TAHOE: STATE OF THE LAKE REPORT 2009

PHYSICAL PROPERTIES

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TAHOE ENVIRONMENTAL
RESEARCH CENTER

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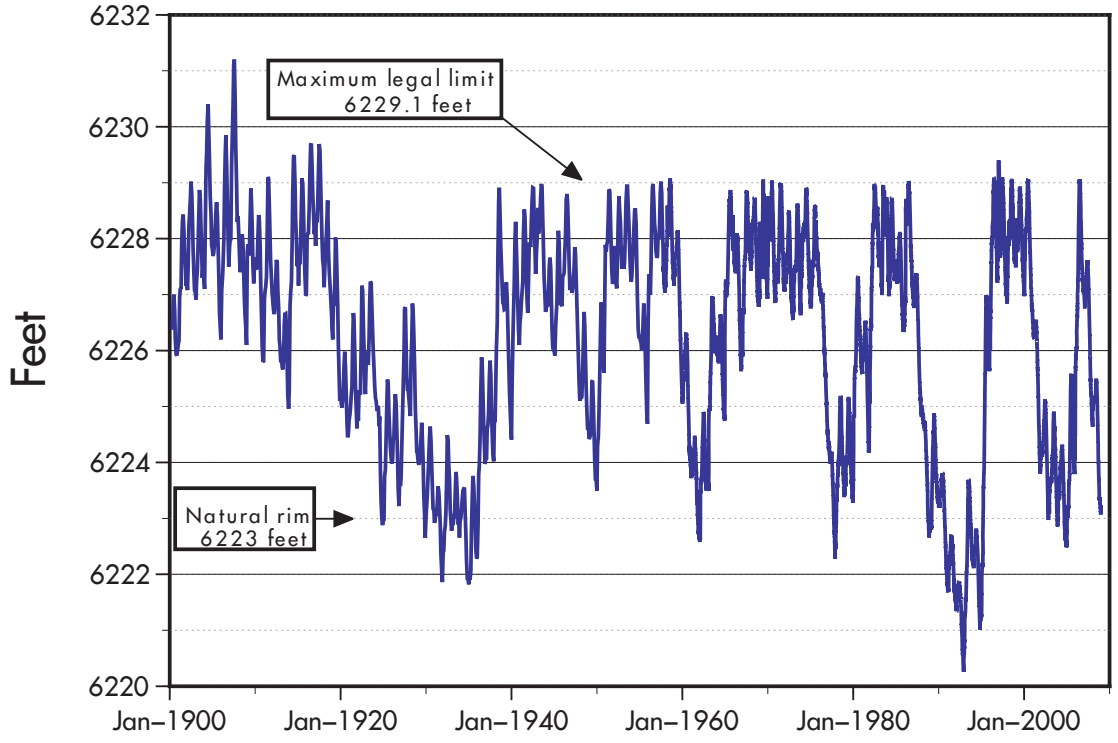
PHYSICAL PROPERTIES

Lake surface level

Daily since 1900

The lowest lake level on record was 6,220.26 feet on Nov. 30, 1992. Since 1900, lake level has varied by more than 10 feet. Lake level typically alternates between several years with values close to the maximum, then several years close to the natural rim. This pattern reflects climate wet and dry cycles in the western US. (Lake surface levels are recorded by the U.S. Geological Survey as height above mean sea level. By law, Lake Tahoe cannot exceed 6,229.1 feet and nor can water be released to the Truckee River when it falls below the natural rim of 6,223 feet.)

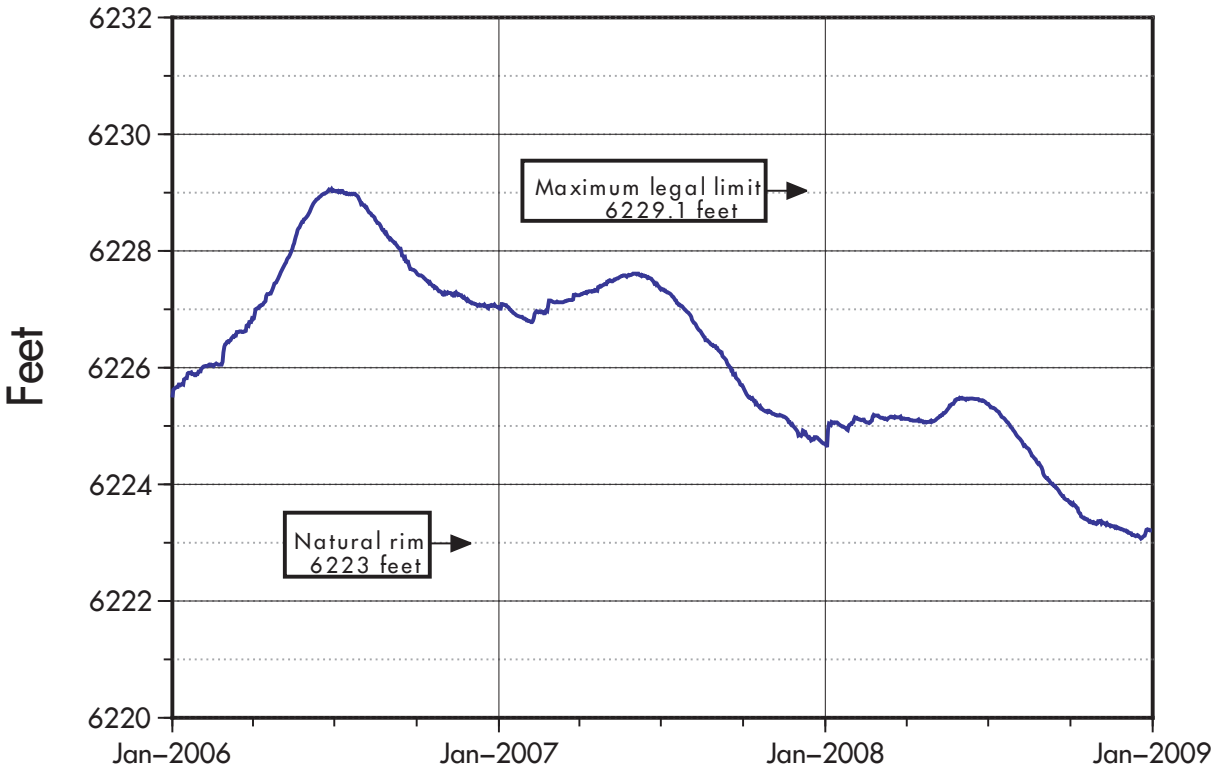


PHYSICAL PROPERTIES

Lake surface level

Daily since 2005

Lake surface level varies throughout the year. It rises due to high stream inflow, groundwater inflow and precipitation directly onto the lake. It falls due to evaporation, in-basin water withdrawals and flow out of the Truckee River. In 2008, dry conditions caused lake level to rise by only 10 inches during snowmelt, compared with several feet in normal runoff years. The highest lake level was 6225.48 feet on June 2, and the lowest was 6223.07 feet on December 19, less than 1 inch above the natural rim.

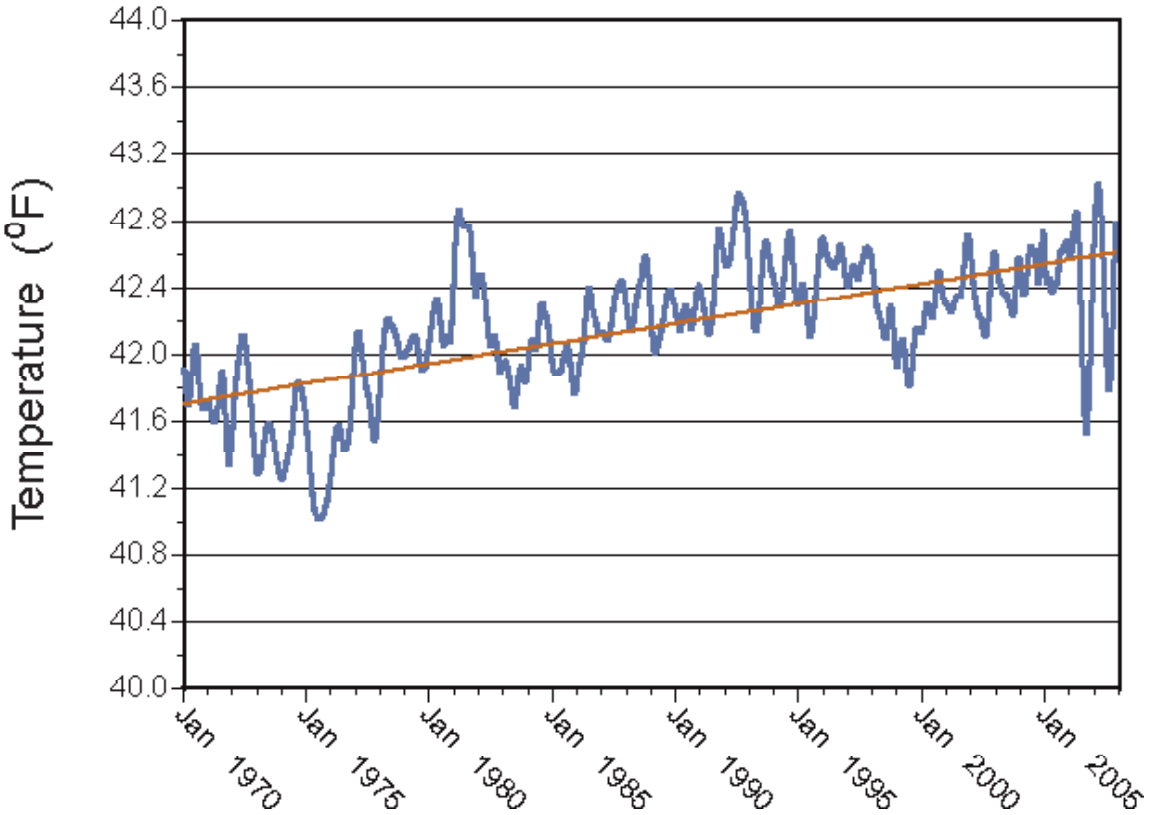


PHYSICAL PROPERTIES

Average water temperature

Since 1970

The volume-averaged temperature of Lake Tahoe has increased nearly a full degree since 1970, from 41.7 degrees F to 42.6 degrees F. The change in water temperature has affected the density stratification in the lake (Fig. 8.8) with a subsequent shift in phytoplankton community structure. A published TERC study showed that small-sized diatom species were able to best adapt to the observed decrease in mixing intensity, highlighting the strong link between climate change, physical processes and species diversity. (The monthly lake temperature profile data in this figure has been smoothed and deseasonalized to best show the long-term trend.)



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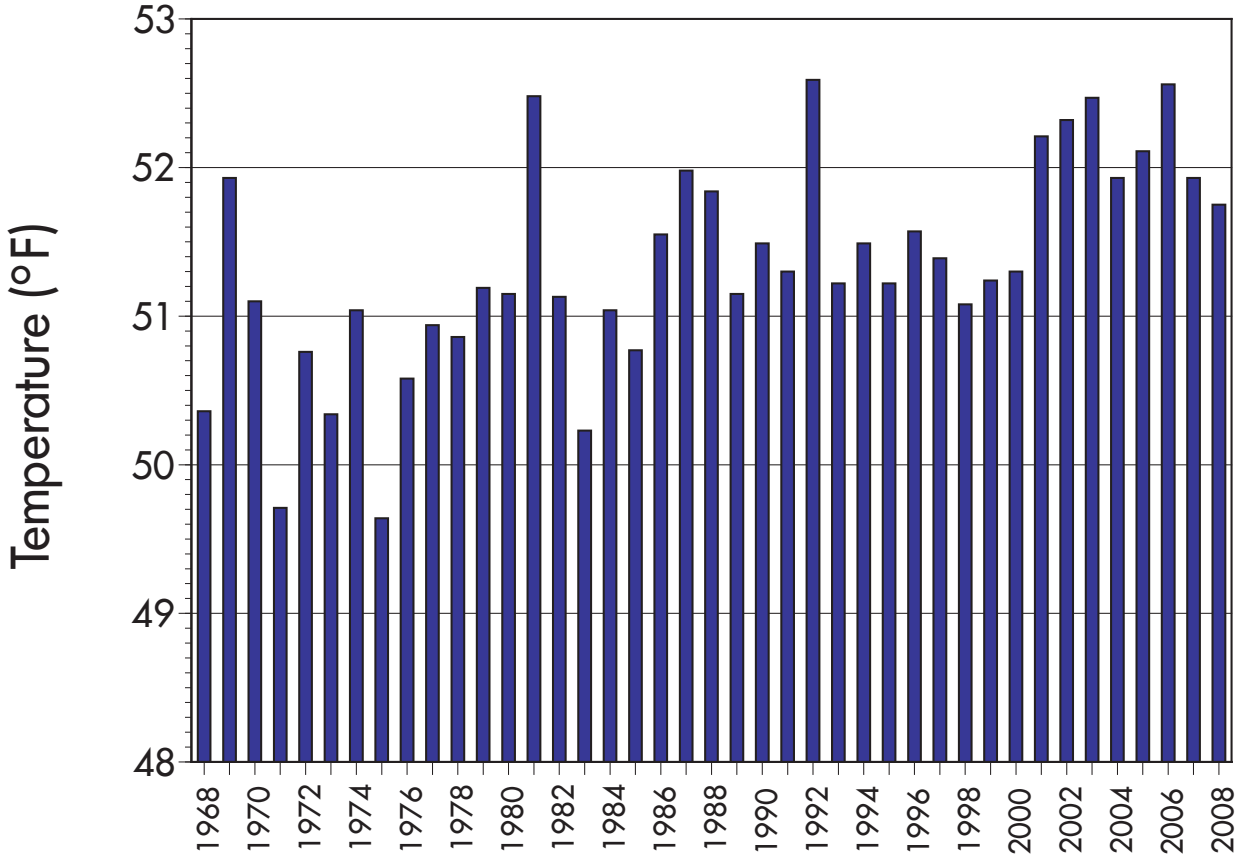
Surface water temperature

Yearly since 1968

Surface water temperatures have been recorded at the mid-lake station since 1968. Despite year-to-year variability, water temperatures show an increasing trend. The average temperature in 1968 was 50.3 degrees F. For 2008, the average surface water temperature was 51.7 degrees F.



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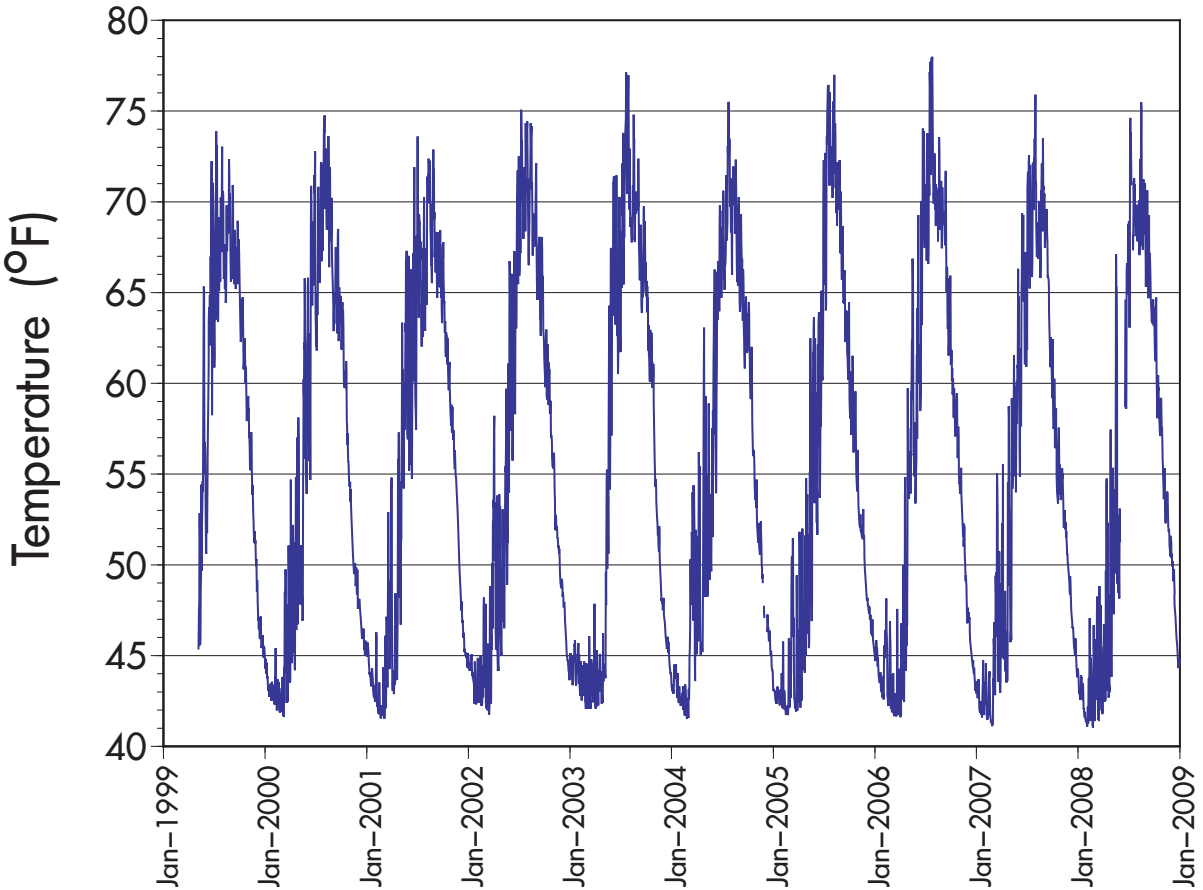
Maximum daily surface water temperature

Every 15 minutes since 1999

Maximum daily surface water temperatures were similar in 2008 to the 2007 values, although summer surface water temperatures continue to show a long-term increase. Since May 1999, the highest maximum daily surface temperature was 77.99 degrees F on July 26, 2006. The lowest maximum surface water temperature was 41.02 degrees F on Feb. 25, 2008. In the last decade, the 28 lowest maximum daily surface water temperatures occurred in 2007 and 2008. This may be attributable to the deep mixing that has occurred in both these years.

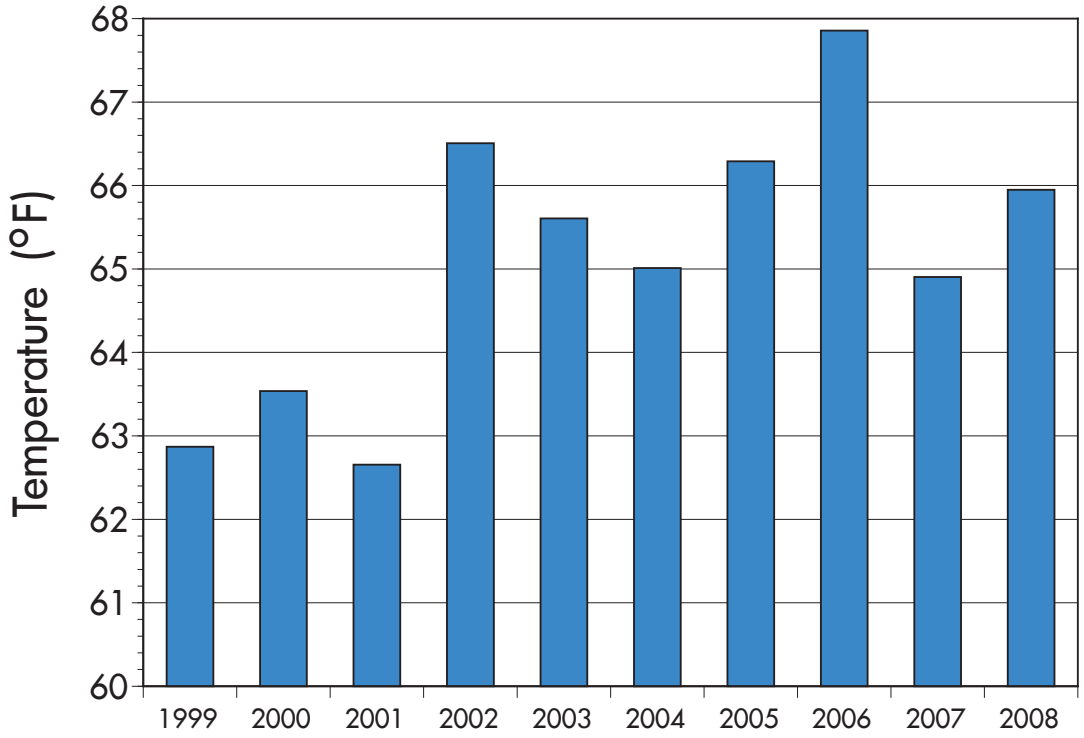


PHYSICAL PROPERTIES

July average surface water temperature

Since 1999

Since 1999, surface water temperature has been recorded every two minutes from four NASA/UC Davis buoys. Shown here are ten years of average surface water temperatures in the month of July when water temperatures are typically warmest. In 2008, July surface water temperature averaged 66 degrees F, 1.1 degrees warmer than in 2007.



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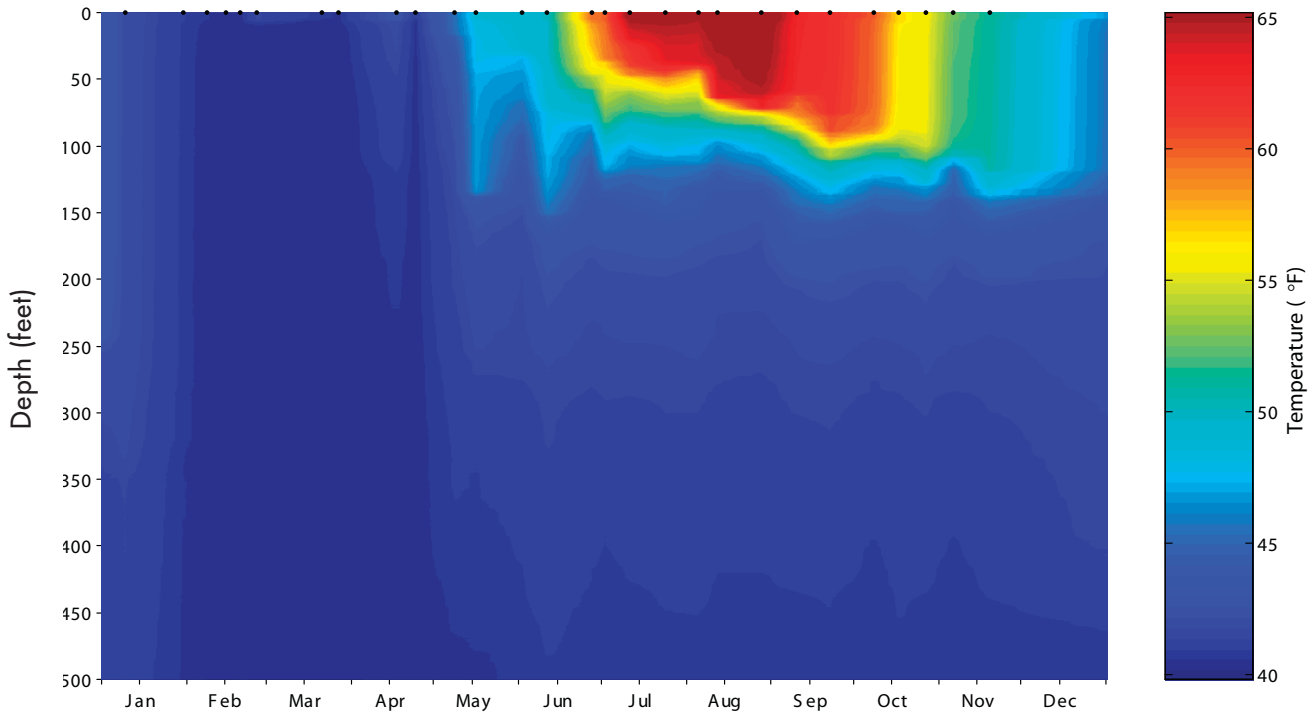
Water temperature profile

In 2008

Water temperatures are measured at six-inch intervals every two to four weeks to produce Lake Tahoe's thermal profile. In 2008, that profile followed a typical seasonal pattern. In early March, the lake was coldest with a uniform temperature throughout its depth. This resulted in a complete mixing from the surface to the bottom (1,645 feet), the second successive year in which this happened. Thermal stratification commenced in May and peaked in late August. From September onwards, the surface layer cooled and deepened.



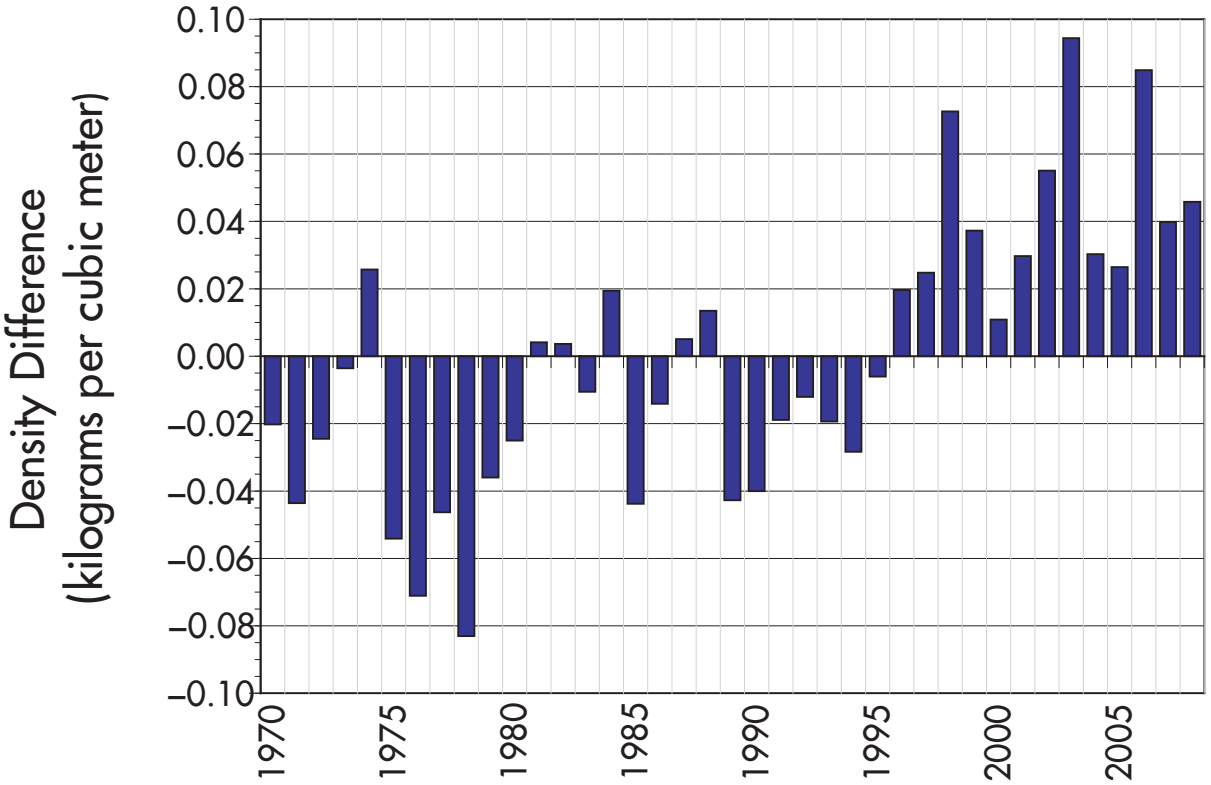
PHYSICAL PROPERTIES

Density stratification

Since 1970

Density stratification in Lake Tahoe has generally increased since 1970, as shown by the trend below. Each bar represents the annual average density difference between deep (100 to 165 feet) and shallow (0 to 33 feet) water, subtracted from the mean density. Density differences increase as Lake Tahoe's surface waters warm, making them less dense or lighter.

Increasing density stratification causes deep mixing of the lake to occur less frequently.



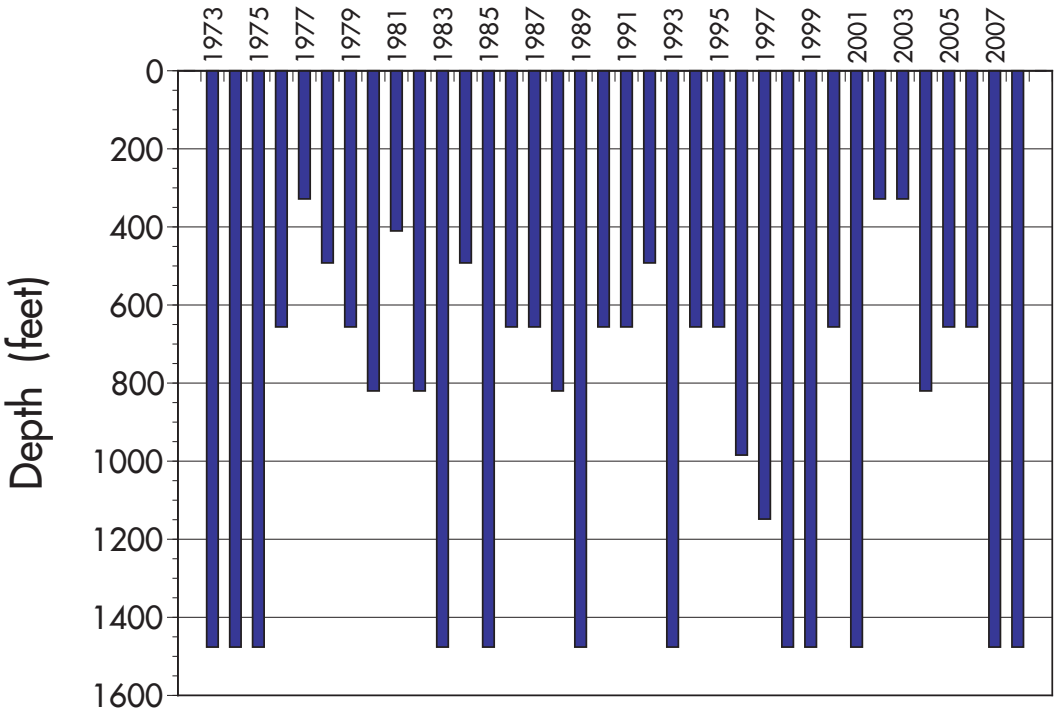
PHYSICAL PROPERTIES

Depth of mixing

Yearly since 1973

Lake Tahoe mixes each winter as surface waters cool and sink downward. In a lake as deep as Tahoe, the wind energy of winter storms helps to determine how deeply the lake mixes. Mixing depth has profound impacts on lake ecology and water quality. Deep mixing brings nutrients to the surface, where they promote algae growth. It also moves oxygen to deep waters, promoting aquatic life throughout the water column. The deepest mixing typically occurs in late February to early March.

In 2008, Lake Tahoe mixed all the way to the bottom at the mid-lake station. This was the second successive year of deep mixing. Complete mixing during two or more successive years has only occurred three times since 1973.

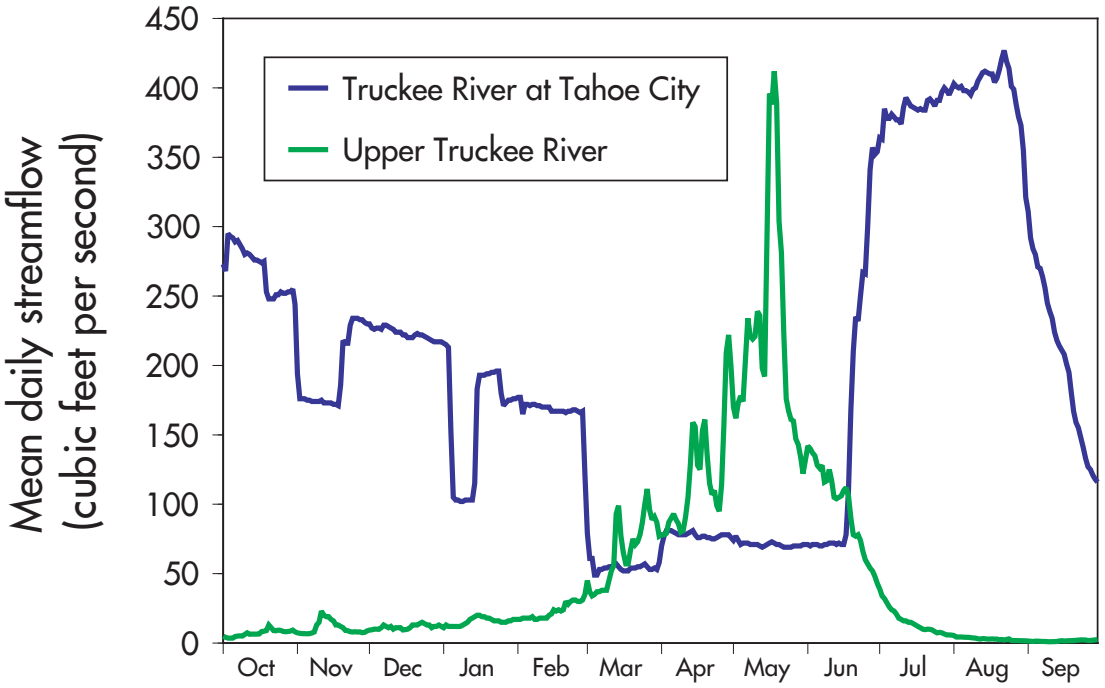


PHYSICAL PROPERTIES

Upper Truckee River vs. Truckee River Mean Daily Streamflow

Water Year 2008

The seasonal pattern (hydrograph) for the Upper Truckee River, as it flows into Lake Tahoe, was dominated by the annual snowmelt that occurs in the spring. In 2008, discharge peaked in mid-May. The low measured flow in the period October to February reflects the lack of significant rainfall, common for dry years such as 2008. The annual pattern of flow leaving Lake Tahoe via the Truckee River at Tahoe City includes natural patterns of drainage into the lake as well as human management of lake level to meet downstream water demands.



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Upper Truckee River vs. Truckee River Annual Streamflow

Since 1980

Flow into Lake Tahoe (e.g. Upper Truckee River) and discharge out of Lake Tahoe (Truckee River at Tahoe City) has shown considerable variation since 1980. The large peaks in discharge from the lake correspond to years when precipitation (and therefore total inflow) was the greatest, e.g. 1982-1983, 1986, 1995-1999. Similarly, the drought-like conditions in the early 1990s and the low precipitation years in the beginning of the 2000s also stand out. Since many of the pollutants of concern for Lake Tahoe's clarity enter along with surface flow, year-to-year changes in clarity is influenced by precipitation and runoff.