Tahoe City Field Station General Information

Location of the Tahoe City Field Station and Eriksson Education Center

- Address: 2400 Lake Forest Road, Tahoe City, CA 96145
- The UC Davis Tahoe City Field Station (also commonly known as the Historic Fish Hatchery) is located just east of Tahoe City on the southwest corner of Highway 28 and Lake Forest Road at the west entrance.
- Please note that parking is limited. Walk, bike, or use public transportation to leave more space available for visitors.
- Information on public transportation: www.laketahoetransit.com. Buses are available every 30 minutes and the transit stop is located right at the entrance to the site.

Important contact information

UC Davis Tahoe City Field Station	530-583-3279	Phone will ring 4-5 times before it redirects to Alison Toy's line
Alison Toy, Docent Program Coordinator		
Work	775-881-7566	
Mobile	510-734-9919	
Email	antoy@ucdavis.edu	
Heather Segale, Education and Outreach Director		
Work	775-881-7562	
Mobile	530-906-1000	
Email	hmsegale@ucdavis.edu	
AmeriCorps Members	775-881-7560, ext. 7474 or ext. 7483	
Brant Allen, Field Lab Director		
Work	775-881-7560, ext. 7472	
Mobile	530-604-6551	
Email	bcallen@ucdavis.edu	
Anne Liston, Lab Manager and Safety Coordinator		
Work	775-881-7560, ext. 7472	
Mobile	530-400-0181	
Email	amliston@ucdavis.edu	

Introduction to the Eriksson Education Center

TERC worked with exhibit design and landscape consultants to develop the themes and messages to be communicated to the public through interpretive exhibits and signs.

Main theme: Our choices and actions directly impact Lake Tahoe, its environment, and its future.

Topics:

- The Historic Fish Hatchery at Tahoe City (Fish Hatchery History)
- UC Davis Tahoe City Field Station (Research Happens Here)
- Native plant demonstration garden (Go native!)
- People and the Tahoe Basin (Living in harmony)
- Stream environment zones (Restoring Polaris Creek)
- Wetland wildlife (Who lives here?)
- Providing natural protection (Wetlands matter)
- Citizen Science (Phenology and Water Quality)
- Best Management Practices (Keeping Lake Tahoe blue and clear)
- Best Management Practices ID signs
- Plant ID signs
- *Forest Health (coming soon)*
- *Plant Phenology (coming soon)*

Background Information

Historical Information

- In 1920, construction of the Tahoe City Fish Hatchery was completed by California Fish and Game Commission (today's California Department of Fish and Game).
- Originally, the building was used as a fish hatchery.
- Desired game fish such as Native Lahontan Cutthroat Trout, Kokanee Salmon, Eastern Brook Trout, Rainbow Trout, & Brown Trout were raised here.
- In 1956, the hatchery closed when it could no longer keep up with the demand for larger fish due to the cold-water temperatures yielding slow fish growth rates.
- California Department of Fish and Game continued to occupy the building until 1975 when Professor Dr. Charles Goldman utilized the space for the UC Davis Tahoe Research Group.
- In 1996, UC Davis purchased the site for $1.
- Today the research group is called the UC Davis Tahoe Environmental Research Center or "TERC".
- Millions of dollars were raised for the historic renovation that you see today.
    - Demolition of exterior buildings
    - Demolition of existing interior walls
    - Earthquake retrofitting
    - New roof
    - New windows
    - Replacement of cedar plank siding
    - Chemistry Lab
    - Scuba Locker
    - Office and meeting space
    - Workroom for experiment preparation
    - Boat house

Side note: John Steinbeck worked at the hatchery for one summer and wrote his first novel, *Cup of Gold* while in Tahoe.

Boat House and Research Vessels

UC Davis operates multiple research vessels, including the RV John LeConte, RV Bob Richards, and RV Ted Frantz. The boathouse is used to store smaller boats and field research equipment. It was refurbished and named in honor of Bob Combs.

UC Davis Research at Lake Tahoe

- Research includes: Limnology (the study of fresh water systems), aquatic invasive species, watershed processes, terrestrial ecology, atmospheric quality, meteorology, remote sensing, numerical modeling, urban hydrology, and 3-D visualizations.
- UC Davis research provides information for management decisions and promotes sustainable use of Lake Tahoe.
- Current projects include (read more on our website terc.ucdavis.edu/research):
    - Cultured Ecology – studying how well algae in tanks extract nutrients and fine sediments from urban runoff
    - Long term lake and stream monitoring
    - Aquatic Invasive Species (AIS) monitoring and management/control
    - Mysis shrimp removal from Emerald Bay effect on clarity
    - Metaphyton and Periphyton algal growth monitoring
    - Microplastics

Education and Outreach

- Connecting UC Davis research to the community
- Community Programs (Monthly Lectures, Docent Program)
- Student and Educator Programs (Field Trips, Trout in the Classroom)
- Special events (Fisheries Field Day, Science Expo)
- Additional information available online at http://tahoe.ucdavis.edu/education
- Direct inquiries to Heather Segale, education and outreach director, 775-881-7562 or hmsegale@ucdavis.edu

Field Site Projects

- Vegetable Phenology Raised Bed - Since 2014, UC Davis TERC has been part of an annual basin-wide phenology project in partnership with the Lake Tahoe Master Gardeners and Slow Foods. The purpose of these trials is to determine the suitability of specific cultivars/varietals of fruits and vegetables to the Truckee/Tahoe region. These varieties are selected for their shorter growing season and adaptability towards a cooler climate. To facilitate the evaluation, we invite people with an interest in science reporting and with special interest in growing fruits and vegetables to participate in a garden workshop. Those participating receive instructions on the history and cultivation techniques as well as the opportunity to receive at no cost several plants to grow in their home gardens. During the course of this study, each participant is expected to provide information on garden location, garden conditions at the time of planting, proposed methods of cultivation and periodic updates related to plant growth and development. The raised bed is used during these workshops as a demo site to show novice gardeners strategies for planting seedlings.

Approximately four to five workshops happen at the Tahoe City Field Station in early spring. Direct inquiries to Alison Toy, (775) 881-7566 or antoy@ucdavis.edu.

- Lath House –TERC's forest and conservation biology lab collect seeds from local and diverse sources to restore and reforest sugar pine populations on the north shore of the Lake Tahoe Basin. In the future, other forest tree and plant species that need restoration and conservation measures can be grown, maintained, and studied in the TERC lath house. Direct inquiries to Alison Toy, (775) 881-7566 or antoy@ucdavis.edu.

Interior Exhibit Panels

1. **Welcome to the Eriksson Education Center in memory of Paul & Helen Eriksson**

2. **The Historic Fish Hatchery at Tahoe City (Fish Hatchery History)**
    a. Why the need for a hatchery in Lake Tahoe?
        i. Responding to the demand for fish in the region, the State of California built a hatchery here
        ii. Overfishing, a growing human population and environmental damage created the need for fish hatcheries
    b. Fish were raised from eggs → alevin (or sac-fry) → fingerlings, before being released in lakes and streams around the region.

3. **UC Davis Tahoe City Field Station (Research Happens Here)**
    a. Researchers from UC Davis and other institutions use this site for field operations.
    b. The work done here today is vital for the study and protection of Lake Tahoe's ecology.

Spanish versions of the panels will be available as printed handouts.

Timeline

Photos and text wrap around the exhibit room with a combined timeline of the history of the hatchery facility and species introductions into Lake Tahoe.

- 1859: The discovery of silver at the Comstock Lode (near Virginia City, NV) brings many more people to the area. Fish populations decline from overfishing and environmental damage from logging.
- 1859-1917: Initially abundant Lahontan cutthroat trout and whitefish populations support a commercial fishing industry on the lake.
- 1870: The California Legislature passes an act that "provides for the restoration and preservation of fish in the waters of the state," leading to the creation of a program to build hatcheries throughout the state.
- 1889 – 1940: The first series of intentional non-native fish introductions into the lake. Of these, only the rainbow trout, brown trout, lake trout, brook trout and Kokanee salmon persist today.
- 1889: First state-run fish hatchery opens at Lake Tahoe. It later closes due to inadequate water supply.
- 1911: William Pomin catches record cutthroat trout (31 lbs. 8 oz.).
- 1912: Lake trout (Mackinaw) becomes established. This fish outcompetes the native Lahontan cutthroat trout to become the new top predator.
- 1917: California bans commercial fishing in Lake Tahoe to protect endangered trout populations.
- 1920: Tahoe City Fish Hatchery opens at this location.
- 1921 – 1956: California Department of Fish and Game staff raise native Lahontan cutthroat trout, eastern brook trout, brown trout, rainbow trout, Kokanee salmon and other fish desired for planting in the Tahoe Basin.
- 1921: Hatchery receives first shipment of eggs. The hatchery has a capacity of 64 rearing troughs and 3 million eggs or 2.5 million fingerling trout. Fingerlings are put into streams and lakes to establish new fish populations.
- 1925-1928: John Steinbeck works as a caretaker at the hatchery, living in a two-story cottage behind this building. He completes his first novel, *Cup of Gold,* about the pirate Henry Morgan, while working here.
- 1934: Crayfish introduced and quickly become established.
- 1939: Lahontan cutthroat trout extirpated from Lake Tahoe.
- 1944: Kokanee salmon escape into Lake Tahoe when hatchery fish-rearing trough overflows.

- 1948: Kokanee salmon become established and spawn annually in Taylor Creek, the outlet of Fallen Leaf Lake. The Kokanee salmon represents a successful introduction, albeit accidental, as they did not compete with native fish and were able to establish a healthy population in the lake.
- 1956 – 1975: California Department of Fish and Game keeps offices here, as well as employee lodging for wardens, seasonal aides and fisheries biologists.
- 1956: Tahoe City Hatchery closes. The facility needs costly renovations and cannot keep up with the demand for bigger trout because the fish grow too slowly in the cold water. The California Department of Fish and Game can raise trout more economically and efficiently at other hatcheries with warmer water supplies.
- 1960 – 1966: First comprehensive study of Tahoe fishes describes sport fishing and establishes management programs to improve fisheries in the lake.
- 1963: Mysis shrimp introduced to provide food to increase fish size and numbers, but after becoming established actually have the opposite effect. Their daily migration to deep, dark waters allows them to escape fish predators.
- 1967: Native fish populations of Lahontan redside shiner and Lahontan speckled dace decline.
- 1973: Dick Bournique catches record Kokanee salmon (4 lbs. 13 oz.)
- 1974: Robert G. Aronsen catches record lake trout (37 lbs. 3 oz.).
- 1975: The UC Davis Tahoe Research Group, led by limnologist Charles Goldman, Ph.D., moves its laboratories to historic fish hatchery to study and monitor the ecology of the lake.
- 1977: *Daphnia* zooplankton (microscopic aquatic animals) population declines due to consumption by the introduced Mysis shrimp – a negative, unintended consequence of this introduction.
- 1991: The warmwater largemouth bass and bluegill become established in shallow bays and marinas. These fish compete with Tahoe's native fish populations and may cause other water quality problems.
- 1995: Eurasian watermilfoil confirmed in the lake. This plant has spread quickly around the lake, clogs boat propellers, and creates habitat for warmwater fishes, allowing them to spread.
- 1995: The Lahontan Cutthroat Trout Recovery Plan is approved by the U.S. Fish and Wildlife Service.
- 1996: UC Davis purchases the hatchery for $1.
- 2001: Asian clam first found in very low numbers in a localized area of the lake. The Asian clam population continues to expand, and there are many high-density infestations found along a majority of the southeastern shore.

- 2002: The U.S. Fish and Wildlife Services began efforts for reintroduction and restoration of Lahontan Cutthroat trout in the Fallen Leaf Lake watershed. This project is still in effect as of 2018.
- 2003: Curlyleaf pondweed, an aggressively spreading plant, was discovered along the southern end of the lake.
- 2007 – 2008: Hatchery is renovated, including earthquake retrofitting; new roof, siding, and windows; new field preparation lab, workroom, offices and SCUBA locker.
- 2008: Large numbers of Asian clams found at Marla Bay.
- 2009: Crayfish populations more than doubled since the first estimates were made in the 1960s and may be reducing native species' diversity like the blind amphipod and Tahoe stonefly.
- 2009: Mandatory watercraft inspections begin over concerns about possible Quagga mussel, Zebra mussel, or New Zealand mudsnail invasion. These inspections protect the lake from introduction of new species since boating is the primary source for introductions. Learn more at https://tahoeboatinspections.com/.
- 2009: Researchers begin utilizing new laboratory. Best Management Practices (BMP) and hydrologic test plots are built in collaboration with scientists from the Desert Research Institute.
- 2010: U.S. Fish and Wildlife begin implementation of removal/suppression of non-native fish that out compete Lahontan Cutthroat Trout.
- 2010: Eriksson Education Center and native plant demonstration garden open to the public.
- 2010: Asian Clams discovered in Emerald Bay.
- 2012: Equipping of laboratory and dedication of Bill Combs boathouse.
- 2012: UC Davis TERC places rubber barrier mats over Asian Clam populations in Emerald Bay to exterminate clams and prevent spreading to other parts of the lake.
- 2013: Bill Brush from Nevada City breaks a 40-year-old state record reeling in a 5lb. 2oz. Kokanee salmon from Lake Tahoe.
- 2014: Removal of rubber barrier mats that effectively killed 90% of the clams in Emerald Bay.
- 2015: Discussion about the use of chemical remediation to manage aquatic invasive species in the Tahoe Keys becomes a hot topic of debate.
- 2018: A bubble wall was installed at the entrance/exit to prevent the spread of aquatic invasive species from the Tahoe Keys.

- 2018: Autonomous Underwater Vehicle in the form of a yellow glider is being used to map out the populations of Mysis shrimp in Emerald Bay for a UC Davis TERC pilot removal project.

Interactive Exhibits on the Touchscreen Monitor

Video Exhibits

13 videos are available on touch-screen monitor, as follows:

1. Historic Fish Hatchery: Built by the California Department of Fish and Game this site operated as a fish hatchery from 1921 – 1956. Transferred to UC Davis in 1975, researchers used the hatchery as the main research lab to study the ecology of the lake.
2. Why Raise Hatchery Fish?: There was a great demand for recreational trout fishing in the late 1800s and early 1900s. Fish hatcheries were constructed to meet this demand. The fish reared at hatcheries like this one were transported to barren lakes and streams around the Sierras to provide a boost in local tourism.
3. How Were Fish Raised?: Historic film footage shows the process of raising fish from fish trapping and forced spawning to raising and caring for these fish through their life stages (from eggs, alevin, fry, fingerling, juvenile to adult).
4. Fish Species of Lake Tahoe: Discover some of the different species of fish that live in Lake Tahoe. Many of these fish species were intentionally added to increase Tahoe's fishery. Because of these introductions, the only native trout, the Lahontan Cutthroat Trout, is not currently found in the lake.
5. Kokanee Salmon Escape: Kokanee Salmon are not native to Lake Tahoe, but they represent one of the most successful introductions. Learn how these fish accidentally escaped into the lake from the hatchery.
6. Mysis Shrimp: Go hunting for Mysis shrimp at night when these big-eyed creatures come off the bottom of the lake to feed. Learn why they were introduced and find out what impact they have had on Lake Tahoe's native zooplankton.
7. Invasive Species: Whether intentional, accidental or illegal, nonnative species introductions have had a profound influence on the lake's ecology. Learn about invasive species and the efforts in place to prevent their establishment and spread.
8. Largemouth Bass: Non-native, warmwater fish species, like the Largemouth bass, are a concern in Lake Tahoe because they compete with and eat native fish species. See how researchers capture and tag bass in order to study their movements and try to prevent them from spreading.
9. Asian Clams: Lake Tahoe's spreading Asian clam population could lead to sharp shells and rotting algae on the lake's popular beaches and affect lake ecology. See the research being done to try to manage their populations.

10. Studying Lakes: Join limnologists in action on Lake Tahoe. Learn how buoys in the middle of the lake collect physical and meteorological data, see how a Secchi disc measures clarity and catch some zooplankton.
11. Shallow Water: The nearshore environment is the part of the lake that most people come in contact with. Learn about the many changes in the nearshore environment and how researchers are studying the algae, plants and fish that live close to shore.
12. Climate Change: Climate change is affecting Lake Tahoe. Learn about the challenges Lake Tahoe and other high alpine lakes may face from mega droughts and increases in surface temperature to shifts in phytoplankton species composition.
13. Preventing Aquatic Invasions: Non-native aquatic pests, including both plants and animals, are easily carried from lake to lake by trailered boats. Boat inspections are essential for preventing this inadvertent transport of alien species into the pristine waters of Lake Tahoe.

Videos can be played with no captioning, English captions, or Spanish captions. These choices should be made first, before selecting to play a video (or it will start over). The default plays with no captioning.

Interactive Games

3 interactive games for kids (and adults) are available on touch-screen monitor.

1. Species ID Game: Do you know what a Rainbow Trout looks like? What is a zooplankton? Help Red the Lahontan redside shiner identify the native and non-native species that call Lake Tahoe home.
2. Trout Life Cycle Quiz: Lahontan cutthroat trout go through many changes growing up. Can you arrange these images in order from youngest to oldest? Touch an image and then touch the square you want to put it in below.
3. Aquatic Invasion Timeline: Learn about the different non-native plants and animals that now live at Lake Tahoe. See what impacts they have had. You may be surprised to find out which species are not native to Lake Tahoe!

Looping Video on Cart

A silent 30-minute video of current research activities and a time-lapse of the wetland and stream restoration is available on the video cart.

Microscope Use

The microscope is a good tool to investigate our natural surroundings further and offer an up-close view of what is happening in the garden!

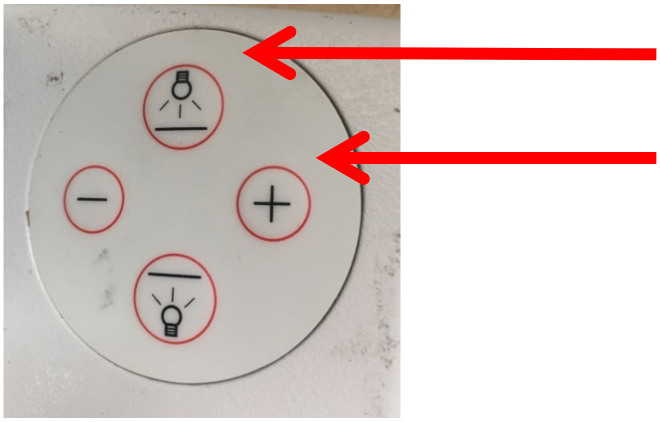
A few things to put under the microscope:

- Native Plants (flowers, buds, fruits, etc.), mushrooms, bark, scat, etc.
- Gall wasps under leaves or “fruit-like” balls containing larvae

Directions for use:

1. Locate switch in the back to turn microscope on/off.

2. Light switch is on the top right. This is where to adjust angles of light (light bulb) and dimness (-, +).



Click to change different light bulbs

Click to adjust brightness

3. Turn the white knob to zoom in and out.

4. Turn the black knob to adjust focus.

Outdoor Interpretive Panels

Eight interpretive panels are located outside along the pavement of the demonstration garden.

Exterior Signs

1. **Native Plant Demonstration Garden = Go Native!**
    a. Native plants in the Tahoe Basin save resources and protect the clarity of Lake Tahoe.
    b. Non-native plants affect the environment by demanding more resources (water, fertilizer, time) and occasionally outcompeting native species.
    c. Plant ID signs are located around the property.

2. **People and the Tahoe Basin = Living in Harmony**
    a. Human actions have resulted in the loss of 75% of the marshes and 50% of the wetlands in the Tahoe Basin.
    b. The loss of wetlands can be seen in the area around the historic hatchery.
    c. The choices we make as residents and visitors can help improve Lake Tahoe's environment.

3. **Stream Environment Zones (SEZs) = Restoring Polaris Creek**
    a. The spring-fed creek has a continuous flow of cold water, making it an ideal location for a fish hatchery.
    b. Modifications for the hatchery were made to better accommodate its operations. These included rerouting of the creek's original flow, excavating a retention pond, and removing wetland area.
    c. The more recent restoration removed buildings, concrete weirs, evergreen trees, re-graded streambanks, and restoring wetland plants.

4. **Providing Natural Protection = Wetlands Matter**
    a. Wetlands support a unique community of plants and animals and serve as a transitional habitat between forested uplands and the lake.
    b. Wetlands naturally filter excess nutrients, pollution, and sediments from runoff before it enters into Lake Tahoe.
    c. Over the years, research has proven a necessity for wetlands so much that wetlands are being reconstructed to restore their vitality and protection is being implemented to the ones that still exist.

5. **Wetland Wildlife = Who Lives Here?**
    a. Wetlands and Stream Environment Zones (SEZs) provide animals with excellent habitat.
    b. 85% of the wildlife in the Tahoe basin use wetlands for food, shelter, nurseries, and more.

    c. See *Field Guides for Mammals, Birds, Butterflies, and Amphibians* to learn about the local wildlife.

6. **Best Management Practices = Keeping Lake Tahoe Blue and Clear**
    a. Lake Tahoe has lost over 30 feet of clarity since 1968.
    b. Microscopic particles less than 20 microns in diameter affect the lake's clarity.
    c. Best Management Practices (BMPs) attempt to mimic the functions of the undisturbed, natural landscape.
        - BMPs are constructed around urban development to increase infiltration of storm water runoff and decrease the amount of erosion.
        - Natural watershed vs. Developed watershed: In a natural, forested watershed, the ground absorbs snowmelt and rain, filtering harmful substances out of the water before it enters Lake Tahoe. Roots from the plants prevent erosion from occurring. In a developed watershed, the ground is less permeable so precipitation cannot infiltrate and will "runoff" allowing pollutants to flow directly into stormdrains and the lake.
        - BMPs Dos & Don'ts for water quality
            - Do not let stormwater runoff or snowmelt run off your property. Try to capture and infiltrate it.
            - Maintain and clean BMPs when necessary.
            - To prevent water from roofs and pavement from eroding soils, place rock mulch down.
            - In steep areas, use retaining walls to hold soil in place.
            - Practice both BMPs and Fire defensible space to protect your home and Lake Tahoe.

7. **UC Davis Forest and Conservation Lath House (*coming soon*)**
    a. A lath house is a greenhouse with greater exposure to the elements of nature. Thin wooden strips (laths) protect seedlings from the sun while providing a window to the outside climate in preparation for successful planting.
    b. This structure can hold up to 20,000 seedlings. Young plants receive necessary air circulation and sunlight but are shielded from strong winds and other threats.
    c. The greatest diversity of five-needled white pine is found in California. Sugar pine, Western White pine, Whitebark pine, Foxtail pine, Great Basin Bristlecone pine, and Limber pine seedlings can be growth in this lath house for restoration and reforestation purposes.

8. **Phenology (*coming soon*)**
    a. Phenology is the study of significant events in plants and animals' lives. Paying close attention to these trends help us understand how our climate is changing.
    b. The Citizen Science Tahoe app is an opportunity to contribute real-time data that will help TERC scientists assess the changing conditions across the Tahoe Basin.
    c. UC Davis TERC grows fruits and vegetables as part of a long-term study to find the most successful varietals for the unique, high-elevation Tahoe climate. Re-shaping our diets and our wallets to include more locally grown and meat-free meals can help save our planet from climate change.

Copies of the panels are available in the *Appendix*. Spanish versions of the panels are available as printed handouts.

Best Management Practices (BMPs)

Small BMP ID signs are located around the property to highlight the various water quality features.

- Stormwater runoff is water that flows off impervious surfaces (like pavement). It can carry pollutants and sediment into Lake Tahoe or to streams that flow directly into Lake Tahoe.
- Rock-lined swales are channels lined with rocks that carry stormwater runoff to a location where the water can be stored until it can soak into the soil.
- Vegetated swales are channels lined with vegetation (usually grasses) that carry stormwater runoff to another location where the water can be stored until it can soak into the soil.
- Infiltration systems catch and hold stormwater runoff allowing more time for it to soak into the ground.
- Slotted channel drains are metal-grated devices that intercept surface runoff and convey it to location for infiltration.
- Subsurface conveyance pipes collect and transport runoff underground to appropriate locations for better treatment or discharge.
- Rip rap (slope stabilization) includes large, angular rocks or cobbles used to protect soil on bare, eroding slopes. Other stabilization methods include retaining walls, terraces, vegetation, and erosion control blankets.
- Drip line rock armoring helps prevent soil erosion caused by roof runoff.
- Vegetation under drip lines stabilizes the soil and infiltrates roof runoff. It is important to use fire-wise plants in these areas. For more information, visit www.livingwithfire.com.
- Native and adapted vegetation in landscaping requires less maintenance and uses less water.
- Lean, Clean and Green. Keep all flammable material and vegetation away from structures. Remember to be lean, clean, and green. For more information, visit www.livingwithfire.info.
- Defensible space is the area between a building and an oncoming wildfire where the vegetation has been managed to reduce the wildfire threat and allow firefighters to safely defend the house. Defensible space also improves the likelihood that a house can survive without assistance. For more information, visit www.livingwithfire.info.

- Forest thinning: As a stand of trees grows, individuals compete with one another for sunlight, space, water and nutrients. Thinning can improve tree health for remaining trees and be an effective tool for wildfire hazard reduction.
- Butterfly Garden: Choose specific plants that are attractive to various butterfly species and you can create habitat and a beautiful garden too.
- Groundcover alternatives: Choosing native groundcover instead of lawn saves water, reduces the amount of harmful chemicals in our environment (e.g., pesticides, fertilizers, and herbicides), and takes less effort… all while you protect the lake.

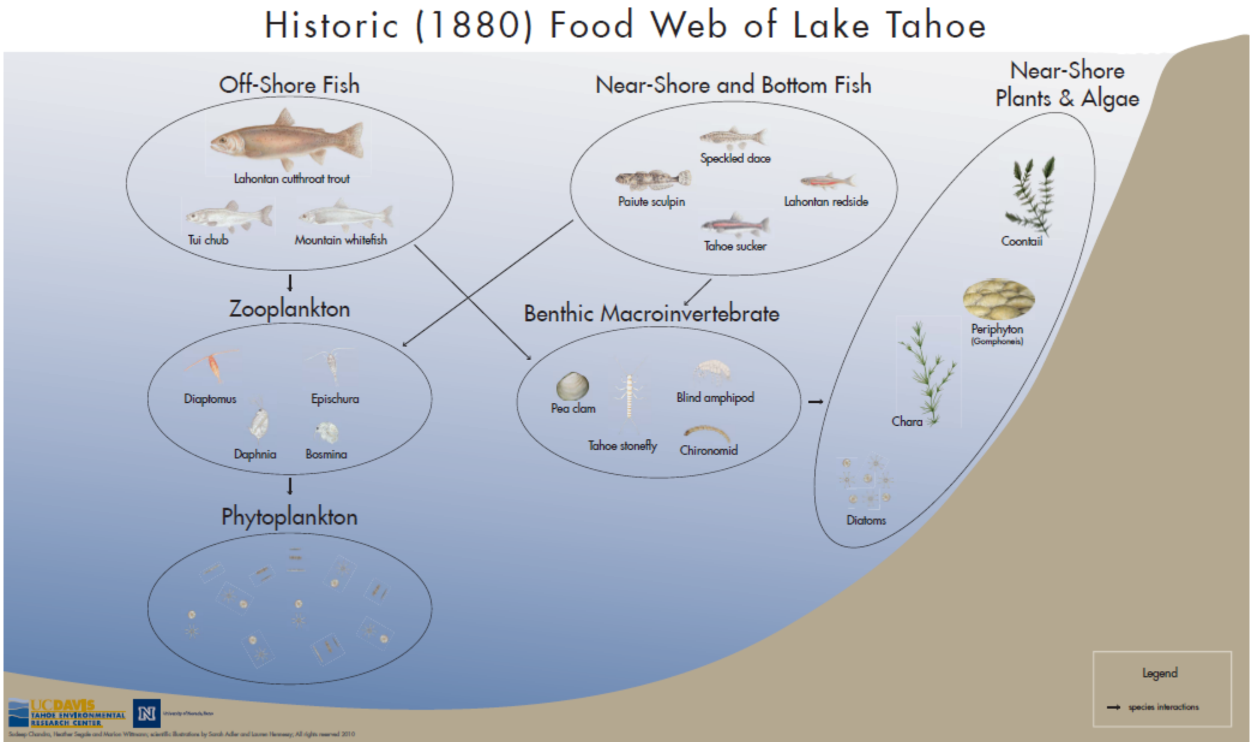
Plant Identification Signs

The following plants are currently (or will be) located in the Native Plant Demonstration Garden:

Common name	***Scientific name***
Azure Penstemon	*Penstemon azureus*
Bishop’s Weed	*Aegopodium podagraria ‘variegatum’*
Canada Goldenrod	*Solidago canadensis*
Cow Parsnip	*Heracleum lanatum*
Creambush	*Holodiscus discolor*
Crimson Columbine	*Aquilegia formosa*
Evening Primrose	*Oenothera biennis*
Fireweed	*Epilobium angustifolium*
Golden Currant	*Ribes aureum*
Graceful Cinquefoil	*Potentilla gracilis var. fastigiata*
Greenleaf Manzanita	*Arctostaphylos patula*
Jacob’s Ladder	*Polemonium sp.*
Large-leaved Lupine	*Lupinus polyphyllus*
Lewis’ Monkey Flower	*Mimulus lewisii*
Ligularia 'The Rocket'	*Ligularia stenocephala*
Mahala Mat (Squaw Carpet)	*Ceanothus prostratus*
Meadowsweet	*Astilbe chinensis*
Mountain Alder	*Alnus tenuifolia*
Mountain Ash	*Sorbus californica*
Mountain Blue Flax	*Linum lewisii*
Mountain Larkspur	*Delphinium glaucum*
Mountain Pennyroyal	*Monardella odoratissima*
Mountain Pink Currant	*Ribes nevadense*
Mountain Pride Penstemon	*Penstemon newberryi*
Mountain Spirea	*Spiraea densiflora*
Mountain Strawberry	*Fragaria virginiana*
Mountain Whitethorn	*Ceanothus cordulatus*
Mule Ear	*Wyethia helianthoides*
Ponderosa Pine	*Pinus ponderosa*
Quaking Aspen	*Populus tremuloides*
Red Twig Dogwood	*Cornus sericea*
Rubber Rabbitbrush	*Ericameria nauseosa*

Scouler's Willow	*Salix scouleriana*
Shiny Willow	*Salix lucida*
Shrubby Cinquefoil	*Potentiilla fruticosa*
Sierra Coffeeberry	*Rhamnus rubra*
Sierra Gooseberry	*Ribes roezlii*
Sierra Wallflower	*Erysimum capitatum*
Snowberry	*Symphoricarpos albus*
Sticky Cinquefoil	*Potentilla glandulosa*
Sulphur-Flower Buckwheat	*Eriogonum umbellatum*
Sweet Woodruff	*Galium odoratum*
Thimbleberry	*Rubus parviflorus*
Tufted Hair Grass	*Deschampsia cespitosa*
Western Blue Flag iris	*Iris missouriensis*
Western Chokecherry	*Prunus virginiana var. demissa*
Western Columbine	*Aquilegia formosa*
Western Mountain Aster	*Aster occidentalis*
Western Serviceberry	*Amelanchier alnifolia*
Wood’s Rose	*Rosa woodsii*
Yarrow	*Achillea millefolium var. californica*
Yellow Evening Primrose	*Oenothera flava*
Yellow Monkeyflower	*Mimulus guttatus*

Historic Food Web Poster Talking Points

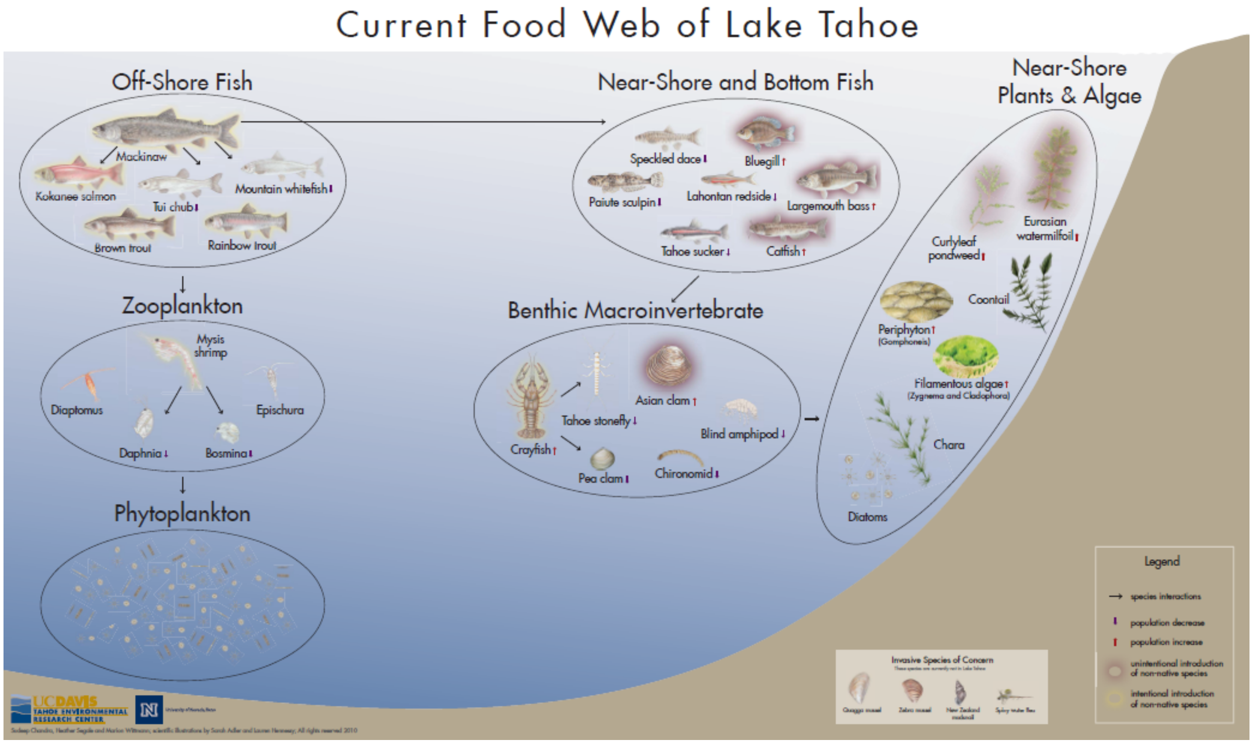


Represents period prior to 1880s when major changes and introductions had not occurred

Native biology was not altered

- The **historic top predator was the Lahontan cutthroat trout** (LCT). The Lahontan cutthroat trout once dominated Lake Tahoe's waters and produced individual fish over twenty pounds within a thriving population. Around the turn of the 20th century, nearly 75,000 pounds of cutthroat trout were commercially harvested from Lake Tahoe.
- The **historic food chain** was very short and efficient. Many of the minnow and sucker species were supported by the phytoplankton production and LCT were the top predator and relied primarily on pelagic zooplankton and fishes, particularly the Tui chub. This allowed the cutthroat to achieve an exceptional biomass for the very limited production of Lake Tahoe.
- Historically, the abundance of fishes was plentiful, despite the limited biodiversity. Historically there were only 7 native fish species, 4 native zooplankton species, and nutritious diatoms were the most common algal species.

Current Food Web Poster Talking Points



The current foodweb of Lake Tahoe shows introduced species and a decoupling trend between the pelagic and benthic zones.

Non-native versus Invasive

The current aquatic food web of Lake Tahoe is dominated by many non-native and several invasive species.

- **Non-native**: An organism added to an ecosystem it is not native to. The introduced non-native species can interact with native species in low-impact and balanced ways.
- **Invasive:** Introduced species in an ecosystem that has altered the natural food web predominately by competing for the other species niche, food, or reproductive modes.

Purposeful Introductions of Non-Native Species by California Fish & Game and Nevada Division of Wildlife:

- Intentional introductions of at least nine species of fish were conducted between the late 1800s and about 1920. These introductions included Chinook salmon, Atlantic salmon, golden trout, Arctic grayling, Great lakes whitefish, brook trout, brown trout, rainbow trout and lake trout or Mackinaw. The Lake trout, rainbow trout, brook trout and brown trout were able to establish self-sustaining populations. All other introduced species failed to thrive in the Tahoe environment.

- **Lake trout** (also known as Mackinaw): Its piscivorous (fish-eating) diet competed with the diet and livelihood of LCT, as the Lake trout primarily consumed young LCT faster than they could reach maturity and reproduce. By the end of the 1920s Lake Tahoe's fishery was dominated by the deepwater Lake trout.
- **Rainbow trout:** Commonly introduced to many ecosystems throughout the world, the Rainbow Trout hybridizes with the LCT, ultimately diluting the genetic vigor of both species.
- **Brown trout:** Unusual for a cool water fish, the brown trout can tolerate higher temperatures than many other trout species.
- ***Mysis* shrimp:** The intentional introduction of the *Mysis* shrimp from 1963 to 1965 resulted in the greatest change in the aquatic community since the loss of the Lahontan cutthroat trout. *Mysis* shrimp was introduced to supplement the diet of larger fishes in Lake Tahoe and they were able to establish a thriving population by the end of the decade. However, their success was due largely to their exploitation of other zooplankton species, nearly eradicating Tahoe's cladocerans (*Daphnia* and *Bosmina*) from the system. They expend large amounts of energy maintaining their daily vertical migration of 300 meters (600 meters round trip!) to avoid light. They avoid predation by swimming to deeper depths during the day and swim toward the surface during the night to feed. This behavior is a result of how highly sensitive their large eyes are to light. Thus, they are unavailable for the intended species they were introduced to as food and consume the larger fishes natural prey.
- **Kokanee salmon:** Originally reared in the Historic Fish Hatchery in Tahoe City, the establishment of the Kokanee Salmon may have initially resulted from a fish trough overflowing and the young being carried away into Lake Tahoe. After it was discovered that they could survive in the lake, Kokanee salmon were added into Tahoe in hopes of both providing forage for the piscivorous lake trout and of creating their own shallow recreational fishery. Kokanee salmon can be seen spawning in Taylor Creek near South Lake Tahoe every year during October.
- **Crayfish:** Introduced in 1934 to Lake Tahoe to bolster larger fish sizes for the commercial fisheries, today the densities of the crayfish average 10 individuals per square meter. This species has been identified in the stomach contents of all trout species in Lake Tahoe and make up 13% of the diet of the Lake Trout. This is a relatively low percentage as trends of decoupling between pelagic and near shore communities continues.

Changes Resulting from Intentional Introductions

- **Lahontan cutthroat trout (LCT) was extirpated** from most of the basin from a combination of overfishing, consumption by Lake trout, and hybridization with Rainbow trout. The heavy fishing pressure significantly depleted the adult population and the introduced Lake trout are believed to have extirpated the dwindling cutthroat population by preying on many of the younger fish remaining in the lake.
- The **top predator became the Mackinaw or Lake trout** as it began to consume LCT faster than it could replace its species.
- The Lake trout holds a stronger trophic position compared historically to the LCT as it makes a larger ecological impact.
- The introduction of *Mysis* has decimated the cladoceran populations in the Lake.

Illegal and Accidental Introductions:

The last series of exotic species introductions has been dominated by illegal introductions by individuals, presumably attempting to establish angling opportunities, and accidental introductions.

- **Bass species:** The bass species, largemouth and small mouth bass, are of growing concern in Lake Tahoe due to their voracious appetite and adaptability to the habitats in Lake Tahoe. The largemouth bass is the top predator in the near shore habitat and preys upon the native minnow and dace species that inhabit the area. The largemouth bass species are prominently found in the Tahoe Keys and utilize the Eurasian watermilfoil in which to hide and ambush prey.
- **Catfish:** This fish has been reported in Lake Tahoe since 1951and its mode of introduction is unknown. Unlike Tahoe's waters, this fish usually inhabits eutrophic waters, rich in nutrients and plant growth.
- **Bluegill:** In Lake Tahoe, warm water fishes are found in the Tahoe keys. This fish is known for its adaptability to many environmental conditions. This fish has increased its population so greatly in Lake Tahoe that the individuals have stunted growth to compensate for the lack of resources.
- **Eurasian watermilfoil:** Is an invasive aquatic plant found abundantly in the Tahoe Keys and in other shallow bays and embayments around the lake. They spread by autofragmentation (term used to define growth by fragmentation of parts of the plant) and seeds. Due to Lake Tahoe's clarity, this macrophyte can grow at deeper depths. This plant harbors concentrated levels of phosphorous in its tissue and provides habitat for non-native warmwater fishes.
- **Curlyleaf pondweed:** This plant thrives in cold waters, making Lake Tahoe ideal for its establishment. This plant spreads via burr-like seeds.

- **Asian clam:** Although, discovered in Lake Tahoe in 2001, large populations were observed in 2008. The Asian Clam can produce 2,000 eggs in a day and 100,000 in their life time. Filamentous algae hover over clam beds as a result highly phosphorous-concentrated excrete produced by the clams. Their spread and eradication is being monitored through the research efforts at UC Davis.

Overall food web alterations

- Benthic and pelagic communities are decoupled. The introduction of *Mysis* shrimp influences this effect as the Lake trout has shifted from a benthic derived reliance (pre *Mysis* introduction) to almost entirely pelagic driven energy consumption. The Lake trout consumption of *Mysis* increases their growth rate profoundly compared to their growth rate when they relied on non-*Mysis* zooplankton.
- The declining populations of *Daphnia* may be associated with declining forage fish populations as *Mysis* may not be a desirable prey item for them compared to *Daphnia* and *Bosmina*.

Citizen Science

Large-scale research projects often involve teams of scientists collaborating across states, countries or continents. More recently, with online platforms it is not necessary to be a trained scientist to contribute to scientific research across the world. Citizen scientists are volunteers monitoring the current state of their surrounding environment. Citizen Scientists for TERC make observations in the Tahoe Basin and contribute their data to the National Phenology Network and the Worldwide Water Monitoring Challenge.

Phenology

TERC uses a phenology-monitoring program in its native plant demonstration garden at the Tahoe City Field Station. Phenology is the study of seasonal changes or phases in plants from year to year, such as growth, flowering, and fruiting. The phases of plants directly affect the rest of the ecosystem, including insects and migratory birds. The timing of these changes has a relationship with weather and climate, and scientists expect that we will see many changes in plant phenology and the organisms dependent on these plants due to climate change. By tracking when seasonal changes occur, we can quantify how much climate change is affecting the local ecosystem.

There are currently four different plant species under observation at the garden: Bigleaf Lupine (*Lupinus polyphyllus*), Mountain Strawberry (*Fragraria virginiana*), Quaking Aspen (*Populus tremuloides*) and Ponderosa Pine (*Pinus ponderosa*). Visitors to the garden can take phenology observations while learning about the biology of plants and the effects of climate change on the local ecology. The data is then entered into Nature's Notebook, a citizen science program under the USA National Phenology Network. Nature's Notebook has a database with phenology data from sites across the country, providing a broad look at plant phenology.

Procedure for Collecting Phenology Observations

1. Take the green data sheets (filed by plant name) from the bottom drawer of the docent desk and attach data sheets to clipboard.
2. Find the plants under observation in the garden. Each plant has a metallic tag with its ID: Bigleaf Lupine [BL#], Ponderosa Pine [PP#], Quaking Aspen [QA#], or Mountain Strawberry [MS#].
3. Fill in the data sheets. Be sure to include the date and time as phenology looks at changes in plants throughout the year. Each data sheet has specific instructions for that species.
4. For each phenophase (an observable stage or phase in the annual life cycle of a plant) circle "y" if it is present, "n" if it is not, and "?" if you are not sure. The back of each data sheet has detailed information about what to look for in each

phenophase. In addition, many phenophases ask for a numerical value, which is also found on the back of the data sheet.

5. Continue to fill in the data sheets as you go through the garden. Each species data sheet has three individual plants, so be sure to fill in the table with the matching plant ID.
6. Once you are finished collecting your data, go inside the office, log in to the computer as a TERC Volunteer and follow the steps on the corkboard for entering your data into the Nature’s Notebook online database. If you do not have time to enter the data, leave the sheets on the desk with a note and TERC staff will take care of it.
7. Please file the data sheets in the folder labeled “completed data sheets.”

Water Quality

Worldwide Water Monitoring Challenge is an international education and outreach program that engages citizens to conduct basic monitoring of their local water bodies. The primary goal of World Water Monitoring Challenge is to educate and empower citizens in the protection of their water resources. Many people are unaware of the impact their behaviors have on water quality. Conducting simple monitoring tests teaches participants about some of the most common indicators of water health and encourages further participation in more formal citizen monitoring efforts.

Our monitoring efforts are aimed at determining the condition of the entire watershed because land-based activities affect the waters that drain the land, including those beneath the ground. The waters in the watershed are all connected and we must protect all of them. With the assistance of the docents, visitors test the water quality of Polaris Creek and Lake Forest Creek near the Tahoe City Field Station.

The water quality sampling kit covers five parameters:

Temperature: How hot or cold something is, or, if you want to get technical, how much energy its molecules have. Aquatic organisms are sensitive to changes in water temperature and require a certain temperature range to survive. Temperature is measured in degrees Celsius (°C).

pH: How acidic or basic something is. pH stands for “potential of hydrogen” and is measured on a scale of 0 to 14. Solutions with a pH less than 7 are acidic and solutions with a pH greater than 7 are basic. Pure water is neutral at pH 7. For example, oranges and lemons are acidic, milk and soap are basic, and clean water is usually neutral. Since pH is a scale, it has no units.

Dissolved Oxygen (DO): All animals need to breathe oxygen. We get it out of the air with our lungs, while fish and aquatic insects get it out of the water with their gills. Oxygen is mixed into water naturally—you can see it in places where a stream runs over rocks and looks white. We measure DO with an ampoule that contains a chemical reagent that reacts with oxygen. The more oxygen in the water, the darker blue the chemical will be. DO is measured in milligrams per liter (mg/L).

Electrical Conductivity (EC): EC measures a given sample’s ability to conduct an electrical current. This is measured in micro Siemens (µS). For comparison, Lake Tahoe typically has a conductivity of 60 µS, while the ocean has a reading of 55,000 µS! Dissolved substances, minerals, and chemicals (such as salt in a water solution) will conduct electricity.

Turbidity: Turbidity is the measure of the relative clarity of water. Turbid water is caused by suspended particles such as clay, silt, organic matter, and microscopic organisms. Turbidity should not be confused with color since darkly colored water can still be clear and not turbid. Turbid water may be the result of soil erosion, urban runoff, algal blooms or bottom sediment disturbances. Turbidity is measured in Nephelometric Turbidity Units (NTU), a measure of how much light hits the turbidity meter.

Benthic Macroinvertebrates/Bio Indicators: These organisms live on the bottom of lakes, rivers, or streams and can provide information about the quality of the water. The lifespan of these organisms help us know how the water is changing. Macroinvertebrates show different responses to changes in water quality and their habitat. The macroinvertebrate's response to environmental changes can be measured and even predicted. The tests do not always show how the environment affects certain organisms.

Procedure for Water Monitoring

1. Grab a blue Stream Monitoring Data sheet from the bottom drawer of the docent desk and attach it to a clipboard.
2. Consult the laminated map in the same drawer in the folder labeled "maps" and find the two different sampling locations. Choose which site you will sample and write in the name on your data sheet.
    a. Lake Forest Creek: Walk along the bike path towards Pomin Park until you reach a culvert under Lake Forest Road. Take the sample off the small footbridge where the bike path and culvert meet.
    b. Polaris Creek at restored pond west of Historic Hatchery building: Collect the sample from the restored pond in Zone 4, near the gray viewing platform.
    c. Polaris Creek at the Bike Path Culvert: Walk towards the main road from the hatchery on the bike path right above Zone 2.
3. Collect water monitoring equipment from the tallest gray cabinet:
    a. Light blue plastic box labeled "turbidity meter"
    b. Clear box with green handle: make sure it has (2) blue EC meters (1) box of pH strips (3) blue thermometers (1) DO test kit
    c. White integrated sampler (cup on a stick)
4. Take this equipment to your sampling location along with a data sheet, a pencil, and a clipboard. First, fill in your name and the starting time. Then make creek observations as a group, circling the answers that apply on your data sheet.
5. Temperature: Submerge a blue thermometer in the water and wait for the temperature to stabilize. Record the result.

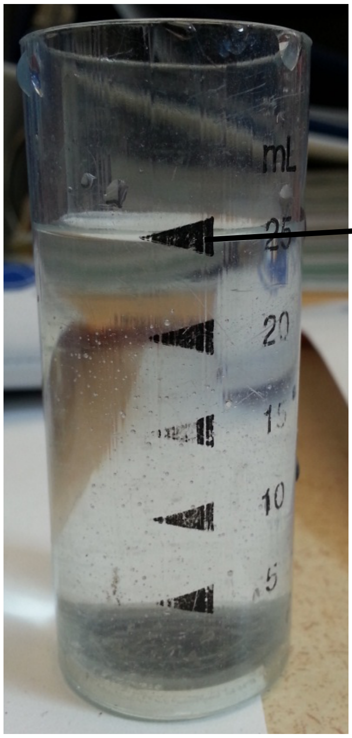
6. Use the cup to collect a water sample from the creek. Try to integrate the sample by gently moving the cup up and down in the water and across the stream. From that sample, you will test pH, DO, EC and turbidity.
7. pH: take one pH strip from the box and dip the colored side of the pH strip into the water for 5 seconds. Take it out of the water and wait 15 seconds to compare the color on the strip to the color key on the box. This will tell you the pH.
8. Dissolved Oxygen: Pour 25 mL of water from the cup into the cylinder in the DO kit. Place a glass ampoule tip-side down against the bottom of the cylinder. Apply pressure on the ampoule against the side of the cylinder to break off the tip—water will rise into the ampoule. Flip the ampoule a couple times and wait two minutes for the reagent to react completely before comparing the color change to the standards in the DO test kit.
9. Electrical Conductivity: Turn on the blue EC meter and make sure it reads “µS” in the corner. If it reads “ppm,” press the mode button until it says “µS.” Remove the black cover from the meter and insert it into the water sample. Wait until the reading stabilizes and record the results.
10. Turbidity: Collect sample in designated vial. Place vial in turbidimeter. See attached instructions on pages 31-32.
11. Once you are finished collecting your data, ask visitors why this kind of monitoring is important. There are many reasons; the one used on the data sheet is the reintroduction of the Lahontan cutthroat trout. Tell the visitors the story of the trout—it is the only trout species native to Tahoe, was overfished and pressured from non-native species until it was driven out of the lake, and now we hope to reintroduce the native species to the lake. Review the requirements for Lahontan cutthroat trout to survive in the creek and make a hypothesis on whether or not this would be successful at this site.
12. Return all the equipment to the kit and return to the hatchery. Log in to the computer as a TERC Volunteer and follow the steps on the corkboard for entering your data into the online database. If you do not have time to enter the data, leave the sheets on the desk with a note and TERC staff will take care of it.
13. Feel free to take home your datasheets; otherwise, please file them in the folder labeled “completed data sheets.”
14. If you would like to view the data you collected from home please consult the UC Davis TERC website at: https://tahoe.ucdavis.edu/citizen-science

pH Strips

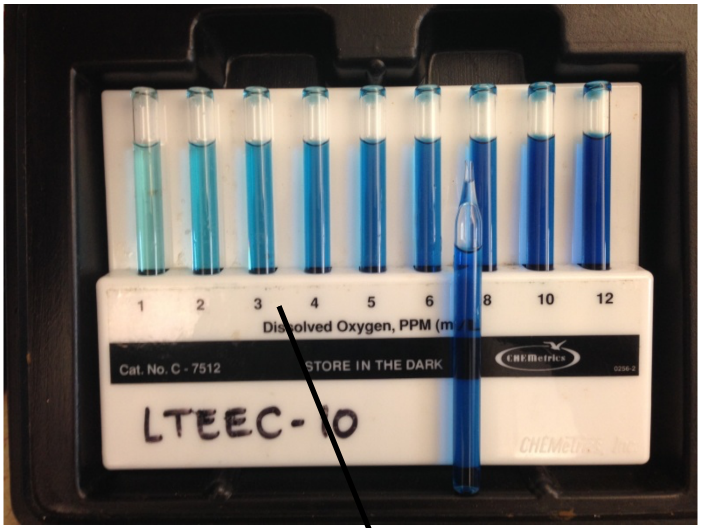
Color chart to compare color change on pH strip to determine pH level

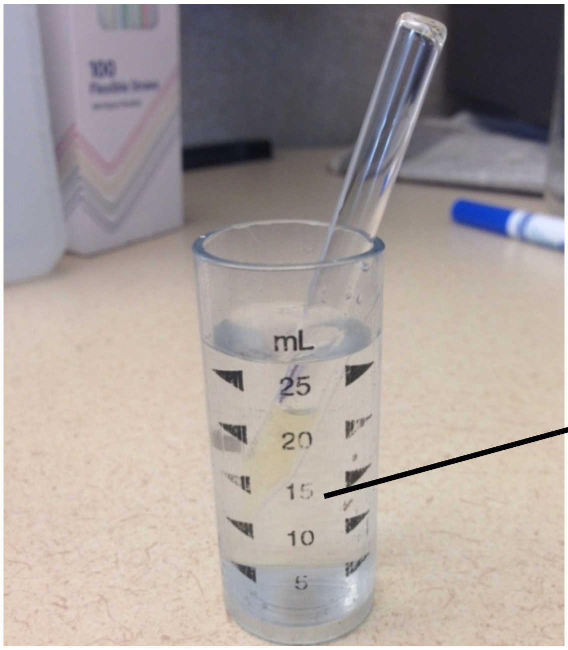
Put this end of the strip into solution

Dissolved Oxygen (DO)



Fill to ~25mL



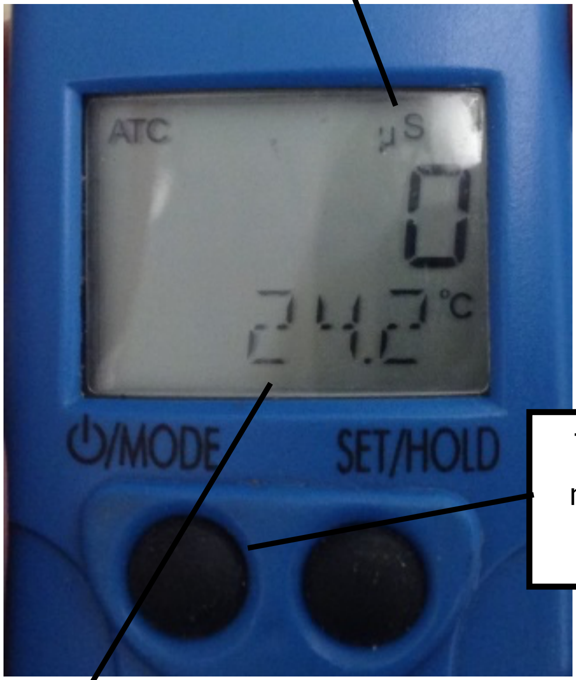


Break tip off in sample

After allowing two minutes for color change compare vile to color standard in box

Blue Electrical Conductivity/Total Dissolved Solids meter

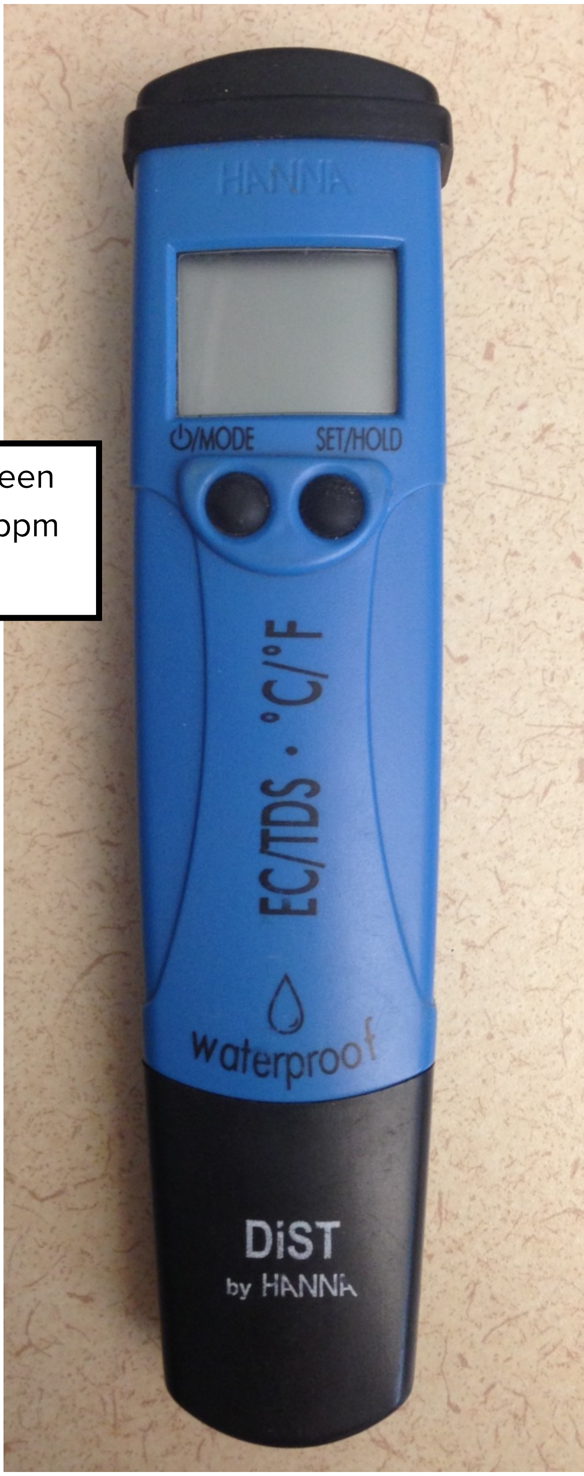
µS (electrical conductivity)



Toggle between modes from ppm to µS

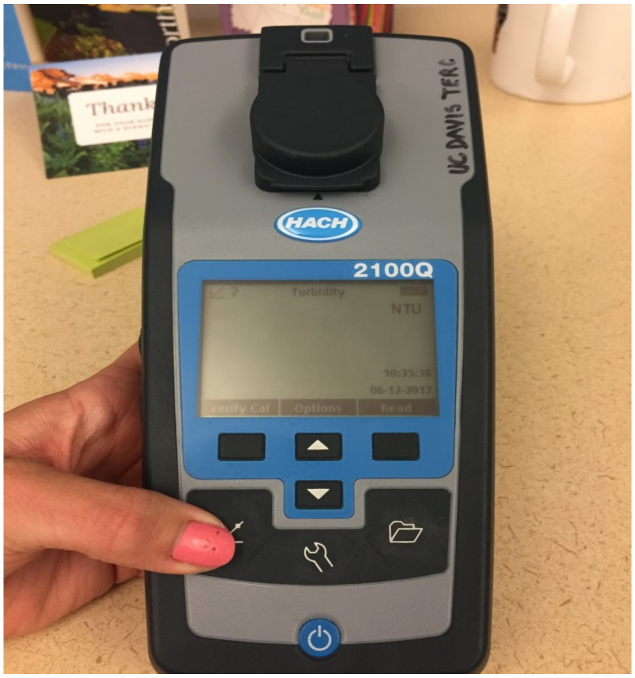
Temperature

ppm (turbidity)

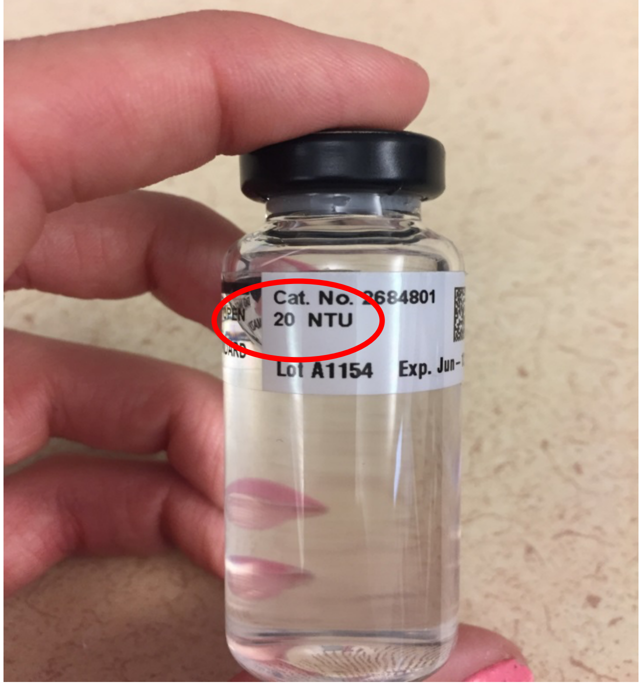


Turbidity

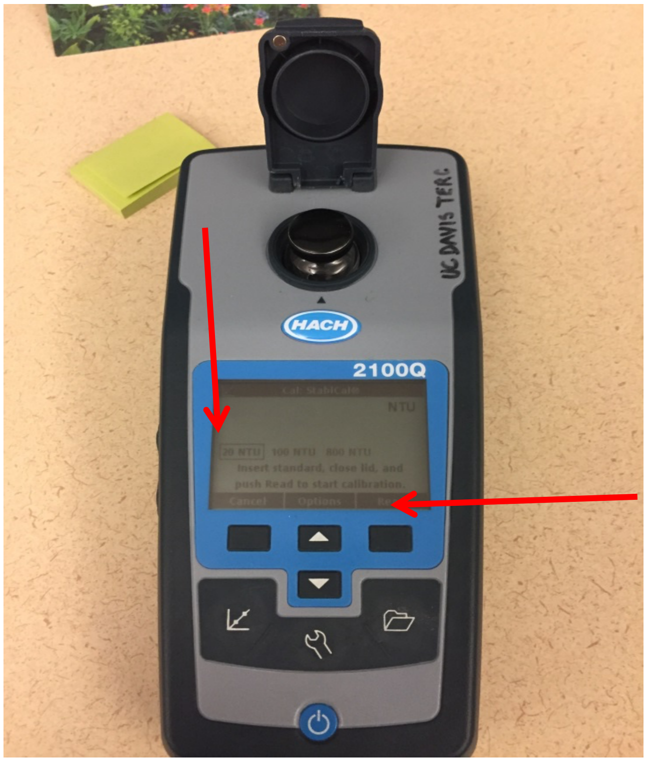
Before using the turbidimeter, you must calibrate it to insure it is working properly. This can be done at the start of your shift or if you can walk visitors through the calibration method and explain the importance of knowing your meter is calibrated and will be giving you precise data.



Step 1: Press the “Calibrate” button in the bottom left of the meter.

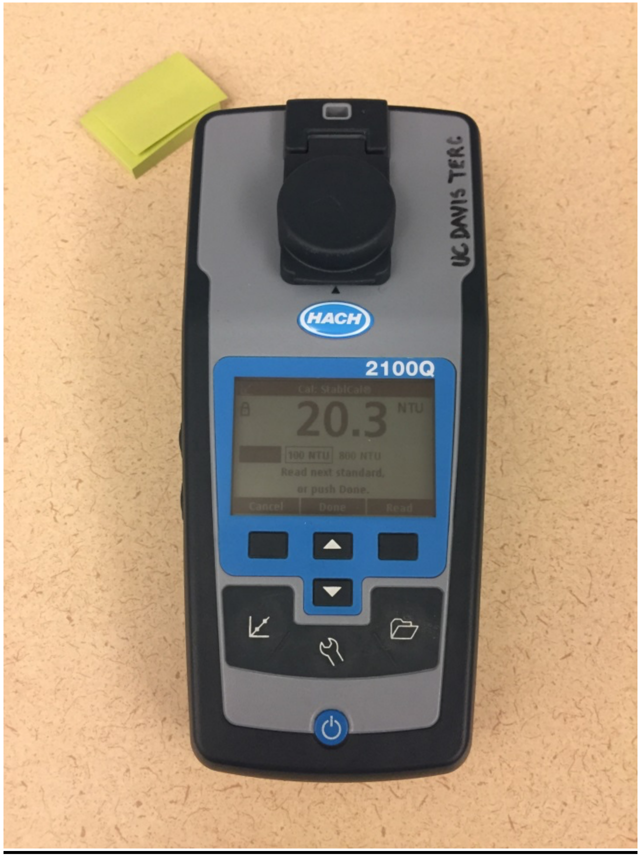


Step 2: Select the “20 NTU” sample first. Be sure to SHAKE THE SAMPLE.



Insert standard, close lid, and push Read to start calibration.

Step 3: Insert the sample into the top of the meter with the sample lid up. Close the lid. The screen will default to highlight the 20 NTU sample first. Press “Read”.



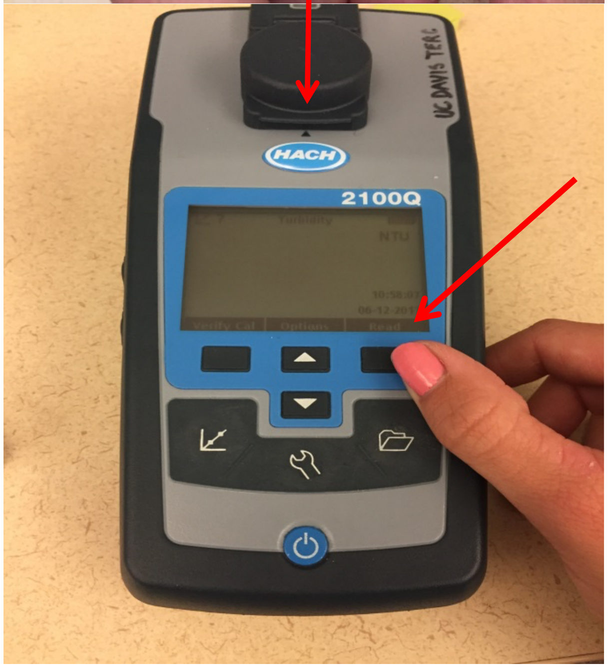
Read next standard, or push Done.

Step 4: If calibrating correctly, you will see this screen. Repeat the same process for the “100 NTU” and “800 NTU” samples.

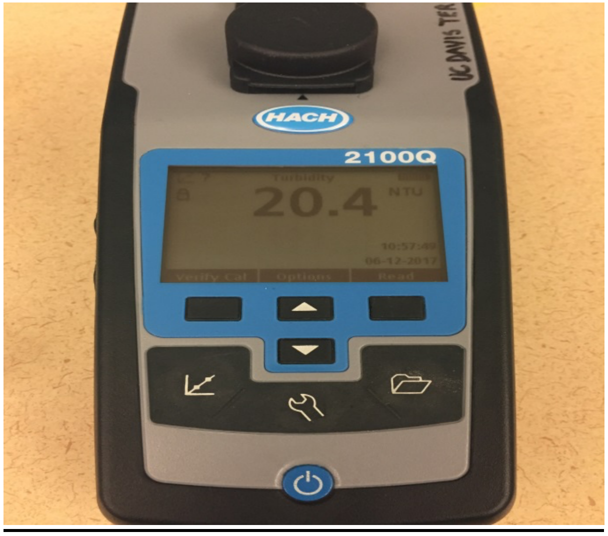
If it did NOT calibrate correctly, repeat the process for the current sample. Make sure to SHAKE the sample well. If this did not correct the problem, consult the handbook in the box.

When you are ready to test a sample:

Step 1: Use an empty container from inside the box. Make sure to wash it out before use. Fill with sample.



Step 2: Place sample in turbidimeter and close lid. Always make sure the arrow on the bottle is in line with the arrow on the turbidimeter (see double-sided arrow) then press the “Read” button.



Step 3: The turbidity reading will appear on the screen.

Stream Monitoring Data Sheet

***Date:** 6/10/18 ***Time:** 11:20 AM

***Creek Name:** Polaris Creek

***Team Members:** Bre, Christine, and Liz

Creek Observations

(Circle those that apply)

Cloud cover	[✓ Sunny]	Partly sunny	Cloudy sky	
Wind conditions	Breezy	Slight breezy	[✓ No breeze]	
***Precipitation past 24 hours**	Clear	Cloudy	Hail	[✓ Rain]
(choose only one)	Sleet	Snow	Trace	
Water clarity	Clear	[✓ Cloudy]	Murky	
Stream flow	Dry creek	Trickle	Riffle/run	[✓ Flooded]
Steam zone habitat	Vegetated	[✓ Undercut]	[✓ Erosion]	Rocky edges

Water Quality Parameters

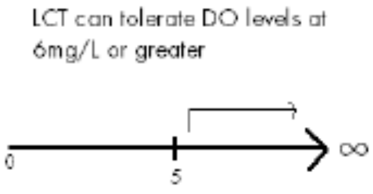
	Reading	Can Lahontan cutthroat trout (LCT) survive based on this measurement?
***Water temperature (^{0}C)**	11 °C	[✓ Yes] No
***pH**	6	[✓ Yes] No
***Dissolved oxygen (mg/L)**	10 mg/L	[✓ Yes] No
Electrical Conductivity (µS)	18 µS	[✓ Yes] No
***Turbidity (NTU)**	36 NTU	[✓ Yes] No

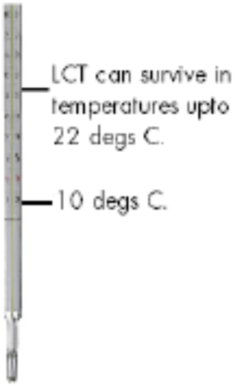
*MUST fill out + a MINIMUM of TWO starred Water Quality Parameters

Trout Tolerance Limits

The Lahontan cutthroat trout (LCT) is the only trout species native to Tahoe. It was driven out of the lake by overfishing and non-native species, but now a project is underway to reintroduce the trout to the lake. Below are the tolerance limits for the parameters measured. Use these to support a hypothesis on whether or not LCT could be reintroduced in the creek you are sampling.

- **Temperature**: Cold water holds more oxygen than warm water. Trout usually thrive in water temperatures between 10 – 22 degrees Celsius. Fish generally die at temperatures above 22 degrees C.
- **pH**: Most fish are healthy in waters with a pH between 6.0 and 7.0. As acidity increases, the food base dwindles and spawning success and egg survival decline. If the pH goes below 5.0, almost all species of aquatic plants and animals die.
- **Dissolved Oxygen**: High levels of oxygen are needed to keep trout alive, sustain growth, maintain egg health until hatching, and support the aquatic insects that are a major food source for trout. Streams with minimum dissolved oxygen of 6 mg/L can sustain trout populations.
- **Electrical Conductivity**: The electrical conductivity of water depends on the concentration and charge of dissolved ions. The average conductivity reading in Lake Tahoe ranges between 50-100 µS.
- **Turbidity**: Water clarity can affect trout feeding, growth and reproduction. In turbid (cloudier) water, trout are unable to see their prey and egg survival is low. Turbidity should be lower than 50 NTU.





Can Trout Survive Here?

Do you think Lahontan cutthroat trout can survive and reproduce in this creek? Yes No

Bigleaf Lupine
(Lupinus polyphyllus)

Observer: Alison Toy ← Write in your name

Site: UC Davis Tahoe City Field Station

Nickname: Broadleaf Lupine-1	Date: 6/12/17
[BL1]	Time: 10:45AM
Do you see...	
Initial Growth	[✓ y] n ?
Leaves	[✓ y] n ?
Flowers or Flower Buds	[✓ y] n ? 11-100
Open Flowers	[✓ y] n 50-74%
Fruits	y [✓ n] ? ______
Ripe Fruits	y [✓ n] ? ______
Recent Fruit or Seed Drop	y [✓ n] ? ______
Check When Data Entered Online:	☑
Comments:	

← Fill in today's date

← Fill in start time (pm or am) Start time should be different for each plant.

Circle the appropriate letter (y n ?)
y (phenophase is occuring)
n (phenophase is not occuring)
? (not certain if phenophase is occuring)
Do not circle anything if you did not check that phenophase. In the blanks, write in the appropriate percentages or range for the phenophase (i.e. less than 3 or 5-24% etc.).

← Check box AFTER the data has been entered at www.usanpn.org

← Please record any interesting or unusual observations

Nickname: Broadleaf Lupine-2	Date: 6/12/17
[BL2]	Time: 10:50AM
Do you see...	
Initial Growth	y [✓ n] ?
Leaves	[✓ y] n ?
Flowers or Flower Buds	[✓ y] n ? 11-100
Open Flowers	[✓ y] n ? 75-94%
Fruits	[✓ y] n ? >3
Ripe Fruits	y [✓ n] ? ______
Recent Fruit or Seed Drop	y [✓ n] ? ______
Check When Data Entered Online:	☑
Comments:	

Nickname: Broadleaf Lupine-3	Date: 6/12/17
[BL3]	Time: 10:55AM
Do you see...	
Initial Growth	[✓ y] n ?
Leaves	[✓ y] n ?
Flowers or Flower Buds	[✓ y] n ? 11-100
Open Flowers	[✓ y] n 50-74%
Fruits	y [✓ n] ? ______
Ripe Fruits	y [✓ n] ? ______
Recent Fruit or Seed Drop	y [✓ n] ? ______
Check When Data Entered Online:	☑
Comments:	

Bigleaf Lupine (Lupinus polyphyllus)

Bigleaf lupines also known as Largeleaf Lupine have characteristic "pea" shaped flowers with two petals on the side that form "wings", one on top that forms the "banner," and two on the bottom that are fused together called the keel. The top of the banner is usually hairless or sparsely hairy and the top of the keel is hairless, which is the best way to distinguish this from the closely related silky lupine (L. sericeus). These other lupines usually have dense silky hairs on the upper leaves, but this can be quite variable.

Directions:

Refer to the below definitions to find out what you should look for, for each phenophase in each species. To report the intensity of the phenophase, choose the best answer to the question below the phenophase, if one is included. Feel free not to report on phenophases or intensity questions that seem too difficult or time-consuming.

Cluster of Bigleaf Lupine open flowers

Initial Growth:

New growth of the plant is visible after a period of no growth (winter or drought), either from aboveground buds with green tips, or new green or white shoots breaking through the soil surface. Growth is considered "initial" on each bud or shoot until the first leaf has fully unfolded. For seedlings, "initial" growth includes the presence of the one or two small, round or elongated leaves (cotyledons) before the first true leaf has unfolded.

Leaves:

One or more live, fully unfolded leaves are visible on the plant. For seedlings, consider only true leaves and do not count the one or two small, round or elongated leaves (cotyledons) that are found on the stem almost immediately after the seedling germinates. Do not include fully dried or dead leaves.

Flowers or Flower Buds:

One or more fresh open or unopened flowers or flower buds are visible on the plant. Include flower buds that are still developing, but do not include wilted or dried flowers. *How many flowers and flower buds are present?* For species in which individual flowers are clustered in flower heads, spikes or catkins (inflorescences), simply estimate the number of flower heads, spikes or catkins and not the number of individual flowers.

Bigleaf Lupine open flower

Less than 3   3 to 10   [✓ 11 to 100]   101 to 1,000   More than 1,000

Open Flowers:

One or more open, fresh flowers are visible on the plant. Flowers are considered "open" when the reproductive parts (male stamens or female pistils) are visible between or within unfolded or open flower parts (petals, floral tubes or sepals). Do not include wilted or dried flowers. *What percentage of all fresh flowers (buds plus unopened plus open) on the plant are open?* For species in which individual flowers are clustered in flower heads, spikes or catkins (inflorescences), estimate the percentage of all individual flowers that are open.

Less than 5%   5-24%   25-49%   [✓ 50-74%]   [✓ 75-94%]   95% or more

Fruits:

One or more fruits are visible on the plant. For Lupinus polyphyllus, the fruit is a pod that changes from green to grayish with dark mottling or black, and splits open, sometimes explosively, to expose the seeds. Do not include empty pods that have already dropped all of their seeds. *How many fruits are present?*

[✓ Less than 3]   3 to 10   11 to 100   101 to 1,000   More than 1,000

Ripe Fruits:

One or more ripe fruits are visible on the plant. For Lupinus polyphyllus, a fruit is considered ripe when it has turned grayish with dark mottling or black. Do not include empty pods that have already dropped all of their seeds. *What percentage of all fruits (unripe plus ripe) on the plant are ripe?*

Less than 5%   5-24%   25-49%   50-74%   75-94%   95% or more

Recent Fruit or Seed Drop:

One or more mature fruits or seeds have dropped or been removed from the plant since your last visit. Do not include obviously immature fruits that have dropped before ripening, such as in a heavy rain or wind, or empty fruits that had long ago dropped all of their seeds but remained on the plant. *How many mature fruits have dropped seeds or have completely dropped or been removed from the plant since your last visit?*

Less than 3   3 to 10   11 to 100   101 to 1,000   More than 1,000

Frequently Asked Questions

- Where are the bathrooms?
    - While there are bathrooms located inside the hatchery, the general policy is that the bathroom are not for public use and the general public should be directed the public facilities located at Pomin Park (towards the lake, just a short walk down the path through the campground). However, bathrooms are available for docents, staff, and visitors on a tour.

- When was the building built?
    - The building was built from 1920-1921 California Dept. of Fish and Game as the Tahoe State Hatchery.

- Who owns the building?
    - Now the building is owned by the UC Davis Tahoe Environmental Research Center (TERC). Once known as the Tahoe Research Group, UC Davis began operating their laboratories in the historic fish hatchery in 1975.

- What is UC Davis TERC?

    - The Tahoe Environmental Research Center (TERC) is dedicated to research, education and public outreach on lakes and their surrounding watersheds and airsheds. Lake ecosystems include the physical, biogeochemical and human environments, and the interactions among them. TERC is committed to providing objective scientific information for restoration and sustainable use of the Lake Tahoe Basin.

- What creek runs through the Hatchery property?
    - Polaris Creek runs year round with springs located north of Highway 28. This provides continuous cold running water.

- Where are the docks or marinas?
    - The docks and marinas are located at the Coast Guard Station and Lake Forest Boat Ramp just down the road.

- Best places to fish in the basin?
    - Many areas around the lake are great for fishing. Some of the areas include Donner Lake, the Truckee River, Fallen Leaf Lake, and Taylor Creek. For more detailed information visit: http://www.gotahoenorth.com/events-and-activities/summer/fishing/fishing-hot-spots

- Where can the Kokanee Salmon be seen spawning & when?
    - Taylor Creek located in South Lake Tahoe in October.