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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. Supported by nutrient loading into the lake, changes in the underwater light environment, and a succession of algal species, the trend shows primary productivity has increased substantially over time. In 2015, there was a decrease in primary productivity to 206.1 grams of carbon per square meter, the third successive year of reduced productivity.





## Algae abundance

Yearly since 1984

Algae (phytoplankton) are the base of the Lake Tahoe food web, and essential for lake health and the well-being of the entire ecosystem. The amount or biomass of free-floating algae in the water is determined by extracting and measuring the concentration of chlorophyll-a, a photosynthetic pigment that allows plants to convert energy from the sun. Though the value varies annually, it has not shown a significant increase since measurements began in 1984. The annual average concentration for 2015 was 0.63 micrograms per liter, slightly lower than the previous two years. For the period of 1984-2015 the average annual chlorophyll-a concentration in Lake Tahoe was 0.70 micrograms per liter.





## BIOLOGY Chlorophyll-*a* distribution

The distribution of algae (measured as chlorophyll–a) is the result of a combination of light availability, nutrient availability, mixing processes, and to a lesser extent, water temperature. This figure shows color contours of chlorophyll-a concentration down to a depth of 350 feet. Below this depth chlorophyll-a concentrations are near zero due to the absence of light. Lake Tahoe has a "deep chlorophyll maximum" in the summer that occupies the range of 150-300 ft. in the water column. In that depth range the light and nutrient conditions are most favorable for algal growth.

In the early part of the year, the algae were distributed over a greater depth range because of the mixing processes that were occurring. With the onset of thermal stratification in spring, the algae were confined to a discrete band. Throughout the year concentrations decreased as nutrients were depleted. In November and December, the commencement of mixing again redistributed the algae over a broader depth range.





## 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 approximately 35 percent of the total abundance of algal cells in 2015. Surprisingly, blue-green algae (cyanobacteria) were the next most prolific group. Blue-greens only occasionally appear in Lake Tahoe in significant numbers. In 2015 they were 26% of the cells. While the proportion of the major algal groups show a degree of consistency from year-to-year, the composition of individual species within the major groups is changing, both seasonally and annually, in response to lake conditions.





## Abundance of dominant diatom species

Monthly in 2015

Diatoms have been the dominant algal group at Lake Tahoe for all but a few years since 1982. Diatoms are unique in that they are enclosed within a cell wall made of silica, called a frustule. Here the dominant diatom species at Lake Tahoe in 2015 are shown. Huge inter-annual variations are evident in the relative composition. Generally, *Cyclotella gordonensis* is the dominant diatom species in Lake Tahoe, although it is not as dominant as it has been in previous years.





## Algal groups as a fraction of total biovolume

Monthly in 2015

The biovolume of algal populations vary month to month, as well as year to year. In 2015, diatoms again dominated the biovolume of the phytoplankton community, especially in the summer. The peak in the biovolume occurred earlier in 2015, occurring in April and May. Note that the biovolume of blue greens is close to zero, despite their large fraction of the individual cell counts. Even at the peak of the bloom, algal cells occupied only one ten-millionth of the water in the lake. The peak biovolume in 2015 (90 cubic millimeters per cubic meter) was ten percent lower than the peak in 2014.





## 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 five to eight times each year, and this graph shows the maximum biomass measured at four sites for the period from January to June. In 2015, concentrations at the four sites shown were at or below their historic lows for the second year in a row. The two most urbanized sites, Tahoe City and Pineland, were one-half to one-sixth of their values in comparison with 2013. While monitoring periphyton is an important indicator of near-shore health, these data do not shed information on what is controlling year-to-year changes.





## **TAHOE: STATE OF THE LAKE REPORT 2016**

#### BIOLOGY

# Shoreline algae distribution

Periphyton biomass was surveyed around the lake during the spring of 2015, when it was at its annual maximum. Nearly 45 locations were inspected by snorkel survey in 1.5 feet (0.5 m) 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 fraction of the local bottom area covered by periphyton multiplied by the average length (cm) of the algal filaments. The PBI had fewer very high occurrences (PBI > 1.5) in 2015, possibly due to the low lake levels that prevailed. Instead there was a greater number of moderate areas (PBI = 0.51 -1.0), especially on the east shore. As lake level falls during low lake level years, the 1.5 ft. measurement depth is increasingly dominated by blue-greens at many sites including the east shore sites resulting in moderate biomass index values (in contrast, the east shore often has relatively low growth of algae at higher lake levels).

Note: The width of the colored band does not represent the actual dimension of the onshore-offshore distribution. Similarly, its length does not represent the precise longitudinal extent.

### Distribution of Periphyton Biomass at 0.5m Depth, Spring 2015

