

TAHOE: STATE OF THE LAKE REPORT 2013

BIOLOGY

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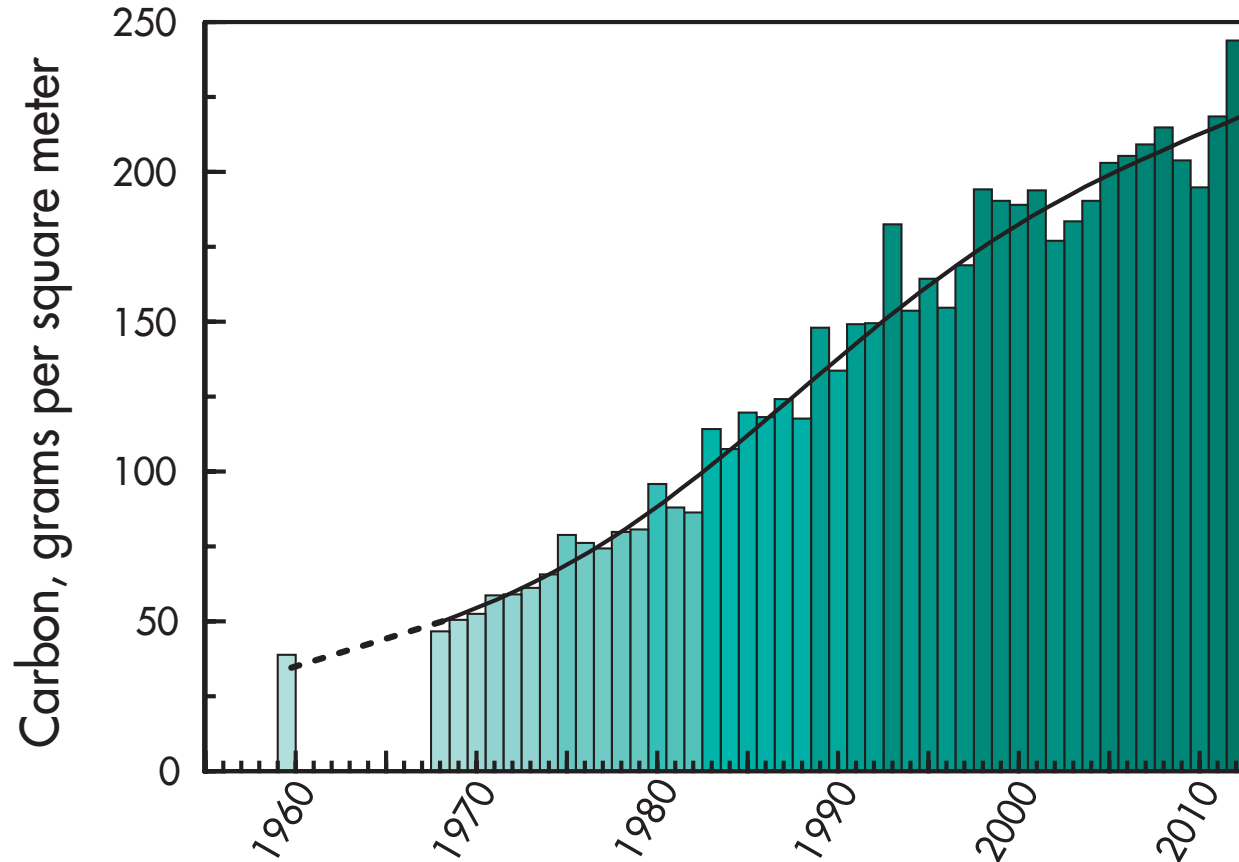
Algae growth (primary productivity)

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 generally increased over that time, promoted by nutrient loading to the lake, changes in the underwater light environment and a

succession of algae species. In 2012, primary productivity was 243.8 grams of carbon per square meter.



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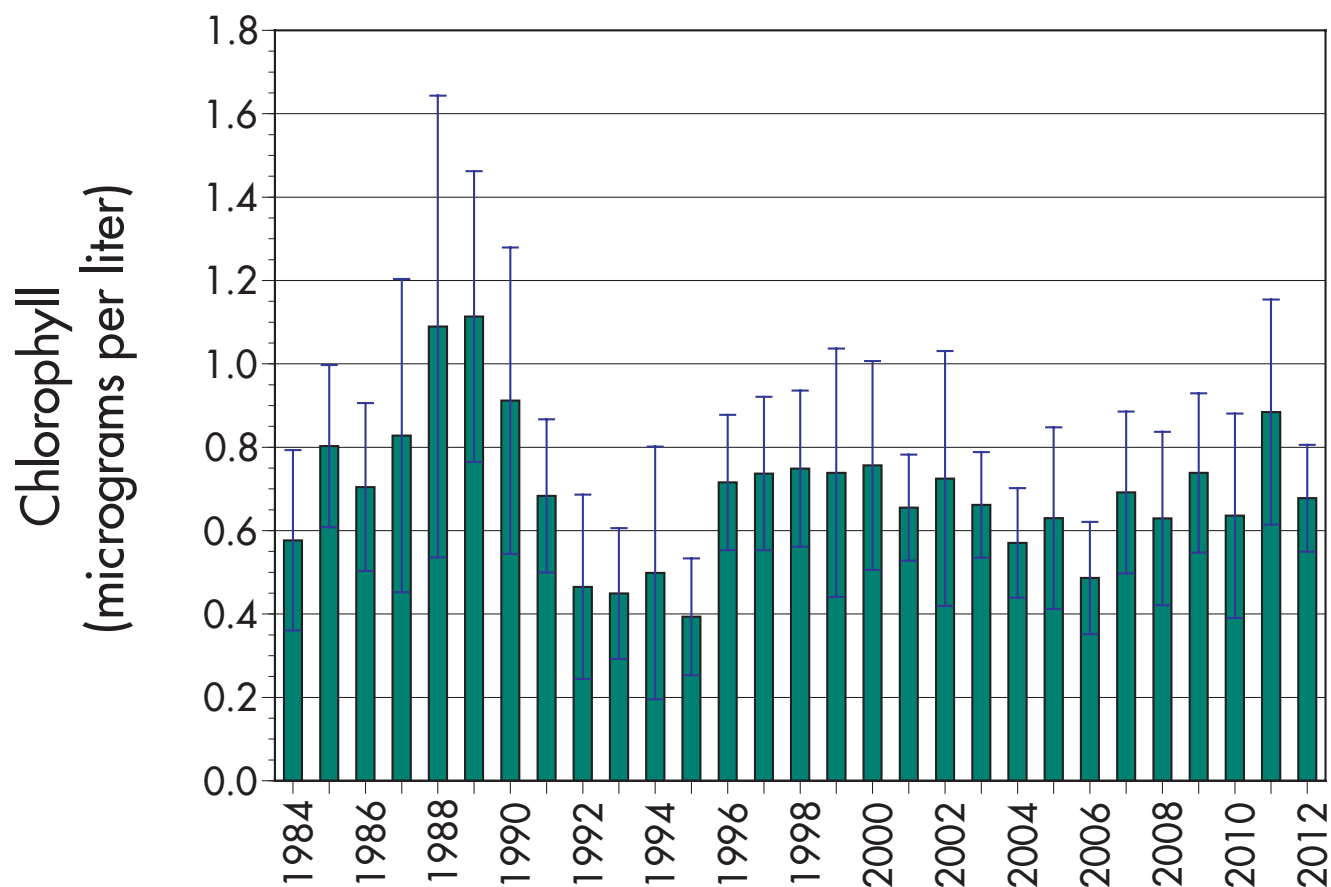
Algae abundance

Yearly since 1984

The amount or biomass of free-floating algae (phytoplankton) in the water is determined by extracting and measuring the concentration of chlorophyll *a*, a photosynthetic pigment that allows plants

to absorb energy from light. Though the value varies annually, it has not shown a significant increase since measurements began in 1984. The annual average value for 2012 was 0.68 micrograms per liter.

The average annual chlorophyll *a* level in Lake Tahoe has remained relatively uniform since 1996. For the period of 1984-2012 the average value was 0.71 micrograms per liter.



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Annual distribution of algal groups

Yearly since 1982

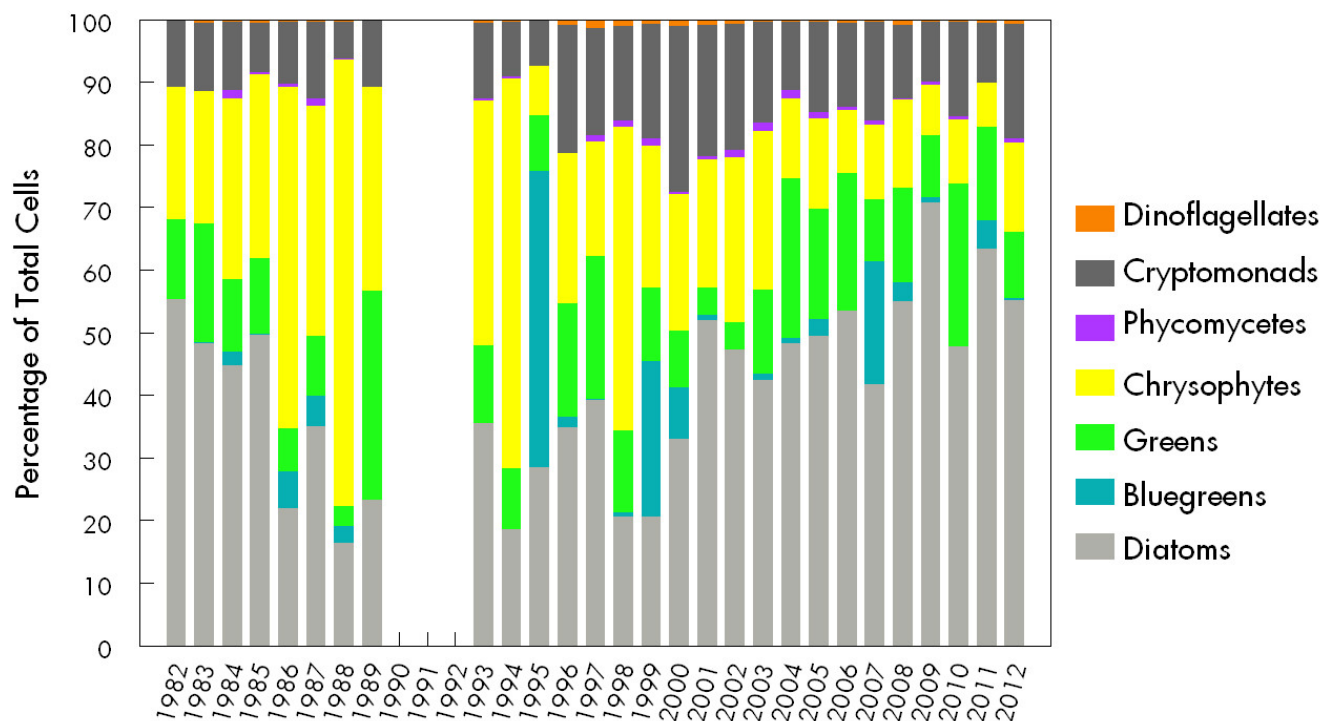
The amount of algal cells from different groups varies from year to year. Diatoms are the most common type of alga, comprising 40 to 60 percent of the total abundance of algal cells each year.

Chrysophytes and cryptophytes are next, comprising 10 to 30 percent of the total. While the proportion of the major algal groups show a degree of consistency from year-to-year, TERC

research has shown that the composition of individual species within the major groups is changing, both seasonally and annually, in response to lake condition.

Algal Groups as a Fraction of Total Population

1982 to 2012



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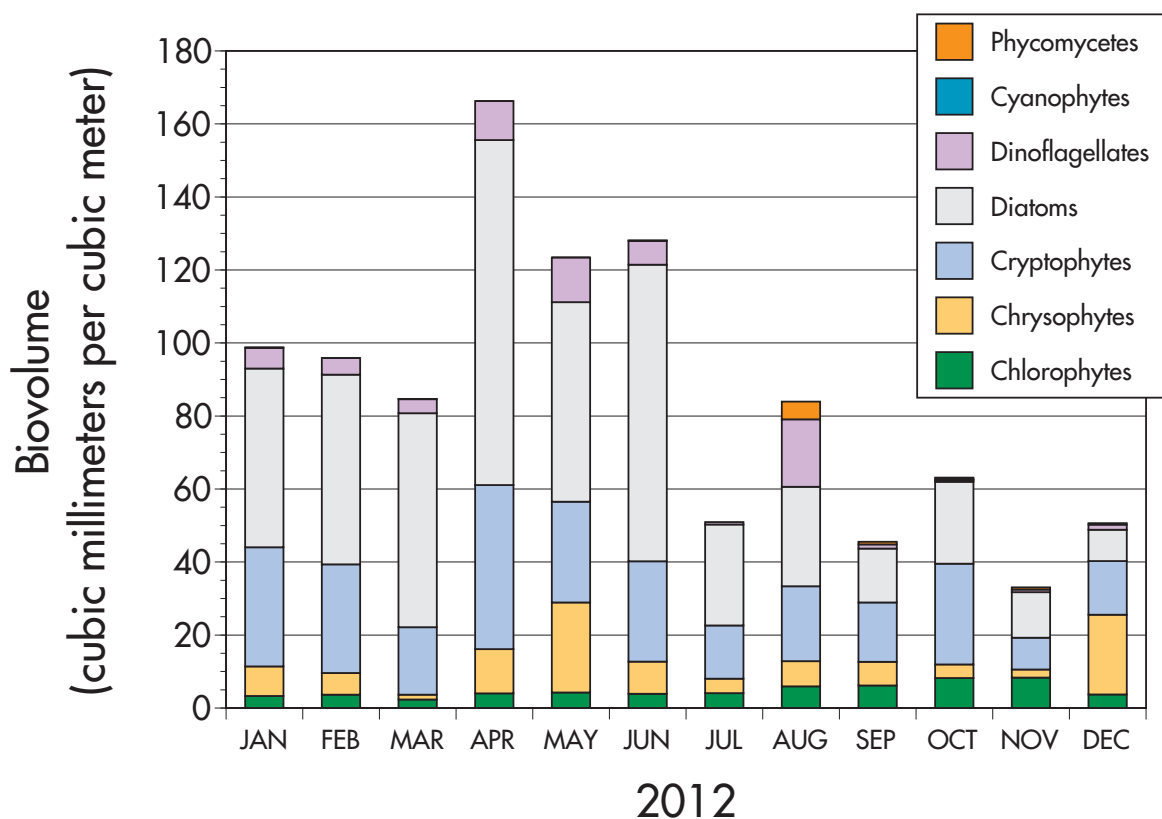
Algal groups as a fraction of total population

Monthly in 2012

Algae populations vary month to month, as well as year to year. In 2012, diatoms again dominated the phytoplankton community, especially

in the first six months of the year. Diatom concentrations peaked in April (the “bloom”) and stayed high through June. In the previous year (2011), the

spring bloom occurred two to three months later, highlighting the natural variability in the lake’s biota.



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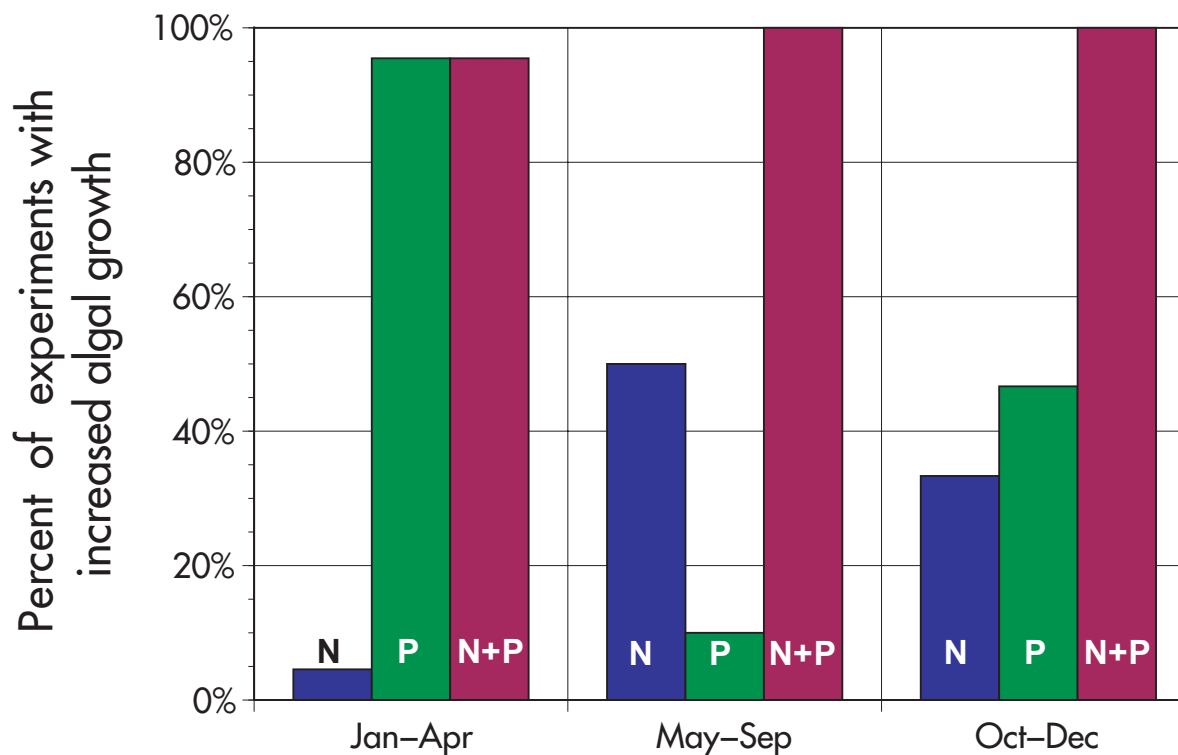
Nutrient limitation of algal growth

For 2002 - 2012

Bioassays determine the nutrient requirements of phytoplankton. In these experiments, nutrients are added to samples of lake water and the change of algal biomass is measured. Phytoplankton response to nutrient addition for the period 2002-2012 is summarized in the

panels below. Between January and April, algal growth was limited largely by phosphorus (P). From May to September, Nitrogen (N) added by itself was more stimulatory, but the lake was co-limited, as shown by the greater response to adding both nutrients. Phosphorus is slightly

more stimulatory from October to December, but co-limitation was again the dominant condition. These results highlight the role of nutrients in controlling algal growth. They also underscore the synergistic effect when both are available.



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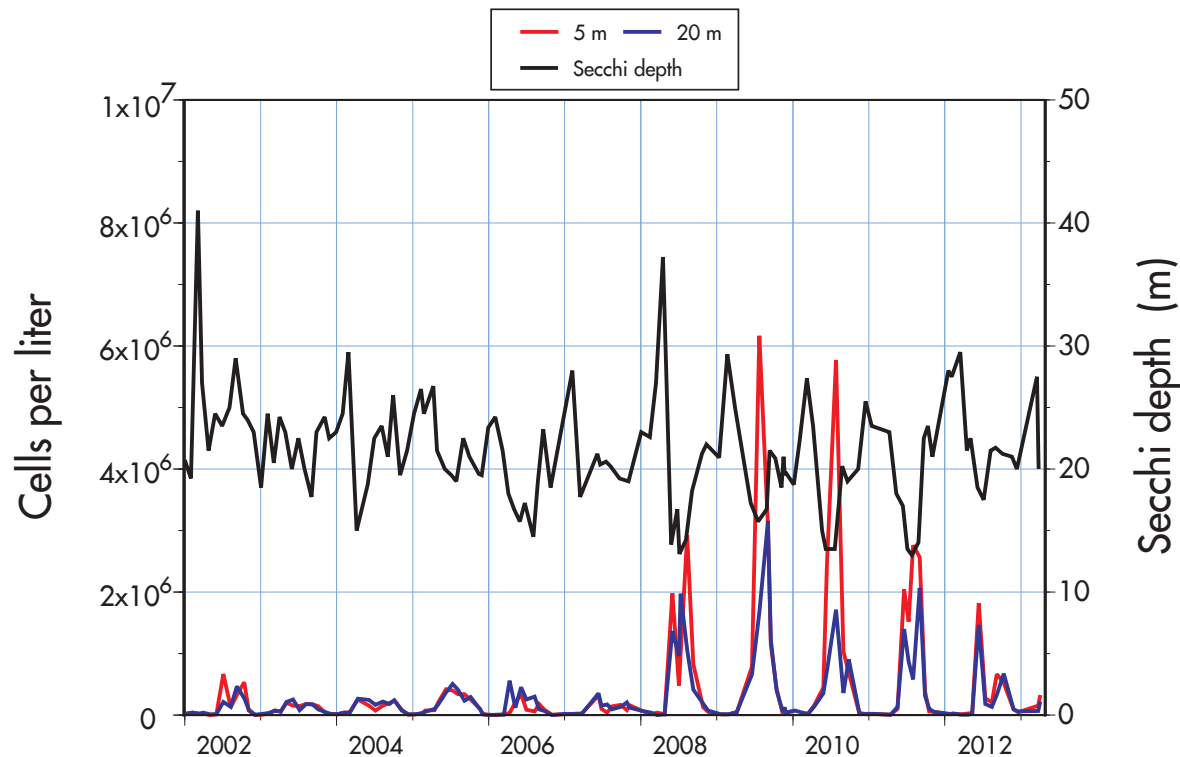
Predominance of *Cyclotella* sp.

From 2002 through 2012

In 2008, one species of algae, *Cyclotella*, started to dominate the make up of algae at Lake Tahoe. The cells range in size from 4 - 30 microns in diameter. During the summer, the smallest cells, 4 - 5 microns control the community in the upper euphotic. This size range is ideal for light scattering, and the growing

numbers of *Cyclotella* in 2008-2011 were believed to be in large part responsible for the major decline in summer clarity in those years. In 2012 the concentration of *Cyclotella* cells decreased to the lowest level in five years, and summer clarity showed an improvement over the previous four years. The red and blue

lines below indicate the concentrations of *Cyclotella* at depths of 20 m (66 ft) and 5 m (16.5 ft) respectively. The black lines indicate the individual Secchi depths taken since 2002. The summer values of Secchi depth coincide perfectly with the changes in *Cyclotella* concentration.



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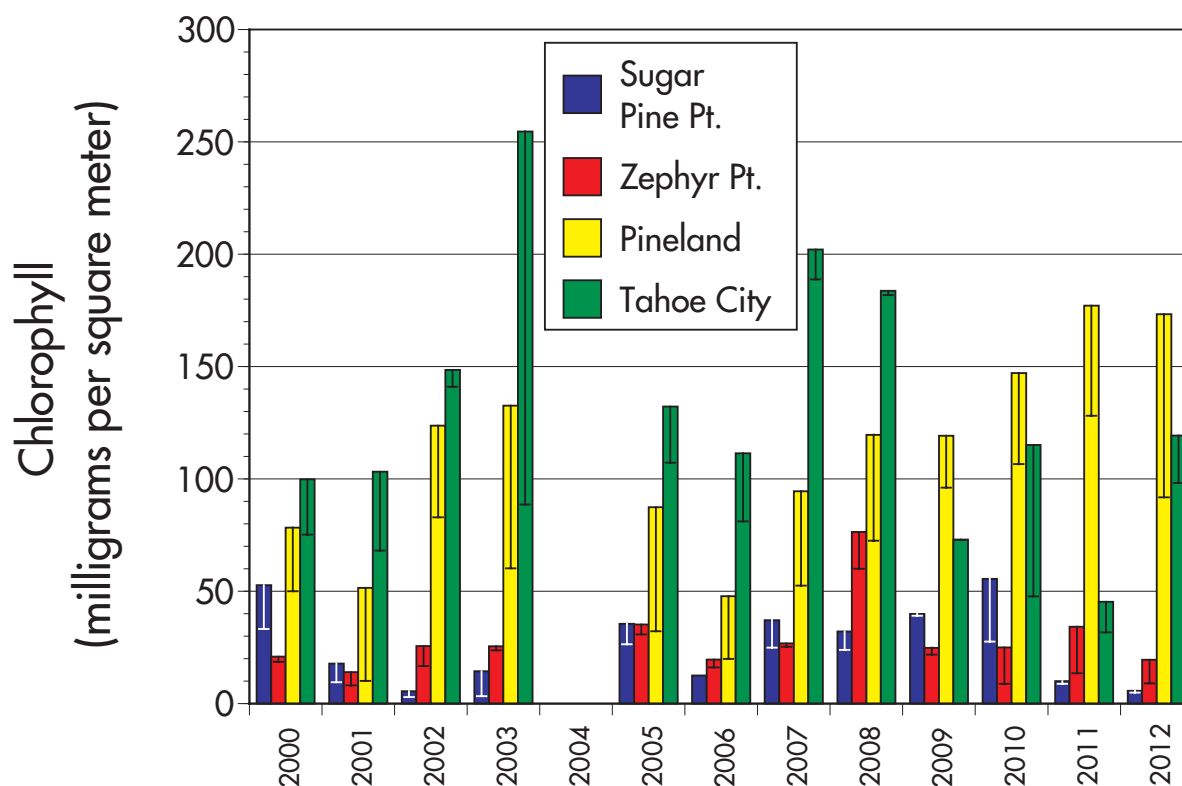
Shoreline algae populations

Yearly since 2000

Periphyton, or attached algae, makes rocks around the shoreline of Lake Tahoe green and slimy, or sometimes like a very plush white carpet. Periphyton is measured eight times each year, and this graph shows the maximum biomass measured at four

of the sites. In 2012, concentrations at Sugar Pine Pt. (no urban influence) and Zephyr Pt. (low urban influence) were below the long-term average. The site with the most periphyton (Pineland) is close to an urban area, and was relatively high this year. The Tahoe

City value was about average for that site. To date, no statistically significant long-term trend in maximum periphyton biomass has been detected at any of these individual locations. Monitoring periphyton is an important indicator of near-shore health.



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Shoreline algae distribution

In 2012

Periphyton biomass was surveyed around the lake during the spring of 2012, when it was at its annual maximum. Nearly 45 locations were surveyed by snorkel in 1.5 feet of water. A Periphyton Biomass Index (PBI) is used as an indicator to reflect what the casual observer would visually detect looking into the lake from the shoreline. The PBI is defined as the percent of the local bottom area covered by periphyton multiplied by the average length of the algal filaments (cm). Zones of elevated PBI are clearly seen. (The width of the colored band does not represent the actual dimension of the onshore-offshore distribution. Similarly its length does not represent the longitudinal extent.) Overall conditions in 2012 were similar to 2011.

**Distribution of Periphyton Biomass
at 0.5m Depth, Spring 2012**

