Annual Report:
2019 Dreissenid Mussel Prevention Program Early Detection Monitoring

Lake County Watershed Protection District

March 31, 2020

Purpose

This document summarizes the continued implementation of the Lake County Quagga/Zebra Mussel Prevention Program from January 1, 2019 through December 31, 2019 as a requirement of Title 14 regulations that became effective April 1, 2016. Specifically, section 672.1 requires that any agency with a Prevention Program submit an annual report that summarizes any changes in the reservoir's vulnerability, monitoring methods and results, and any resulting program conclusions. This report is being submitted by the Lake County Watershed Protection District, herein referred to as "The District" and being submitted to the California Department of Fish and Wildlife (CDFW) Region 2 Office and the Regional Staff Environmental Scientist.

Executive Summary

On January 6, 2007, quagga mussels (*Dreissena rostriformis bugensis*), a type of invasive mussel closely related to invasive zebra mussels (*Dreissena polymorpha*), and often referred to as "dreissenid mussels", were discovered in Lake Mead, Nevada. Since that time, quagga mussel infestations have been discovered in a growing number of western lakes and reservoirs, including 43 locations in California (CDFW January 2019). On January 16, 2008, zebra mussels were discovered in San Justo Reservoir, San Benito County, California.

Lake County has always been especially susceptible to invasive Quagga / Zebra mussel (herein referred to as "Q/Z") invasion risk because Clear Lake, the largest natural freshwater lake located entirely within California. This lake is a fishing destination, attracting novice and professional bass fishermen from all over the country, and was rated within the top three best bass fishing lakes in the continental US by Bassmaster Magazine in 2016. The lake is also a water recreationists paradise, popular for tubing, swimming, sailing, kayaking, paddle boarding, water skiing, jet skiing, and leisure boating. Due to the popularity of Clear Lake, Lake County receives thousands of visitors -- and their boats -- annually. In 2019, at least 15,000 local or visiting boats were used in Lake County. Because invasive mussels are primarily spread by boaters, the probability of an invasive Q/Z mussel introduction via one of at least 750 public or private boat ramps on the lake is high.

The most important part of Lake County Q/Z prevention management revolves around the county's mussel sticker program. Information on this program and the Lake County Quagga and Zebra Mussel Prevention Plan are available on the Lake County Q/Z mussel –specific website www.nomussel.com. Within the program, every vessel coming into the county has to go through a screening process, where they are deemed low, medium, or high risk, depending on their registered or resident origin and most recently-visited waterbody (High risk locations are provided in an Infested Counties List provided in **Attachment 1**). Once vessels are deemed safe to launch, they are given a resident or visitor-specific hull sticker. This program helps to assure that incoming vessels and other watercraft are mussel-free, which helps to lower vulnerability into Lake County Waterbodies. Additional outreach and education efforts are a major influence on the success of this program, as an educated populace can promote and distribute the tenants of a prevention plan and associated programs (More information on sticker sales and education and outreach results and products are available in **Attachment 2**).

The Q/Z monitoring program was established to detect any known populations of Q/Z mussels in waterbodies vulnerable to invasion in Lake County. Monitoring efforts in Lake County is completed by a partnership between The District and CDFW. The monitoring program includes artificial substrate monitoring, infrastructure / surface structure surveys, and veliger tows. All monitoring protocols are provided by the CDFW and are available online at: https://www.wildlife.ca.gov/Conservation/Invasives/Quagga-Mussels.

Additionally, in-situ water quality metrics, important for determining habitat suitability for Q/Z mussels, are traditionally collected by CDFW during lake monitoring. The District also supports the monthly collection of water quality measurements in Clear Lake, which are available through Department of Water Resources (WDR) Water Data Library, and tracks the relevant parameters to assess Q/Z suitability in this lake.

Based on 2019 monitoring, Clear Lake, Indian Valley Reservoir, Blue Lakes, and Lake Pillsbury, the four most visited lakes in Lake County's waterbodies with both public and private access, have not had a positive detection of Q/Z mussels. However, 2019 in Lake County was an especially unusual year, with less boating activity in the early portion of the year (February – March) due to severe flood events that required some ramp closures and strict boating restrictions.

Monitoring Methods

The primary agency responsible for managing the Q/Z mussel prevention program in Lake County is the Lake County Watershed Protection District. The District, was originally created as the Lake County Flood Control and Water Conservation District as a political subdivision of the State of California established under the Lake County Flood

Control and Water Conservation Act, of the State Water Code in 1951. The District is administered by the Director of Water Resources who reports to the County Board of Supervisors, which acts as its Board of Directors. The District functions to plan, manage, maintain, implement, evaluate, and expand all aquatic invasive species programs such as the Aquatic Plant Management Program and the Q/Z Mussel Prevention Program. The District relies on several partners to maintain the Q/Z program. With logistic support from the District, CDFW conducts veliger tows 3-5 times a year at multiple sites in Lake County including Clear Lake, Blue Lakes, and Indian Valley Reservoir. PG&E conducts tows and monitoring at Lake Pillsbury. The California State Parks Division of Boating and Waterways provides Q/Z grant funds to support the District's boat ramp monitor network for Clear Lake, inspection training and equipment, and all essential educational materials.

Table 1: Type of watercraft access and monitoring for Lake County waterbodies.

Lake Name	Vessel Accessibility Type (Public vs. Private)	Type of Q/Z Mussel Monitoring		
		Veliger Tows (CDFW or PG&E)	Artificial Substrate Monitoring Stations (LCWRD)	Infrastructure / Surface Monitoring
Blue Lakes	Private	✓ (CDFW)	✓	✓ (CDFW)
Clear Lake	Public	✓ (CDFW)	✓	✓
Hidden Valley Lake	Private		✓	
Highland Springs	Public*		**	✓
Indian Valley Reservoir	Public	✓ (CDFW)	✓	✓ (CDFW)
Lake Pillsbury	Public	✓ (PGE)	✓	✓ (CDFW)

*Restricted to 5mph/ non-personal watercraft vessels.
**Q/Z mussel signage was added in 2019 and water pump infrastructure is monitored, a permanent substrate monitoring station will be added 2020.

a) Artificial Substrate Monitoring. The District performs monthly artificial substrate monitoring according to the methods and procedures provided by the CDFW . Artificial substrates are a series of submerged PVC plates suspended from a dock, bridge, or buoy (***Figure 1***). Placement of these 18 substrates is based on proximity to a potential introduction pathway, mostly located near popular public ramps and access points, but also located in an area where they can remain undisturbed but also easily accessible for

monitoring by staff. The district staff monitor and record results of artificial substrates monthly, except for the months of December and January, however the substrates remain in the water year-round. Current results of artificial substrate monitoring indicate that all substrates are clean and the monitored waterbodies within the county currently do not have any detections of invasive mussels established on artificial substrates (Table 4, Monthly data provided in ***Attachment 3***).

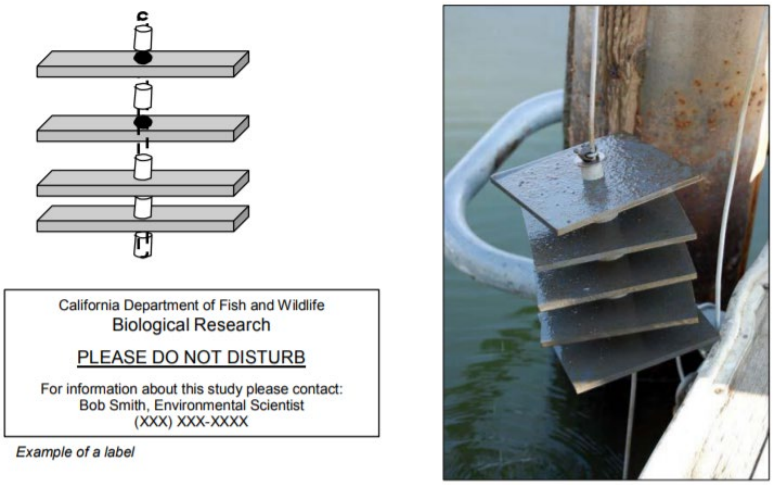

Figure 1 Artificial substrate example provided by the CDFW.

b) Infrastructure / Surface structure surveys are also performed by the District and CDFW at the end of summer season when temporary docks and associated infrastructure are removed from Clear Lake and placed in dry, storage areas. Additional survey inspections have occurred when buoys have been removed from Grebe nesting areas in late summer. During this process, submerged chains and buoy bodies are inspected for any attached mussels. To date, there have been no findings of invasive mussel presence or establishment from these surface surveys. Prior to 2019, the protocol for this monitoring did not follow the recommended CDFW protocols in regards to Minimum Sample size, however, starting in 2019, Lake County staff implemented and initiated a revised surface survey protocol that aimed to meet the CDFW requirements.

c) In 2019, veliger tows were performed by CDFW Region 2 Regional Biologist Angie Montalvo. CDFW conducts mussel monitoring in all high risk waterbodies in the State according to the protocols outlined in online at CDFW Mussel Tow protocols. Within Lake County, CDFW collects drag tows 3-5 times a year in Indian Valley Reservoir, Upper Blue Lakes and Clear Lake. The veliger monitoring in Lake Pillsbury is completed by PG&E, who own and manage the Scott's dam and reservoir. Water samples from three sites are aggregated into one bottle and sent to the CDFW Shellfish Health Lab (SHL) located in Bodega Bay, CA. Water samples are analyzed for the

presence / absence of veligers following a cross-polarized light microscopy (CPLM), based on the methods of Johnson, 1995. Molecular (PCR) methods were not used to analyze the samples. Based on tow data collected during 2019, there are currently no positive detections for invasive mussel veligers in these Lake County waterbodies at this time.

d) Drinking water intake monitoring. Lake County Special Districts operates or oversees approximately three water intakes on Clear Lake of the 18 total public and private water delivery systems on the lake. Because fish screens at intake sites, and the intake themselves are constructed of materials that pose risk for colonization, majority of water purveyors are aware of the importance of monitoring QZ for maximized AIS prevention. Each water district has been alerted to the possibility of mussel's introduction and establishment and they monitor for any mussel presence when regular maintenance is performed on inlet pipes, screens and filters. In June 2019, AIS District staff Angela De Palma-Dow, presented on Q/Z and drinking water systems to several drinking water purveyors and the Water Board drinking water division regional engineer at a quarterly meeting in Lakeport, CA. In addition to sharing education and outreach for Q/Z monitoring and prevention, the group decided to create a monitoring and reporting plan for Q/Z drinking water prevention for Clear Lake during 2020.

Monitoring Results

Multiple veliger tows were conducted by CDFW during 2019, with each tow contents being collected into one or more sample jars. For each sampling, in Upper Blue Lakes (n=3), Clear Lake (n=9) and Indian Valley Reservoir (n=8), sample jars were analyzed and resulted in no positive detections of Q/Z mussel veligers for 2019 (Table 2). Artificial substrate monitoring was performed by both Lake County Water Resources staff in Clear Lake (n=13), Blue Lakes (n=1), Lake Pillsbury (n=2), and by citizen monitors in Hidden Valley Lake (n=2) and results from these surveys resulted in no positive detections of attached adult Q/Z mussels (Table 3). Additional infrastructure monitoring in late 2019 of removed docks, also indicated no presence of settled adult mussels (Table 4). Results from all monitoring surveys during 2019 returned no detection of Q/Z in the sampled waterbodies.

In addition, lake water quality conditions, when measured, in Blue Lakes, Clear Lake and Indian Valley Reservoir, such as water temperature, calcium, pH, dissolved oxygen, turbidity, and salinity, are well within the ranges preferred by Q/Z mussels. (Pucherelli et al. 2016, Whittier et al. 2008; Cohen 2005;2008) (Table 5).

Table 2: 2019 Results of Veliger Tows Lake County by CDFW (aggregated), ND= Non-detection of Q/Z mussel veligers in analyzed samples

Waterbody	Month	Result
Blue Lakes, Upper	June	ND
	October	ND
Clear Lake	April	ND
	July	ND
	October	ND
Indian Valley Reservoir	April	ND
	May	ND
	June	ND
	July	ND
	Sept	ND

Table 3: Results of Artificial Substrate Inspections Lake County– 2019

Waterbody	Site	Material	2018
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	Clean
	3rd Street, Lakeport	Concrete discs	Clean
	5th Street, Lakeport - new	Square plastic plates	Clean
	Redbud Launch ramp	Square plastic plates	Clean
	Redbud Launch ramp - new	Square plastic plates	Clean
	Clearlake Oaks	Concrete discs	Clean
	Clear Lake State Park	Square plastic plates	Clean
	Clear Lake State Park - new	Square plastic plates	Clean
	Keeling Park	Concrete discs	Clean
	Lakeside Park - new	Square plastic plates	Clean
	Konocti Vista Casino Resort	Concrete discs	Clean
	Braito's Marina	Concrete discs	Clean
	Lucerne Harbor	PVC pipe	Clean
Blue Lakes	Narrows Resort	Concrete discs	Clean
Lake Pillsbury	Pillsbury Resort	Square plastic plates	Clean*
	Fullers campground	PVC pipe	Clean*
Hidden Valley	Fishing dock	Square plastic plates	Clean
	Marina	Square plastic plates	Clean

*During winter and spring months the lakes were flooded, or road closed due to flooding and slides. Most of these substrate observations were conducted during summer and fall months 2019.

Table 4: Infrastructure and Surface structure surveys -2019

Waterbody	Location	Type	Technician	Date	Result
Clear Lake	3rd St Lakeport	Floating Dock	M. Miller & E. Jones	Nov, 2019	Clean
	3rd St Lakeport	Floating Dock		Nov, 2019	Clean

Table 5: Average water quality measurements from Blue Lakes, Clear Lake and Indian Valley Reservoir (2016-2019) and parameter ranges shown to be suitable for the growth and establishment of (Adult) Q/Z mussels. All data is provided by A. Montalvo (CDFW) unless otherwise noted.

Year	Temp (°C)	Conductivity (mS/cm)	pH*	D.O. (mg/l)	Total Hardness[1] (mg/L CaCo3)	Salinity (ppm)	Total Calcium[1] (mg/L)
Blue Lakes - Upper							
2019, June	N/A	N/A	8.5	N/A	N/A	N/A	32.0
2019, Oct	N/A	N/A	10.2	N/A	N/A	N/A	28.0
Clear Lake							
2016 May	22.3	0.4	8.7	6.6	173.0	0.2	30.0
2016, Nov	16.7	243.0	9.5	3	131.0	0.1	23.0
2017, April	14.4	0.3	8.3	1.2	113.0	0.1	21.0
2017, July	26.0	263.0	10	7.0	123.0	0.1	22.0
2017, Oct	17.4	257.1	9.1	2.9	127.0	0.1	23.0
2018, April	16.0	243.3	8.6	1.6	N/A	0.1	N/A
2018, Oct	18.5	304.9	7.5	6.2	N/A	0.2	N/A
2019, April	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019, June[1]	25.3	269.0	8.4	7.8	116	N/A	22
2019, July	N/A	N/A	8.7	N/A	N/A	N/A	N/A
2019, August[1]	25.9	287.2	8.0	8.0	125	N/A	23.5
2019, Oct	N/A	N/A	9.2	N/A	N/A	N/A	N/A
Indian Valley Reservoir							
2016, Dec	10.7	0.3	7.9	10.1	N/A	0.2	N/A
2017, June	22.8	223.4	8.7	6.9	N/A	0.1	N/A
2017, Oct	18.9	222.5	8.4	3.5	N/A	0.1	N/A
2018, Oct	19.9	253.7	8.1	6.3	N/A	0.1	N/A
2019, April	N/A	N/A	9.2	N/A	N/A	N/A	N/A
2019, May	N/A	N/A	9.5	N/A	N/A	N/A	N/A
2019, July	N/A	N/A	9.1	N/A	N/A	N/A	N/A
2019, Sept	N/A	N/A	10.0	N/A	N/A	N/A	22.0

Preferred Range for Q/Z mussels	6-32[2]	>22µS/cm[3]	6.5-9.5[2]	>2-6[2]	100-420[2]	0-12[3]	>12[2]

*Where multiple measurements were taken in one month, the pH value reflects an average
[1] Data provided by DWR (Surface 0.5 m, Upper Arm) Water Data Library
http://wdl.water.ca.gov/waterdatalibrary/
[2] Data provided by *Pucherelli et al. 2016 (BLM)*
[3] Data provided by *Cohen 2005 (prepared for CDWR*)

Discussion

There are several important factors to consider when assessing the vulnerability of a waterbody, or bodies, to the introduction and establishment of invasive mussels. The first factor, which determines the introduction, is the likelihood that a mussel, adult or veliger, could be introduced to the waterbody. Due to the inability of these species to walk, fly, or be transported among non-hydrologically connected waterbodies, the main source of distribution across long, terrestrial distances is through transport on trailers and/or boats or boating equipment (Cohen 1998; Dalton & Cottrell 2013). The second factor is the probability of the invasive species, once introduced, has suitable habitat to survive, reproduce and become established. Habitat suitability for invasive mussels is based on several specific environmental conditions of the waterbody, such as temperature, conductivity, pH, DO, hardness, salinity, and calcium (Cohen 2005; 2008). Based on the water quality chemical and physical parameters collected from at least four waterbodies in the county, Clear Lake, Upper Blue Lakes, Lake Pillsbury and Indian Valley Reservoir (Table 5) contain the appropriate water quality parameter and habitat for invasive mussels to survive and become established. The remaining factor, that can most easily be controlled, is the introduction risk by boat or trailers.

The single most important water characteristic that indicates a high risk of colonization is a calcium level of 15 mg/L or greater. Clear Lake has an average 25 mg/L calcium level (DWR Water Data Library 2019). With preferable environmental conditions well-suited to an invasive mussel establishment, preventing and managing all vulnerable introduction pathways is going to be the best strategy for preventing an invasion.

When considering these two factors together, likelihood for an introduction coupled with the required water quality environment, Clear Lake, the largest waterbody in the county does contain preferable environmental conditions for the establishment of Q/Z mussels. Therefore, because Clear Lake has a high probability of Q/Z introduction, establishment and invasion, monitoring becomes a vital important component of the management and prevention effort in both the lake and throughout the county.

References

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Attachment 1. 2019 Infested Counties List updated annually or as needed.

3/27/2019

MUSSEL INFESTED COUNTIES
CALIFORNIA

HIGH RISK

CALIFORNIA
Imperial
Los Angeles
Orange
Riverside
San Bernardino
San Diego
Ventura

NEWLY INFESTED LAKES
PERRIS
CASTAIC
SILVERWOOD
PIRU
PYRAMID

HEAVILY INFESTED LAKES

MEAD
POWELL
HAVASU
MOHAVE
COLORADO RIVER
SKINNER
EL CAPITAN
OTAY
HODGES

MUSSEL INFESTED COUNTIES in the WESTERN STATES

HIGH RISK

ARIZONA
Coconino
Gila
La Paz
Maricopa
Mohave
Yuma

COLORADO
Archuleta
Grand
Logan
Park
Pueblo

NEW MEXICO
De Baca
Rio Arriba
San Juan

NEVADA
Churchill
Clark
Elko
Lyon
Pershing

UTAH
Emery
Garfield
Kane
San Juan
Uintah
Wasatch
Washington

MUSSEL INFESTED COUNTIES in the WESTERN STATES

HIGH RISK

TEXAS

ALL VESSELS LAUNCHED IN TEXAS IN THE PAST 30 DAYS MUST BE INSPECTED

MUSSEL INFESTED COUNTIES in the WESTERN STATES

HIGH RISK

MONTANA
Liberty
Lewis & Clark
Broadwater
Washington

STATES NOT MUSSEL INFESTED

LOW RISK

Alaska
Florida
Hawaii
Idaho
Maine
New Hampshire
New Jersey
North Carolina
Oregon
Rhode Island
South Carolina
Washington
Wyoming

Attachment 2. Outreach Education products and results 2019.

Some additional noteworthy results and outcomes from mussel prevention programming in Lake County include the following:

1. 2019 participation in the Lake County Mussel Sticker Program
    a. About 33 business / vendors participated in the Sticker program during 2019.
    b. Sold 6284 resident stickers, 8872 visiting monthly stickers, totaling 15,156 stickers during 2019. Lower numbers sold during the early part of the year was due to flooding in February and March and limited access to ramps and some roads.
    c. During 2019 we recorded vessel 170 inspections and about 34 of those were either spot, partial or went through a full decontamination.
    d. County staff and sheriffs issued 6 citations for non-compliance to visiting boaters launching into Clear Lake without acquiring the required screening and sticker. This is compared to 8 issued in 2018 and 3 issued in 2017.

2. Outreach and educational efforts improve Q/Z outreach and education
    a. Updated and purchased new educational signage and advertising
        i. Signage/ kiosks were installed at five popular ramp locations within lake county 2019, including Lakeport Library Parks, Lakeside County Park, Clearlake Redbud Park, Clearlake Oaks, County Park Lucerne.
        ii. Advertising in the form of digital radio PSAs aired between May – October 2019, resulting in 89,792 completed impressions.
    b. Increased social media / digital presence by updating and maintaining the Water Resources Department Facebook page. Q/Z mussel prevention program posts have proved to be some of the most popular type of posts. For example, a post from July 13, 2019 inviting participation in the QZ sticker program by highlighting an example from Utah, generated 2434 reaches, 43 likes, 27 shares, and 158 post clicks.
    c. Q/Z awareness and attitude outreach survey was distributed from July – October 2019 and resulted in 134 respondents. Some of the brief results below include:
        i. 88% of respondents indicated being aware of the lake County Q/Z prevention sticker program
        ii. 94% of respondents agreed that a Q/Z introduction will have negative impacts to both the ecology and economy of Clear Lake.
        iii. 96.6% of respondents identified boats as the number one pathway for QZ introduction.
        iv. More than 50% of respondents indicated that they have an above average knowledge level of a) the Q/Z mussel threat in CA, b) The spread of Q/Z mussels, c) The “Clean, Drain, Dry” program, and d) the Q/Z prevention program in Lake County.

April 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131	**4.5**	2011		Flooded
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913	7	2007		Flooded
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129		2007		Flooded
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	5.5	2011		Flooded
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378	6	2007		Flooded
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378	8	2014		Flooded
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	7	2007		Flooded
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133	7	2015		Flooded
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132	5	2011		Flooded
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	7	2007		Flooded
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477	5	2011		Flooded
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	7	2007	4/18/2019	no Mussels
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516		2007		Flooded
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	7	2004		Flooded
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972	4	2007		Flooded
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159	4	2010		no acess
Pillsbury	Pillsbury Resort	PVC pipe	F&G Region 2	39.421472	-122.958		2007		road closed (slides)
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686		2010		road closed (slides)
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012	March	clean
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012	March	clean

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

May 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131		2011	5/23/2019	dock lifted out 4 ft. out of water due to flooding
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913		2007	5/23/2019	dock lifted out 4 ft. out of water due to flooding
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129	6.5	2007	5/23/2019	no mussels, cleaned
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	6.5	2011	5/23/2019	no mussels, cleaned
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378		2007	5/23/2019	CLOSED FLOODED
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378		2014	5/23/2019	CLOSED FLOODED
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	6.5	2007	5/23/2019	no mussels, cleaned
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133		2015	5/23/2019	CLOSED FLOODED
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132		2011	5/23/2019	CLOSED FLOODED
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	5.5	2007	5/23/2019	no mussels, cleaned
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477		2011	5/23/2019	CLOSED FLOODED
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	6.5	2007	5/23/2019	no mussels, cleaned
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516	6	2007	5/23/2019	no mussels, cleaned
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	4	2004	5/23/2019	no mussels, cleaned
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972		2007	5/23/2019	FLOODED
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159		2010	5/23/2019	CLOSED FLOODED
Pillsbury	Pillsbury Resort	PVC pipe	F&G Region 2	39.421472	-122.958		2007	5/23/2019	ROAD CLOSED
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686		2010	5/23/2019	ROAD CLOSED
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012	5/1/2019	clean
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012	5/1/2019	clean

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

June 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131	4.5	2011	N/A	REINSTALLED 6/17 AFTER FLOOD REPAIR
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913	5.5	2007	N/A	REINSTALLED 6/17 AFTER FLOOD REPAIR
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129	6.5	2007	6/20/2019	NO MUSSELS
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	6.5	2011	6/20/2019	NO MUSSELS
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378	6	2007	6/20/2019	NO MUSSELS
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378	7	2014	6/20/2019	NO MUSSELS
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	6.5	2007	6/20/2019	NO MUSSELS
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133	5	2015	6/21/2019	NO MUSSELS
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132	4.5	2011	6/21/2019	NO MUSSELS
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	5	2007	6/20/2019	NO MUSSELS
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477	5.5	2011	6/21/2019	NO MUSSELS
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	4.5	2007	6/21/2019	NO MUSSELS
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516	5.5	2007	6/20/2019	NO MUSSELS
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	3.5	2004	6/20/2019	NO MUSSELS
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972	5	2007	6/21/2019	NO MUSSELS
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159	5.5	2010	6/6/2019	INSTALLED NEW / OLD SUBSTRAITE MISSING
Pillsbury	Pillsbury Resort	Square plastic plates	F&G Region 2	39.421472	-122.958	6	2007	6/7/2019	INSTALLED NEW / OLD SUBSTRAITE MISSING
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686	6	2010	6/7/2019	INSTALLED NEW / OLD SUBSTRAITE MISSING
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012	6/1/2019	clean
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012	6/1/2019	clean

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

July 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131	4.5	2011	7/9/2019	no mussels
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913	5	2007	7/9/2019	no mussels
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129	4	2007	7/9/2019	no mussels
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	4	2011	7/9/2019	no mussels
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378	4.5	2007	7/10/2019	no mussels
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378	4	2014	7/10/2019	no mussels
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	5	2007	7/10/2019	no mussels
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133	4	2015	7/9/2019	no mussels
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132	3.5	2011	7/9/2019	no mussels
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	4.5	2007	7/10/2019	no mussels
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477	4.5	2011	7/10/2019	no mussels
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	4.5	2007	7/9/2019	no mussels
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516	6	2007	7/10/2019	no mussels
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	3.5	2004	7/10/2019	no mussels
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972	4	2007	7/9/2019	no mussels
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159	5	2019	7/12/2019	no mussels
Pillsbury	Pillsbury Resort	Square plastic plates	F&G Region 2	39.421472	-122.958		2007	N/A	
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686		2010	N/A	
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012	N/A	
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012	N/A	

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

August 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131	4	2011	9/8/2019	no mussels
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913	4	2007	9/8/2019	no mussels
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129	3.5	2007	9/8/2019	no mussels
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	4	2011	9/8/2019	no mussels
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378	4	2007	9/9/2019	no mussels
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378	4.5	2014	9/9/2019	no mussels
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	4.5	2007	9/9/2019	no mussels
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133	4	2015	9/8/2019	no mussels
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132	3	2011	9/8/2019	no mussels
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	4	2007	9/9/2019	missing, replaced with new
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477	4	2011	9/8/2019	no mussels
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	4	2007	9/8/2019	no mussels
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516	5	2007	9/8/2019	no mussels
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	3	2004	9/8/2019	no mussels
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972	3	2007	9/9/2019	no mussels
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159		2019	9/9/2019	no mussels
Pillsbury	Pillsbury Resort	PVC pipe	F&G Region 2	39.421472	-122.958	4	2019	N/A	N/A
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686	4	2019	N/A	N/A
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012		N/A
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012		N/A

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

September 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131	**4**	2011	**9/8/2019**	**no mussels**
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913	4	2007	9/8/2019	no mussels
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129	4	2007	9/8/2019	no mussels
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	4	2011	9/8/2019	no mussels
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378	4	2007	9/9/2019	no mussels
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378	4.5	2014	9/9/2019	no mussels
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	4.5	2007	9/9/2019	no mussels
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133	3.5	2015	9/8/2019	no mussels
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132	3	2011	9/8/2019	no mussels
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	4.5	2007	9/9/2019	missing replaced with new
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477	4	2011	9/8/2019	no mussels
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	4	2007	9/8/2019	no mussels
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516	5	2007	9/8/2019	no mussels
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	3	2004	9/8/2019	no mussels
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972		2007	9/9/2019	
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159	4.5	2019	9/9/2019	new
Pillsbury	Pillsbury Resort	PVC pipe	F&G Region 2	39.421472	-122.958		2019	N/A	N/A
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686		2019	N/A	N/A
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012	N/A	N/A
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012	N/A	N/A

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

October 2019 - Artificial Substrate Monitoring

Waterbody	Sampling Site	Type	Agency / ownership	Latitude	Longitude	Depth (ft)	Date Installed	Date Inspected	Mussels
Clear Lake	3rd Street, Lakeport - new	Square plastic plates	County	39.04391	-122.9131	**3**	2011	10/8/2019	**no mussels**
Clear Lake	3rd Street, Lakeport	Concrete discs	County	39.04396	-122.913	3	2019	10/8/2019	no mussels
Clear Lake	5th Street, Lakeport	Concrete discs	County	39.04534	-122.9129	3	2007	10/8/2019	no mussels
Clear Lake	5th Street, Lakeport - new	Square plastic plates	County	39.04534	-122.9129	3	2011	10/8/2019	no mussels
Clear Lake	Redbud Launch ramp	Concrete discs	County	38.94855	-122.6378	3	2018	10/10/2019	no mussels
Clear Lake	Redbud Launch ramp - new	Square plastic plates	County	38.94847	-122.6378	3.5	2017	10/10/2019	no mussels
Clear Lake	Clearlake Oaks	Concrete discs	County	39.01923	-122.6741	3	2007	10/10/2019	no mussels
Clear Lake	Clear Lake State Park	Square plastic plates	County	39.02018	-122.8133	3	2015	10/8/2019	no mussels
Clear Lake	Clear Lake State Park - new	Square plastic plates	County	39.02017	122.8132	2	2018	10/8/2019	no mussels
Clear Lake	Keeling Park	Concrete discs	County	39.12114	-122.8551	3	2007	10/10/2019	no mussels
Clear Lake	Lakeside Park - new	Square plastic plates	County	39.02944	-122.8477	3	2018	10/8/2019	no mussels
Clear Lake	Konocti Vista Casino Resort	Concrete discs	County	39.02214	-122.8878	3	2007	10/8/2019	no mussels
Clear Lake	Braito's Marina	Concrete discs	County	39.02143	-122.7516	3.5	2007	10/8/2019	no mussels
Clear Lake	Braito's Marina	PVC pipe	DWR, Sacto	39.02143	-122.7516	3	2004	10/8/2019	no mussels
Clear Lake	Lucerne Harbor	Concrete discs	County	39.09046	-122.7972	2	2007	10/10/2019	no mussels
Blue Lakes	Narrows Resort	Square plastic plates	County	39.17423	-123.0159	3.5	2019	10/10/2019	no mussels
Pillsbury	Pillsbury Resort	PVC pipe	F&G Region 2	39.421472	-122.958		2019	N/A	N/A
Pillsbury	Fullers campground	Square plastic plates	County	39.43809	-122.9686		2019	N/A	N/A
Hidden Valley	Fishing dock	Square plastic plates	County	38.80735	-122.5625	3.5	2012	10/1/2019	no mussels
Hidden Valley	Marina	Square plastic plates	County	38.81066	-122.5603	3	2012	10/2/2019	no mussels

Mussels P/A: present or absent), Absent or "Clean"

Notes: Comments on substrates, e.g., missing, damaged, etc.

Did not inspect for November due to severe weather conditions - Snow & wind for most of the month, followed by holidays