

Volunteer education, empowerment, and water quality monitoring at Lake Tahoe

Chris Joseph

Lake Tahoe is perched at 6,223 feet above sea level in the Sierra Nevada mountain range, straddling the California-Nevada border. Granitic peaks tower 10,000-feet over the lake's 72 miles of shoreline and famously blue water whose clarity plunges to an average depth of 65 feet. Around 15 million people live within a half-day drive of Tahoe, its 13 ski resorts, and 250 average days of sunshine per year.

The destination absorbs approximately 17 million annual visits, about four times as many as Yosemite National Park. Yet Tahoe is not a national park, despite several failed attempts to make it one. People come to ski and snowboard in the winter; swim, paddle, and boat in the summer; and enjoy stunning natural beauty year-round.

That is a very expansive way to say that the Lake Tahoe Basin is popular. This popularity puts pressure on the natural environment, especially water quality and clarity, in the form of litter, fine sediment pollution from roads and urban areas, and aquatic invasive species.

Fortunately, Tahoe enthusiasts are willing to donate their time and effort to protect the place through citizen science volunteering. The environmental nonprofit "Keep Tahoe Blue" mobilizes thousands of volunteer hours each year. This donor-funded, science-based organization of environmental experts and Tahoe lovers has worked to protect and restore the Lake Tahoe Basin's health, sustainability, and scenic beauty since 1957.

In addition to its work in science, advocacy, and innovation, Keep Tahoe Blue engages the lake's diverse community of residents and visitors in hands-on water quality monitoring programs and events. They include

"Snapshot Day," an annual water quality monitoring event; "Eyes on the Lake," an aquatic invasive species identification and reporting program; and "Citizen Science Tahoe," a web-based app where anyone can report environmental observations with nothing more than a phone.

Tahoe-Truckee "Snapshot Day"

This is an annual event held each May in which volunteers collect water quality data from streams, creeks, ponds, and lakes in the Tahoe-Truckee region for a moment-in-time "snapshot" of the Truckee River watershed's health (Figure 1). Keep Tahoe Blue, together with partner organizations, trains community members to sample sites from the Truckee River's headwaters, around Lake Tahoe, then along the river to Reno and through to its inland terminus at Pyramid Lake.

The event began in 2001 and has run every year without interruption, even through the COVID-19 pandemic. Since 2014, Keep Tahoe Blue has organized the southern zone, which has included 89 sampling sites spanning 25 different water bodies. The nonprofit staff members visit each sampling site before the event and assign a priority level based on past monitoring results, current conditions, and accessibility. They also calibrate sampling equipment, including multiparameter water meters. Around 100 volunteers, grouped into teams of three to six people, participate each year. Team leaders go through a training session of classroom instruction and practice with testing equipment about a week before they lead their teams into the field.

Although it occurs just once a year, Snapshot Day is a fan favorite that draws many volunteers back year after year.

One such volunteer, a professor at the local community college, has participated in every one of the event's 25 years, and many more people are four-, five-, and six-time returners. In 2025, one team even had shirts custom embroidered with their adopted team name, the "Trout Creekers." They are joined by full-time residents, second homeowners, frequent visitors, and high school and community college students whose class curricula features Snapshot Day.

The event partners who conduct sampling in the other zones are just as varied. Over the years, they have included research institutes, utility districts, water providers, resource conservation districts, public agencies, and land managers. In 2026, two Native American tribes, the Washoe Tribe of Nevada and California and the Pyramid Lake Paiute Tribe, will join.

During the event, volunteer teams collect:

Field Measurements

- *Water temperature* is a key indicator of ecosystem health. In mountain streams and lakes, cooler water provides better habitat for aquatic life.
- *pH* measures how acidic or basic a water sample is, on a scale from 0 (very acidic) to 14 (very basic). Most aquatic life prefers a pH close to 7.
- *Dissolved oxygen* is the amount of gaseous oxygen dissolved in water – an essential ingredient for fish and other aquatic life. When levels drop, many species become stressed.
- *Electrical conductivity* measures how easily water can carry an electric current. Sudden or



Figure 1. A Snapshot Day volunteer team collects water samples and makes visual observations on the northern shore of Fallen Leaf Lake, California, in May 2024.

significant changes in conductivity can signal new discharges entering the water.

- *Total dissolved solids* are a measure of the inorganic and organic particles dissolved in water. Shifts can indicate new inputs from runoff, pollution, or other sources.

Visual Observations

- *Weather observations*, like cloud cover and wind, provide context about short-term conditions that may affect water quality. A major storm, for example, could increase runoff or erosion in the sampling area.
- *Water sample observations*, like water odor and color, offer qualitative clues that can help explain measurements at a site.
- *Sampling site conditions*, including in-stream flow and water clarity, add more context to measurements. For example, evidence of a new pipe or storm drain can help explain unexpected results.

Samples for Lab Testing

- *Nutrients* support the growth of plants and algae at the base of the aquatic food web, but at elevated levels, they can become a problem, increasing the potential for harmful algae and aquatic invasive species. Nitrogen and phosphorus are the two most important nutrients monitored, and both occur in several different forms.
- *Bacteria* are present in every natural system, but elevated levels can indicate contamination from wastewater, wildlife, or other inputs. *E. coli*, in particular, is monitored for potential risks to human health.
- *Turbidity* measures how cloudy the water is, caused by suspended particles like sediment, algae, or organic matter. Sudden changes can indicate erosion or other inputs upstream (Figure 2).

The data collected across all sampling zones are compiled into an annual report and made publicly available at www.tahoetruckeesnapshotday.org.

Keep Tahoe Blue also prepares annual reports for public land managers, as many sampling sites are located on national forest, state park, or conservancy agency land. Land managers may add the data to their own environmental monitoring portfolios or use it to address areas of concern highlighted in the measurements. Keep Tahoe Blue recently released a 25-year cumulative report as an online, interactive StoryMap available at www.keeptahoeblue.org/ssd. The trends and overall picture are encouraging: tributaries and lakes across the Tahoe-Truckee watershed consistently show healthy water quality. Yet this doesn't mean every result is perfect. When something looks off, like an unusually high bacteria reading, event organizers follow up with land managers to find the source and if needed, resample. In some cases, measurements can reveal point-source pollution, such as livestock let loose in a meadow above a sampling site.

Beyond a quarter-century of data, Snapshot Day's qualitative benefits are just as valuable. The event connects the community to its watershed, exposes

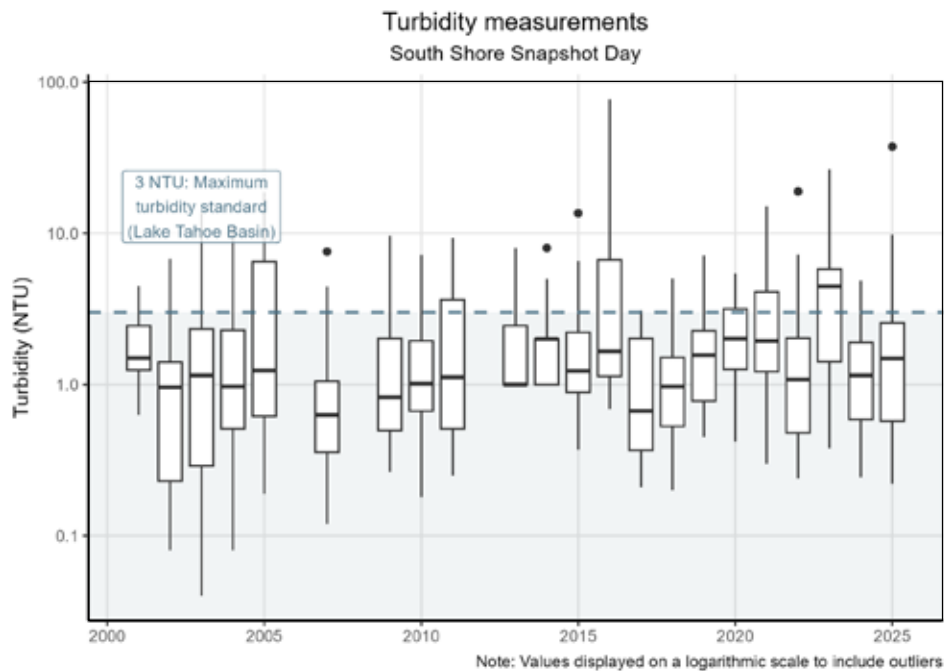


Figure 2. Twenty-five years of South Shore Snapshot Day turbidity data are charted using box-and-whisker plots. Eighty percent of these turbidity readings fall below the 3 NTU standard set for shallow waters near Lake Tahoe’s tributaries.

students to environmental science, and fosters environmental stewardship in everyone involved.

Eyes on the Lake

Eyes on the Lake is Keep Tahoe Blue’s citizen science program to help prevent the spread of aquatic invasive species (AIS), which pose the biggest threat to Lake Tahoe’s delicate ecology and water quality. Program volunteers “protect while they play” by learning about aquatic invasive species in Tahoe, conducting self-paced field surveys while they enjoy the lake, and reporting their observations through a web app available at citizensciencetahoe.org.

Where Snapshot Day is a time-bound, one-day event, Eyes on the Lake was created by Keep Tahoe Blue in 2013 to meet Lake Tahoe enthusiasts where they are – on or near the water, whenever that may be. By making participation simple and unscheduled, the program creates a stream of real-time, GPS-located, crowd-sourced water monitoring data.

The first step is education. Multiple training sessions are held each year, both in person and online, where participants learn how to distinguish invasive species from their native look-alikes and what to do if they think they’ve spotted one (Figure 3). Members of the public are

trained for free, alongside staff from agencies like California State Parks and the California Tahoe Conservancy, as well as the people who operate Tahoe’s 13 marinas. Marinas are required to attend an Eyes on the Lake training each year as part of their operating permits. As frontline workers, their ability to spot and report aquatic invasive species is key to protecting the lake’s water quality.

For folks who can’t attend a training, the Citizen Science Tahoe web app is built with prompts and sample photos to help users determine whether what they’re seeing is a native species like northern milfoil (*Myriophyllum sibiricum*), or an invasive species like Eurasian watermilfoil (*Myriophyllum spicatum*).

Keep Tahoe Blue’s staff review observations shortly after they are submitted through Citizen Science Tahoe. If a submission indicates a possible new infestation of aquatic invasive plants or mollusks, the *Early Detection and Rapid Response* protocol can be triggered. This system lays out clear steps for Keep Tahoe Blue, the Tahoe Regional Planning Agency, and the Tahoe Resource Conservation District to contact the property owner, conduct a site assessment, determine the appropriate response, designate a lead agency, and secure funding to perform the work. The goal is to move quickly and in coordination to root out populations of aquatic invasive species before they can establish.

Here is a typical example: A paddler sees what they think may be curlyleaf pondweed (*Potamogeton crispus*) growing near a marina. They submit a photo, GPS coordinates, and other information through the Citizen Science Tahoe web app. Within a few days, scuba divers are in the water to remove the few problem plants before they can proliferate (Figure 4).



Figure 3. Volunteers practice aquatic plant identification using samples and printed ID guides as part of an Eyes on the Lake training in 2025.



Figure 4. A diver examines an aquatic plant specimen removed from the lake floor below a Tahoe marina to determine whether it is curlyleaf pondweed. The action was part of a 2021 deployment of Tahoe’s Early Detection and Rapid Response Protocol to prevent aquatic invasive species from spreading.

The Eyes on the Lake program has trained 680 volunteers and generated 1,506 aquatic invasive species surveys. That volunteer effort has led to the identification and prevention of eight aquatic invasive species infestations in Lake Tahoe – eight instances where the lake’s water quality was protected because citizen scientists were empowered and active.

Tahoe’s environmental agencies use the data to determine where additional monitoring is needed to track the extent of aquatic invasive species in the lake. The compiled survey data has guided the creation of scuba diver transects. Eyes on the Lake also includes a proactive element: the Outreach Team. These volunteers get special training before roaming beaches during the summer season to speak with beachgoers face to face. They offer education about the dangers invasive species pose to Lake Tahoe’s health and share simple steps recreators can take to stop invasives from spreading, such as making sure all water gear is clean, drained, and dry before it touches the water (Figure 5).

Citizen Science Tahoe

The Citizen Science Tahoe web app was designed to collect much more than sightings of aquatic invasive weeds. It

was built using ArcGIS’s Survey123 and includes six surveys where people can share observations of nearshore water quality, algae, litter, and graffiti, among other things (Figure 6).



Figure 5. Eyes on the Lake Outreach Team volunteers educate recreators about the threat of invasive golden mussels in the summer of 2025. They also provide instructions for how to clean, drain and Dry water gear.

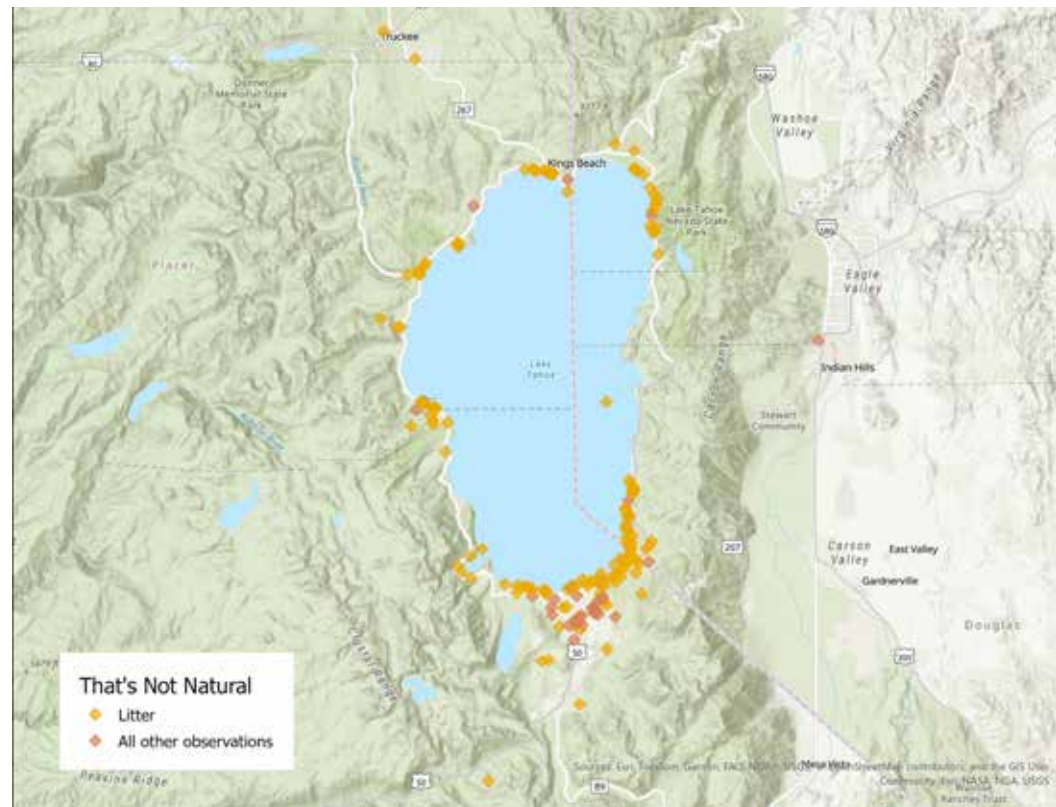


Figure 6: The Citizen Science Tahoe web app displays the observations that users submit in real time. This map shows pollution observations submitted through the That’s Not Natural survey.

The web app is a collaborative venture between the University of California Davis Tahoe Environmental Research Center, the Desert Research Institute, and Keep Tahoe Blue. Observations of pollution, in any form, are collected using the web app's *That's Not Natural* survey. A simple set of questions prompts the user to input information about what they saw, how much, when, and where, including dropping a GPS map pin and submitting photos (Figure 7).

Just like with Eyes on the Lake survey submissions, these reports are all reviewed and flagged for importance. As the dataset grows, it can reveal trends that prompt managerial action. For example, recurring reports of overflowing dumpsters can point to a developing litter hotspot. This can lead to changes in what trash and restroom infrastructure are placed in that area and how frequently they are serviced.

Through events like Snapshot Day and programs like Eyes on the Lake and Citizen Science Tahoe, businesses, agencies, and the public have an open door to monitor and protect Lake Tahoe's unique water quality.

Chris Joseph is communications director for Keep Tahoe Blue. He oversees the organization's science communications, strategic writing, marketing, and public relations. Chris holds a B.S. in geography from



Figure 7. Before picking up litter near the shoreline, a paddler reports it using the Citizen Science Tahoe web app. Observations like this help identify and address litter hotspots.

UCLA and M.Sc. in biodiversity conservation & management from Oxford University. Learn more about Keep Tahoe Blue's work at www.keeptahoeblue.org.



More moments like this brought to you by EasyPro® SRC Aeration with Sound Shield™

Artist's Rendering

Performance you can trust but can't hear

EASYPRO™ DELUXE AERATION SYSTEMS

 Game changing > 50% reduction in perceived loudness compared to competitors' compressors

 Unchanged reliability and proven performance

 All EasyPro® Deluxe Aeration Kits with Stratus™ SRC Compressors now include Sound Shield™ and cabinet with noise reducing foam.

Kits are available to easily retrofit existing Stratus™ SRC Compressors.



EASYPRO
Pond Products

800-448-3873
EASYPRO.COM