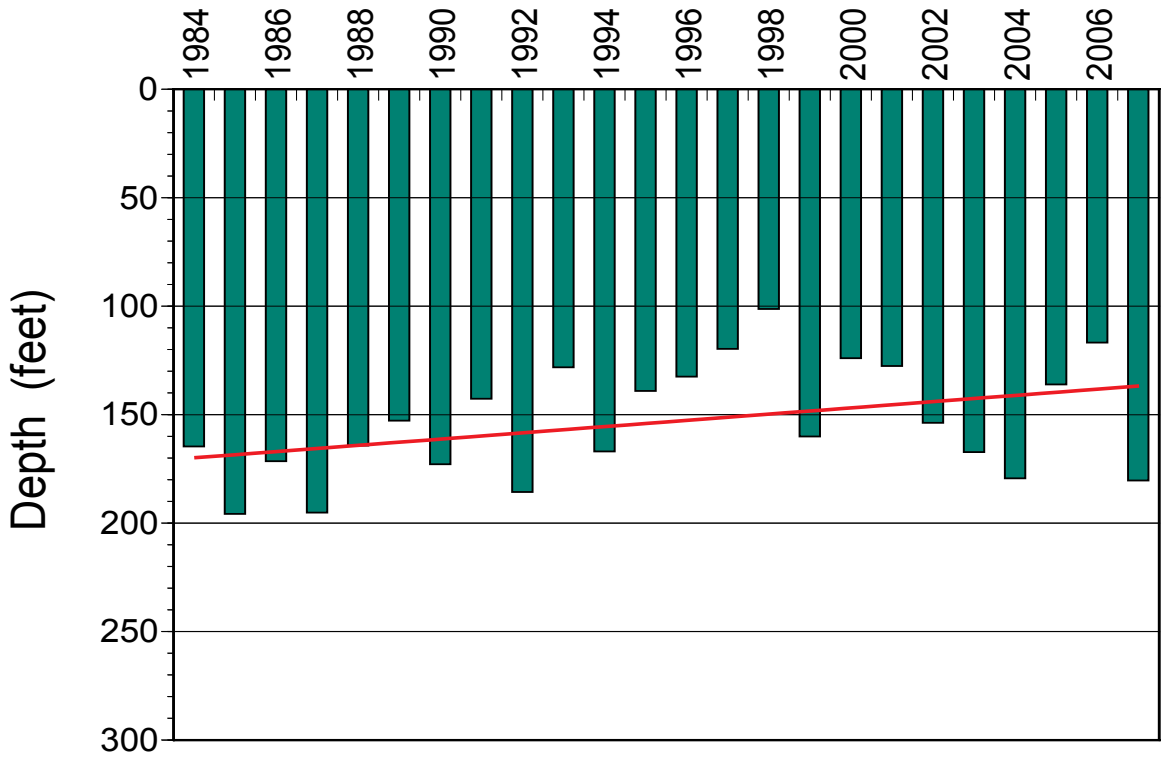
Depth of chlorophyll maximum

Yearly since 1984

The depth at which the deep chlorophyll maximum occurs varies from year to year. In 2007, the deep chlorophyll maximum was about 180 feet, considerably deeper than the last two years. The deep chlorophyll maximum depth has generally been getting shallower over time, a trend believed to be linked to the decline in water clarity.



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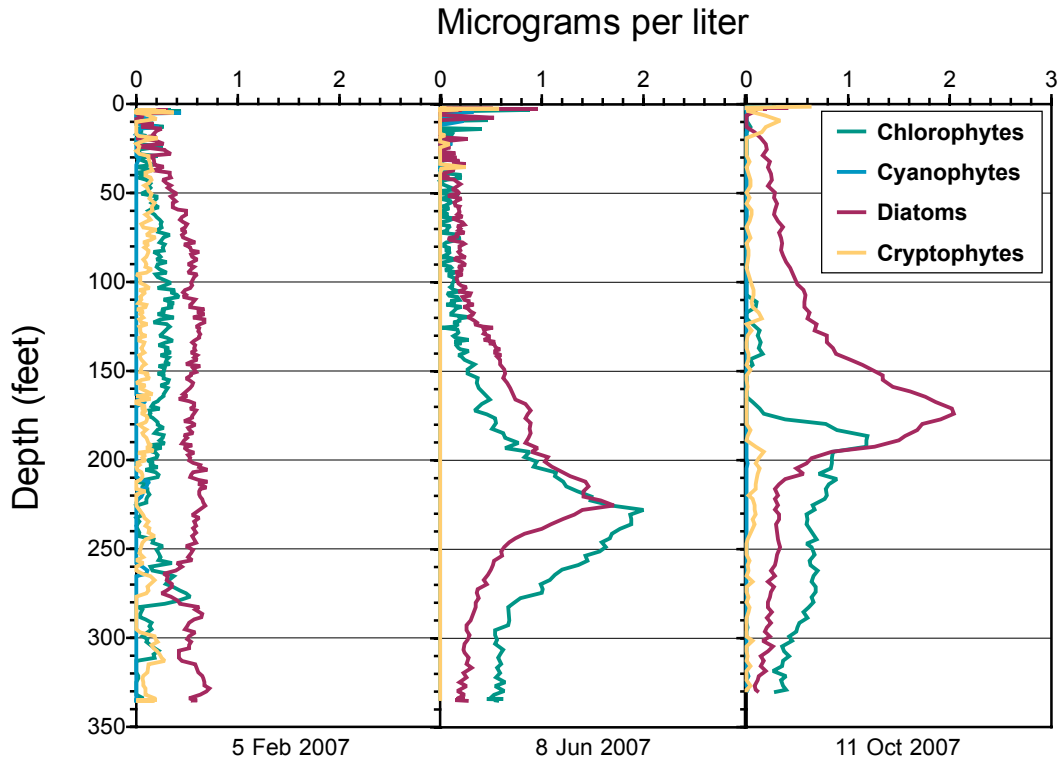
Algae group distribution by depth

Three days in 2007

Different algae groups grow at various depths below the lake surface, depending on what light and nutrients they need. Distributions of different algae taxonomic groups vary seasonally, as shown by these three profiles. In winter, algal groups were evenly distributed in the water column. In summer and fall, diatoms and green algae (chlorophytes) dominated the phytoplankton community, and the deep chlorophyll maximum was clearly present. Cryptophytes and cyanophytes were far lower in concentration and tended to favor shallow depths. By mid-October, both the diatoms and green algae were higher in the water, with diatoms clearly dominant.

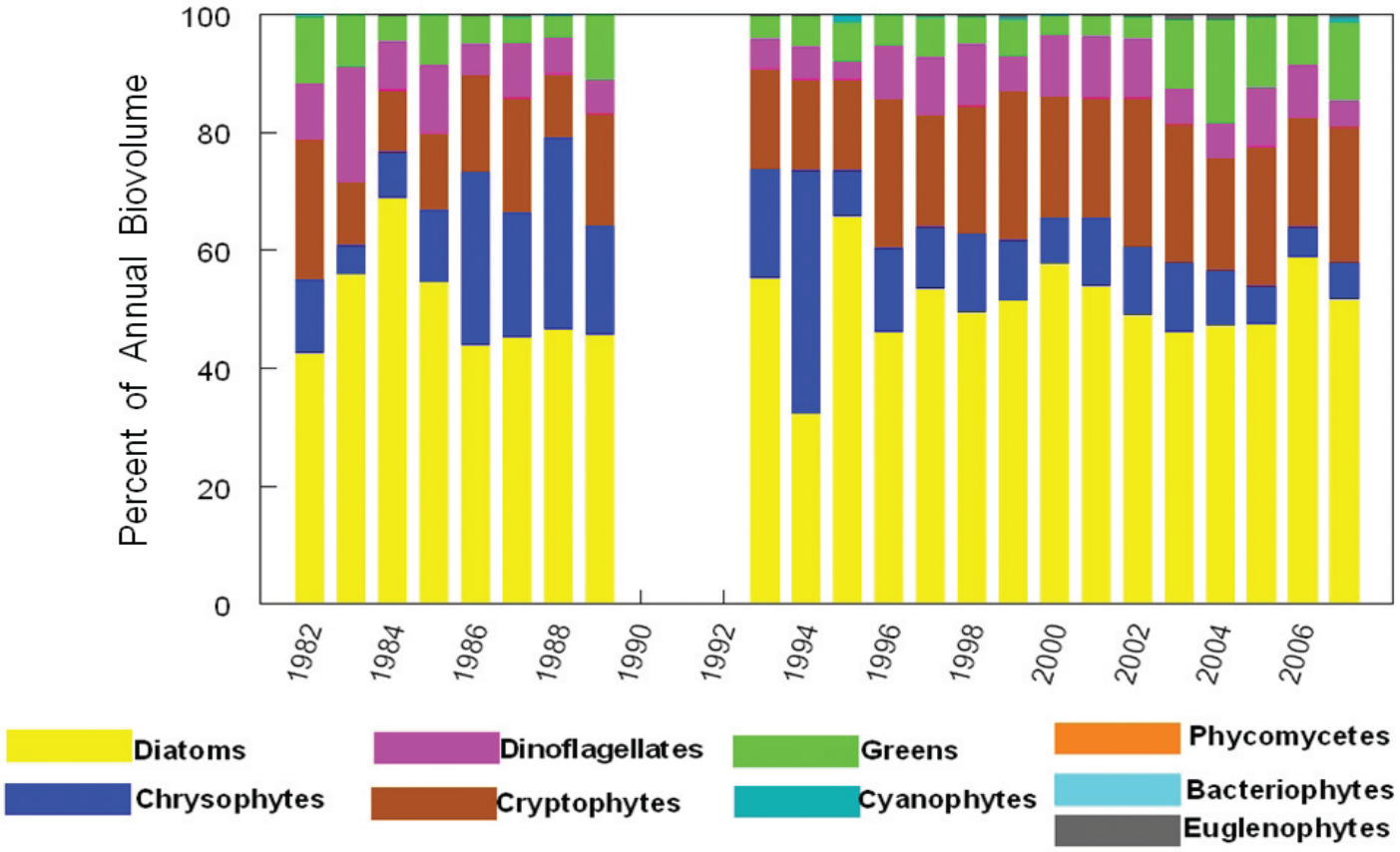


BIOLOGY

Algae groups as a fraction of total population

Yearly since 1982

The population, or biovolume, of algal cells from different groups varies from year to year. Diatoms are the most common type of alga, comprising 40 to 60 percent of the total biovolume each year. Chrysophytes and cryptophytes are next, comprising 10 to 30 percent of the total. Since 2003, the chlorophytes, or green algae, have increased in abundance.



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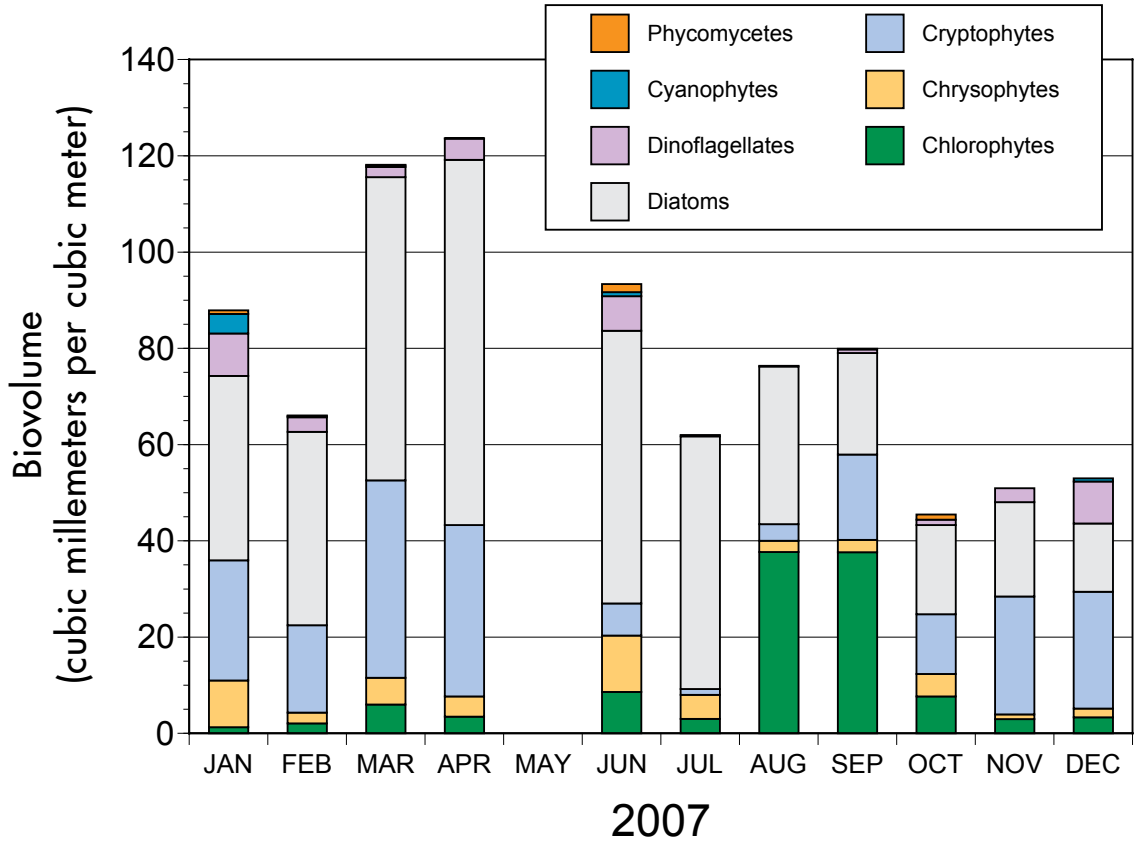
Algae groups as a fraction of total population

Monthly in 2007

Algae populations vary month to month, as well as year to year. In 2007, diatoms dominated the phytoplankton community from January through July. The chlorophytes peaked in August and September, when they also dominated the biovolume.



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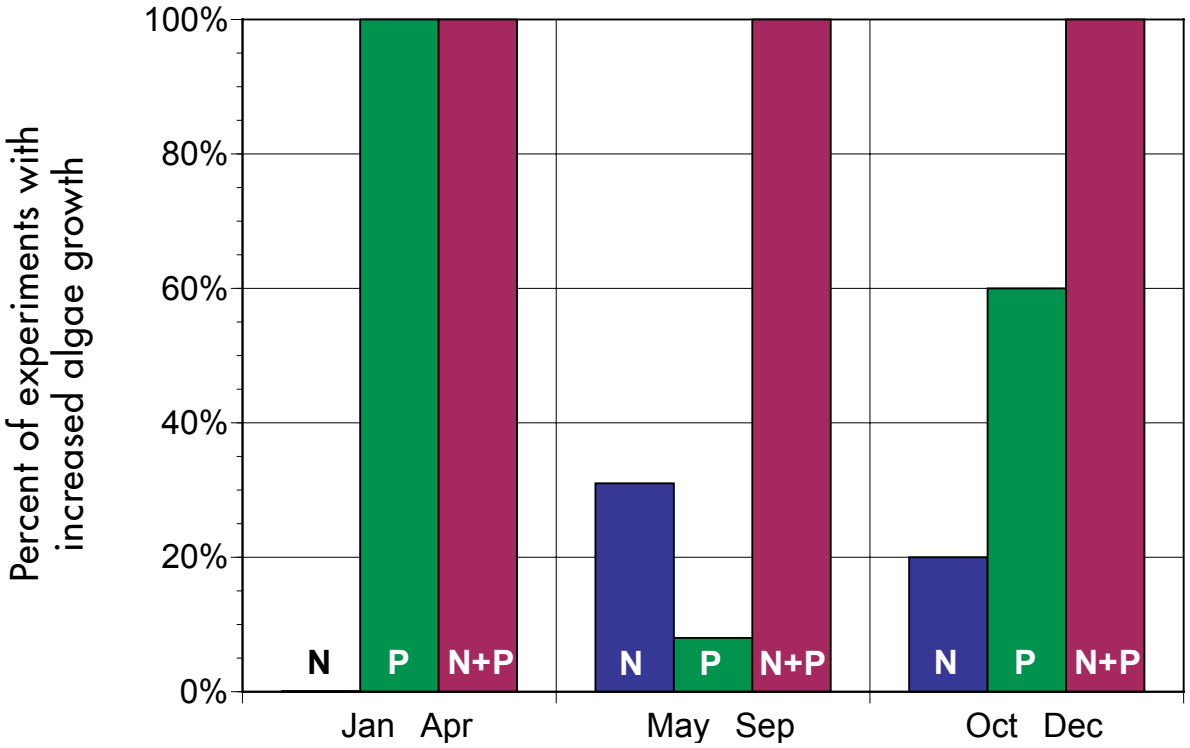
Nutrient limitation of algal growth

In 2007

Bioassays determine the nutrient status of phytoplankton by adding nutrients to lake water samples and then measuring increased algae growth. These tests document both seasonal and long-term changes in nutrient limitation. Between January and April in 2007, algae were exclusively limited by phosphorus. From May to September, nitrogen was more limiting, but the lake was co-limited, as shown by the greater response to adding both nutrients. Phosphorus was again limiting from October to December, but co-limitation was also present. These results highlight the role of nutrients in controlling algal growth. They also underscore the synergistic effects of adding both nutrients together.



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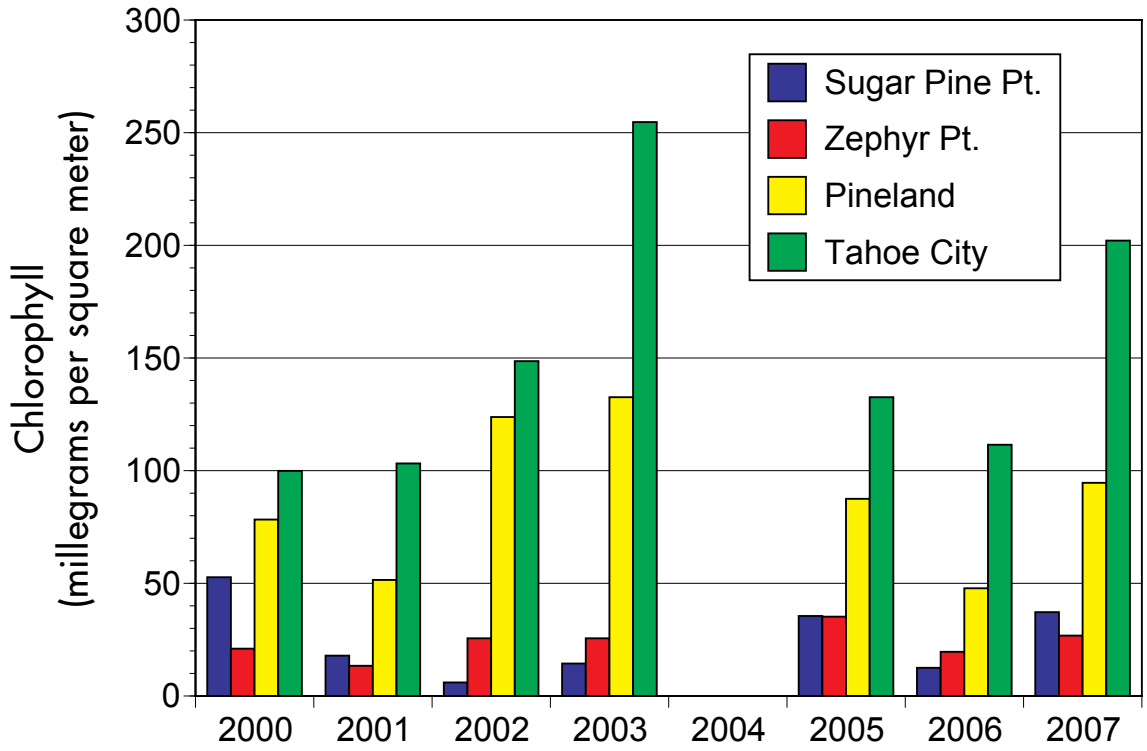
Shoreline algae populations

Yearly since 2000

Periphyton, or attached algae, makes rocks around the shoreline of Lake Tahoe green and slimy. Periphyton is measured eight times each year, and this graph shows the maximum biomass measured at four sites. In 2007, concentrations were above average. The two sites with the most periphyton (Tahoe City and Pineland) are closest to urban areas.



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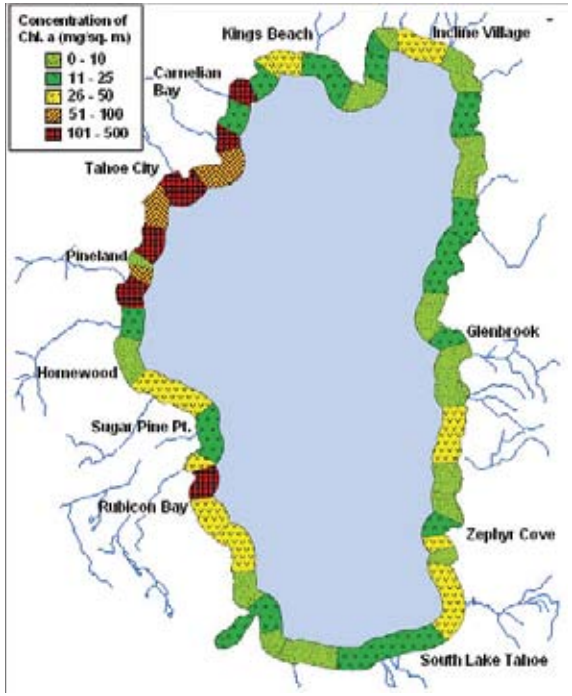
Shoreline algae distribution

In 2007

Periphyton biomass was surveyed around the lake during the spring of 2007, when it was at its annual maximum. Nearly 50 locations were surveyed by snorkel in 1.5 feet of water. Periphyton concentrations were highest along the northwest shore. (The width of the color band does not represent the distribution.)

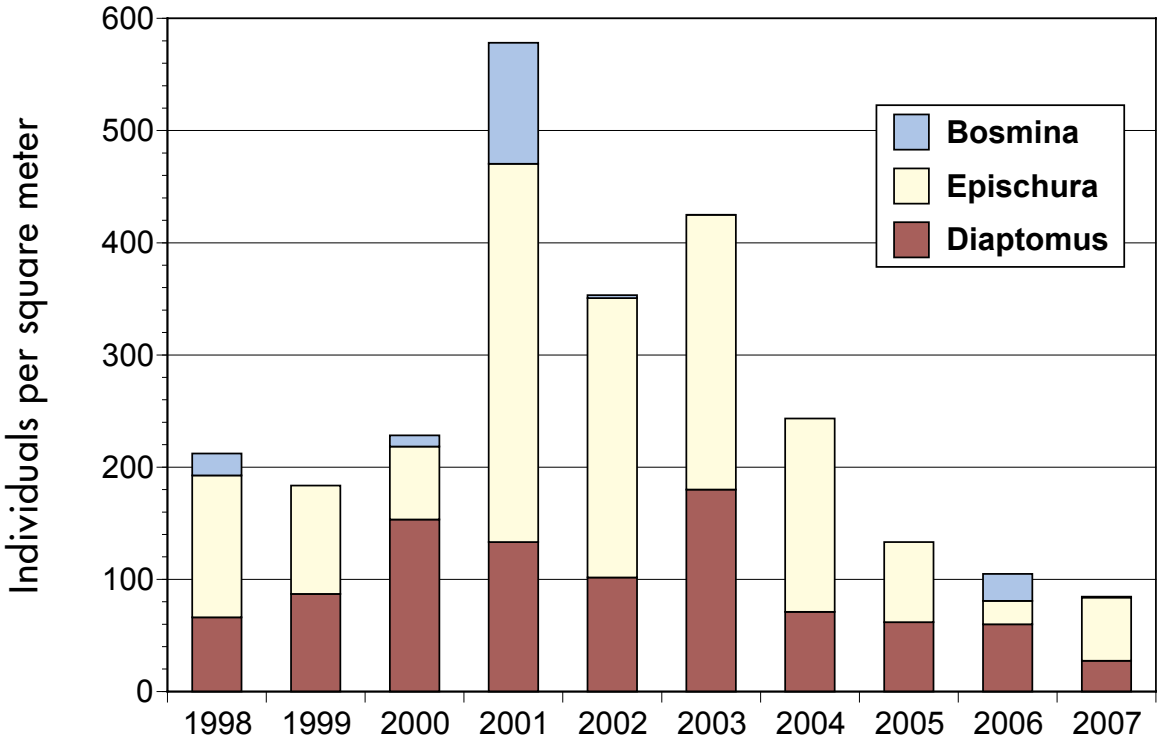


BIOLOGY

Zooplankton population by genus

Yearly since 1998

Zooplankton (microscopic aquatic animals that graze on algae) populations vary from year to year. Since mysid shrimp were introduced to Lake Tahoe, zooplankton have been dominated by *Epischura* and *Diaptomus*. In some years, *Bosmina* are also present, typically in small numbers. In 2007, zooplankton biovolume, an important component of the aquatic food web, was the lowest since 1998.



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Zooplankton population by genus

Monthly in 2007

Diaptomus was the dominant zooplankton during the winter and spring of 2007, as in most years. *Epischura* was dominant in summer. *Bosmina* was present at low concentrations in January, a remnant of greater numbers recorded between October and December of 2006.