TAHOE: STATE OF THE LAKE REPORT 2023

CLARITY

UCDAVIS
Tahoe Environmental
Research Center

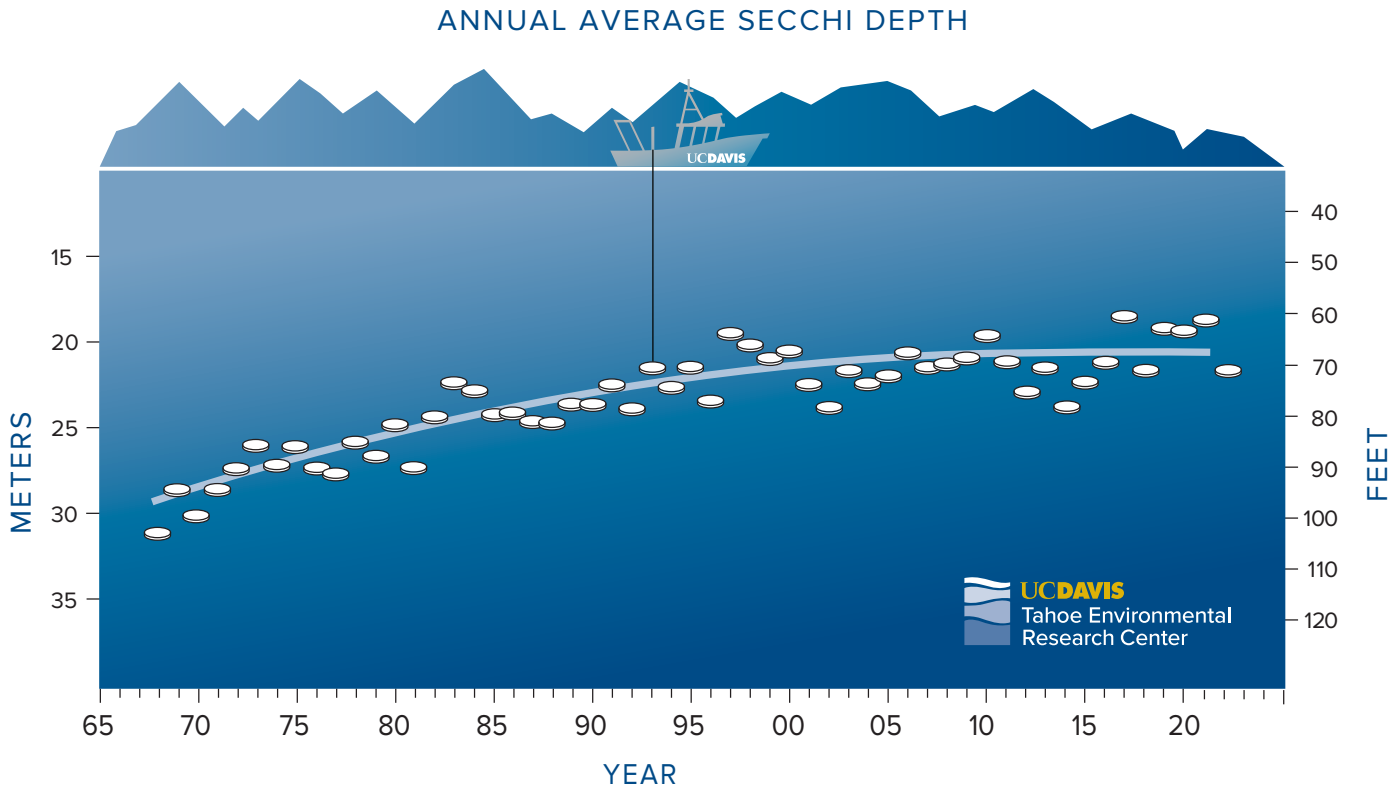
Annual average Secchi depth

Yearly since 1968

The Secchi depth is the depth at which a 10-inch white disk, called a Secchi disk, remains visible when lowered into the water. In 2022, the annual average Secchi depth was 71.7 feet (21.9 m), a 10.7 foot improvement from the previous year. The greatest individual value recorded in 2022 was an astounding 137.8 feet (42 m) on January 5, the second highest value ever recorded. This was the result of an ephemeral lake "upwelling." Upwellings are episodic events produced by strong winds and are not reflective of the overall lake clarity and health. The lowest clarity reading was 50.0 feet (15.24 m) on May 13. The clarity in 2022 was the result of a combination of factors including the absence of deep mixing of the lake in the first part of the year, and then the removal of fine particles and algae through zooplankton grazing in the second part of the year. The differences are explained in Figure 11.4.

The clarity restoration target of an annual Secchi depth of 97.4 feet (29.7 m) set by federal and state regulators, is a goal that agencies and the Tahoe Basin community continue to work toward.

Data source: TERC lake monitoring.

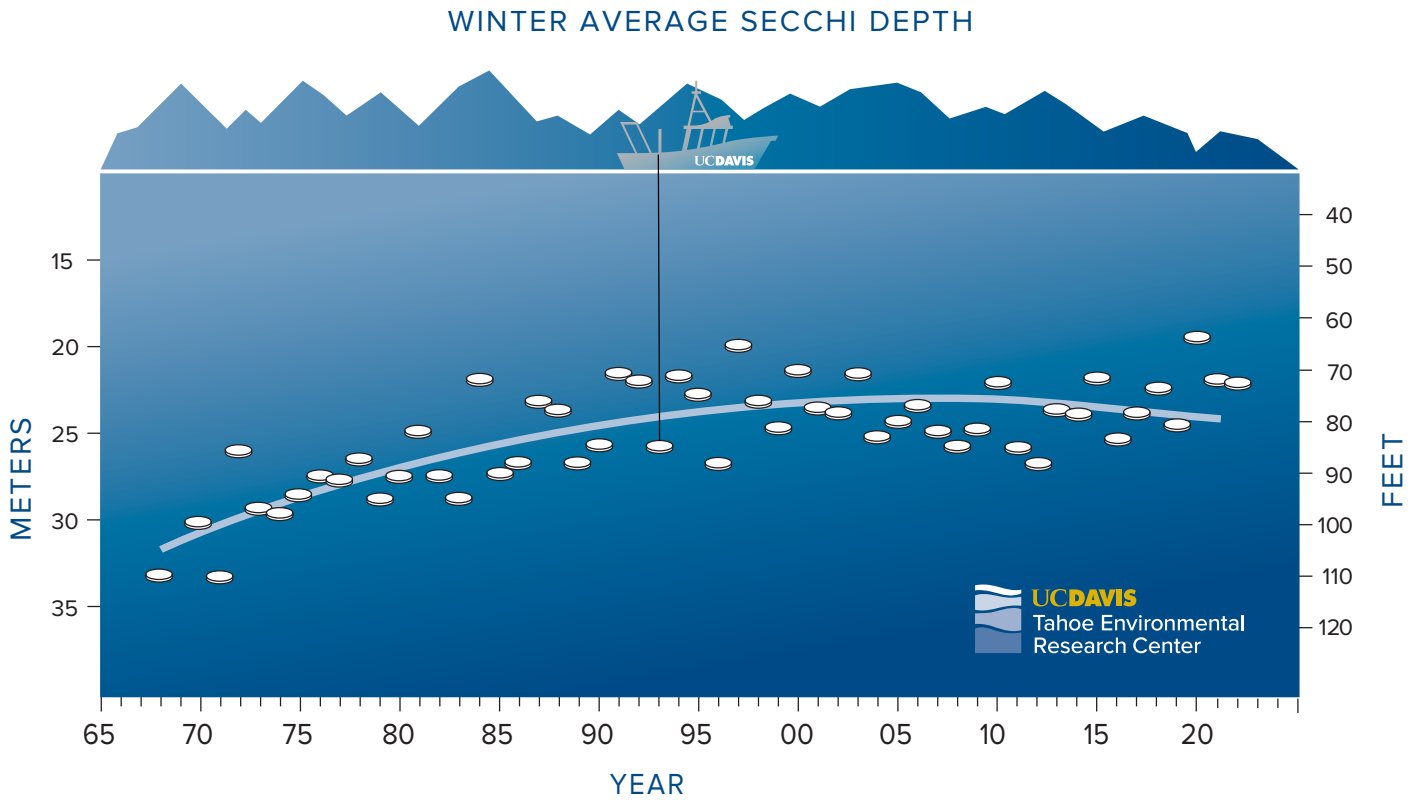


Winter Secchi depth

Yearly since 1968

Average winter Secchi depth was 72.2 feet (22.0 m), based on ten readings between December 2021 and March 2022. Winter precipitation was close to the long-term average and the clarity values were less than the long-term trend. The reasons for the low values are still not fully understood, although the record high algal biovolume (Fig. 10.6) and the unusually high cell abundances of tiny cyanobacteria (Fig. 10.4) may have played a role.

Data source: TERC lake monitoring.

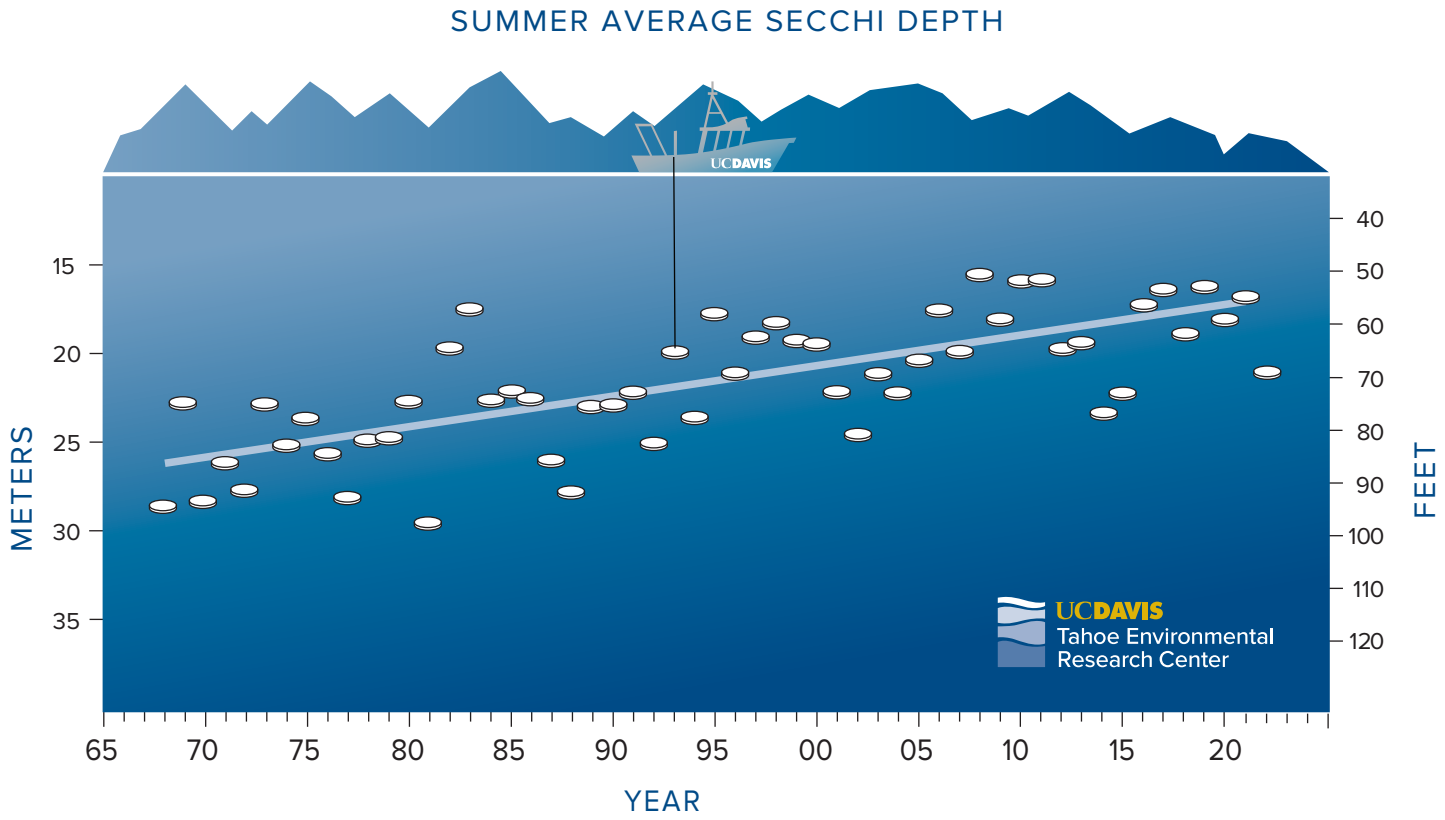


Summer Secchi depth

Yearly since 1968

Summer (June–September) clarity in Lake Tahoe in 2022 was 68.9 feet (21.0 m), an increase of over 20 feet from the previous year. This is significantly above the lowest summer value of 50.5 feet (15.4 m) in 2008. Summer is typically the season of poorest clarity. The long-term summer trend is dominated by a consistent degradation. As shown in Figure 11.4, the clarity in the month of July began to improve and from September onwards there were some of the highest Secchi depth readings in the last 40 years.

Data source: TERC lake monitoring.



Individual Secchi depths

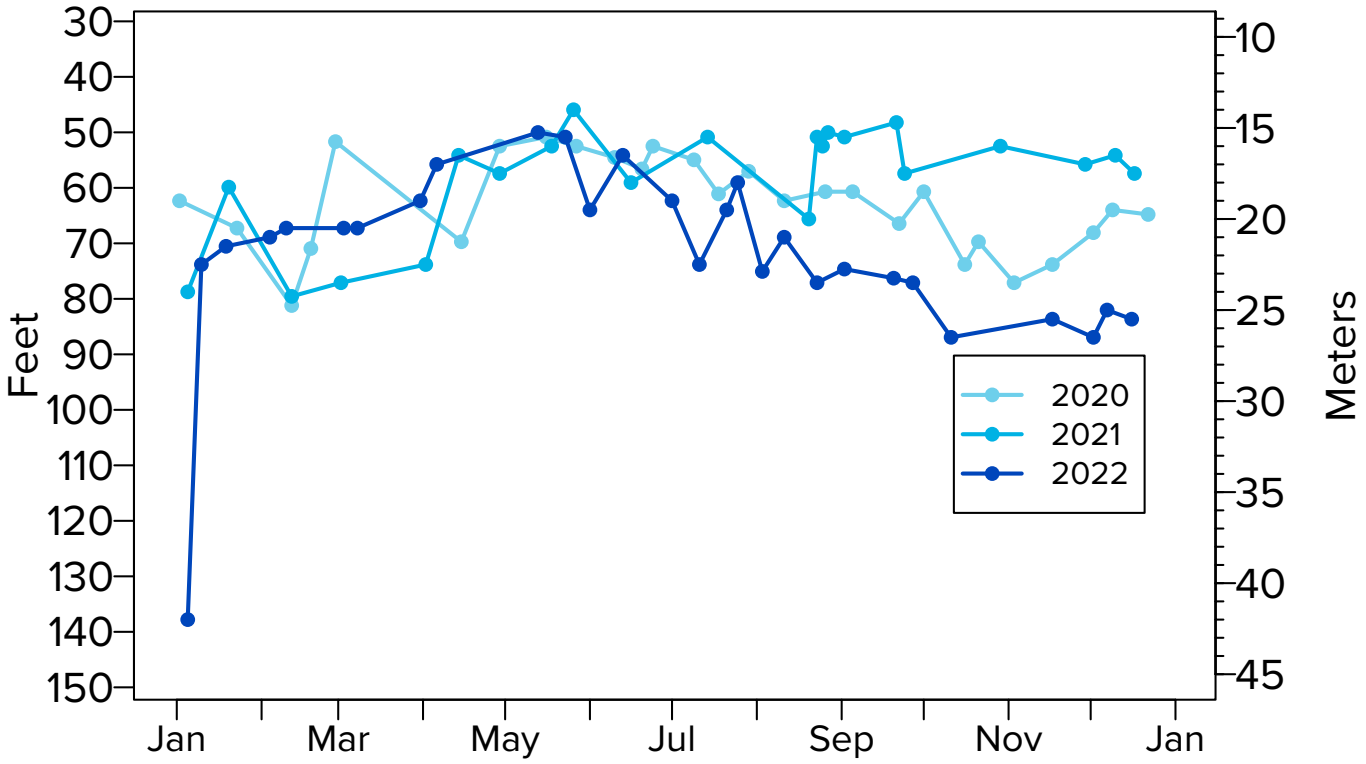
2020, 2021, 2022

The individual Secchi depth readings from the Index station on the west side of the lake for 2020, 2021, and 2022 are plotted. Secchi values can be seen to sometimes vary considerably over short time intervals. It is worth noting that a Secchi depth of 138 feet (42 m) was observed on January 5, 2022. This is the second deepest Secchi depth ever recorded at Lake Tahoe and was the result of a wind-driven upwelling, a temporary phenomenon that brings very clear hypolimnetic (bottom) water up to the surface.

The extremely low Secchi depth values at the end of 2021 were due to the unusual presence and very high abundance of the small cyanobacterial alga, *Leptolyngbya sp.* Because of its small diameter that ranges 0.9–1.3 microns, it is very effective at scattering light. The continued presence of *Leptolyngbya* in January–March of 2022 contributed to an overall winter clarity that was unexpectedly low.

This figure clearly shows that commencing in July, the 2022 Secchi depths started to substantially improve in comparison to the previous two years. From August through December, the average Secchi depth was comparable to clarity data recorded in the 1980s.

Data source: TERC lake monitoring.



August through December Secchi depths

Yearly since 1968

The magnitude of the shift in lake clarity in the latter part of 2022, can best be appreciated by plotting the Secchi depth average for the period August through December, for each year of record. The dots represent the average Secchi depth over those months, and the whiskers represent the standard deviations. Here it is evident that the level of clarity observed has not been experienced consistently since the 1980s.

Given all the factors that we know that influence lake clarity, the extended improvement in clarity through December 2022 cannot be accounted for solely by factors such as nutrients, light environment, stream inflows, and lake temperatures. Additionally, food web changes prompted by the collapse of the introduced *Mysis* population, and the subsequent changes to the phytoplankton and the zooplankton populations are likely playing a major role. The linkages are complex and monitoring in the coming year may shed light on these processes.

Data source: TERC lake monitoring.