EXECUTIVE SUMMARY

Long-term data sets are invaluable: They are the key to understanding ecosystem function and change.

The long-term data set on the Lake Tahoe ecosystem that has been collected over nearly 40 years by the University of California, Davis, has become essential to public programs of ecosystem restoration and management in the Tahoe Basin.

The data reveal a unique record of trends and patterns — the result of both natural forces and human actions that have occurred over many time scales ranging from days to decades. They tell us that Lake Tahoe is a complex ecosystem, and its behavior is not always as expected.

The UC Davis Tahoe Environmental Research Center has developed sophisticated computer models that are helping scientists better predict that behavior. The long-term data sets are being used to refine the accuracy of those models. In these times of rapid change, reliable predictive models are essential tools for Tahoe Basin resource managers.

In this and future annual State of the Lake reports, we will present data for the previous year[1] placed in the context of the long-term record and arranged in the subject areas of meteorology, physical properties, nutrients, biology and clarity. In future years, we will update the data in these subjects and hope to add new ones.

The entire report is available online at http://terc.ucdavis.edu. This Web site also contains the homepage for the UC Davis Tahoe Environmental Research Center and summarizes our current activities.

Here are some highlights of the data presented in the following pages.

METEOROLOGY

The Lake Tahoe ecosystem is in large part controlled by the meteorological conditions to which it is exposed. In the short term, these are expressed as the day-to-day variations in the weather that can, for example, produce a series of storms that will result in high stream flows and pollutant runoff into the lake. In the long term, these are expressed as normal cyclical variations, as well as abnormal variations related to global warming.

The most significant trend in the meteorology data is the record of climate warming.

Historical record:

- The nightly minimum temperatures recorded at Tahoe City have displayed an upward trend, with an overall increase of more than 4 degrees F. (Fig. 6.1)
- The number of days with average air temperatures below freezing has decreased by 30 days per year. (Fig. 6.2)
- The fraction of snow in the total precipitation has decreased from 52 percent to 34 percent. (Fig. 6.6)

Previous year:

- The number of freezing days was 62. (Fig. 6.2)
- The annual average air temperature was 56.1 degrees F. (Fig. 6.3)
- March 2006 was the coldest month in the past 8 years, with an average air temperature of 27.4 degrees F. (Fig. 6.3)
- Precipitation at Tahoe City was 48.4 inches, higher than the annual average of 32.4 inches. (Fig. 6.4)
- The wettest month in the water year was December 2005, with 18.6 inches (water equivalent), making it the ninth wettest month since 1911. (Fig. 6.5)
- The fraction of snow in the total precipitation was 37.4 percent. (Fig. 6.6)

PHYSICAL PROPERTIES

Lake Tahoe's physical properties are largely a response to the external factors that are imposed upon it, especially meteorology. In turn, the physical properties determine the environment in which all the lake's chemical and biological processes (see next sections) take place.

Historical record:

- Average lake surface water temperature has risen by more than 1 degree F. in the past 35 years, and was 52.6 degrees F. in 2006. (Fig. 7.2)

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[1] *"Previous year" for some parameters means data collated in terms of the water year, which runs from October 1 through September 30; for other parameters, it means data for the calendar year, January 1 through December 31. Therefore, for this 2007 report, water-year data are from Oct. 1, 2005 through Sept. 30, 2006. Calendar-year data are from Jan. 1, 2006 through Dec. 31, 2006.*

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- Surface water temperatures in July have risen by 5 degrees F. in the past 7 years. July 2006 was the warmest on record, with an average temperature of 67.8 °F. (Fig. 7.4)
- The highest recorded surface water temperature occurred on July 26, 2006: 78 degrees F. (Fig. 7.3)

Previous year:

- Lake surface level was generally high. The lowest lake level for the year was 6225.49 feet on Jan. 1. (Fig. 7.1)
- The annual cycle of mixing in Lake Tahoe extended to a depth of 650 feet in 2006, approximately one third of the total depth. (Fig. 7.6)
- Throughout the year, dissolved oxygen concentration in the surface water was between 90 and 100 percent of the saturation limit. (Fig. 7.8)

NUTRIENTS

Overgrowth of algae is a problem in Lake Tahoe. It coats rocks on shorelines, making them green and slimy. And offshore, it contributes to making the water greenish and less clear.

The two nutrients that most affect algal growth in Lake Tahoe are nitrogen and phosphorus. These nutrients are measured at various depths at both the Mid-lake and Index stations. One form of nitrogen—nitrate—enters the lake via stream runoff, urban runoff, groundwater and atmospheric deposition (falling out of the air). Phosphorus naturally occurs in Tahoe Basin soils and enters the lake via soil disturbance and erosion.

UC Davis research has found that, while Lake Tahoe algae are more responsive to increases in phosphorus than nitrogen, the greatest response occurs when both are added.

Historical record:

- Nitrogen concentrations in the lake have remained generally constant for many years. (Fig. 8.1)
- Phosphorus decreased to a minimum in 1999 and since has shown an increasing trend. (Fig. 8.2)
- Stream inputs of both nitrogen and phosphorus are directly linked to the amount of annual precipitation.

Previous year:

- Atmospheric inputs of both nitrogen and phosphorus in 2006 were relatively low.

BIOLOGY

The aspects of lake biology that have been measured for the longest times are those elements at the base of the food web – the algae (or phytoplankton) and the zooplankton (microscopic aquatic animals that graze on algae). Algae and zooplankton affect clarity and overall lake aesthetics, as well as influencing the entire lake food web.

Historical record:

- Primary productivity, or the rate at which algae produce biomass through photosynthesis, has been increasing since 1959. (Fig. 9.1)
- Since 1984, we have not seen a clear, long-term trend in phytoplankton abundance. (Fig. 9.3)
- Since 1984, the average annual depth for deep chlorophyll maximum (the depth in Lake Tahoe where the highest chlorophyll concentrations occur) declined by approximately 45 feet. (Fig. 9.5)

Previous year:

- Primary productivity in 2006 was the highest on record, at five times the 1959 level. (Fig. 9.1)
- The deep chlorophyll maximum occurred at a depth of 117 feet. (Fig. 9.5)
- Periphyton (attached algae) concentrations in 2006 were average. The two sites with the most periphyton were near the two more urban areas. (Fig. 9.9)
- Zooplankton concentrations in 2006 were the lowest recorded since 1998. Epischura concentrations were unusually low but the rarely seen Bosmina were present. (Fig. 9.10)

CLARITY

Clarity remains the parameter of greatest interest at Lake Tahoe because of its role as the leading indicator of lake degradation and the community's efforts to restore clarity to historic values. Secchi depth (the point below the lake surface at which a 10-inch white disk disappears from view) is the longest continuous measure of water clarity at Lake Tahoe. Secchi measurements began in 1968.

- In 2006, the Secchi depth was 67.7 feet, a reduction of 4.7 feeet from the previous year. The year's high precipitation (see Fig. 6.6), and the resulting high urban runoff and stream flow, largely account for this decrease. (Fig. 10.1)