



# CLEAR LAKE, CALIFORNIA

## Virtual Rapid Response Workshop

June 20-21, 2023

Next slide

Lisa DeBruyckere, Creative Resource Strategies, LLC  
Leah Elwell, Conservation Collaborations, LLC

# Exercise Goals

- Become familiar with invasive quagga and zebra mussel issues and their threats to the Clear Lake economy, natural resources, and recreation
- Gain understanding of potential management decision making and roles and responsibilities in the event of an introduction of invasive mussel
- Build knowledge base for preparedness actions
- Understand the financial constraints, challenges, and needs associated with an introduction of invasive mussels



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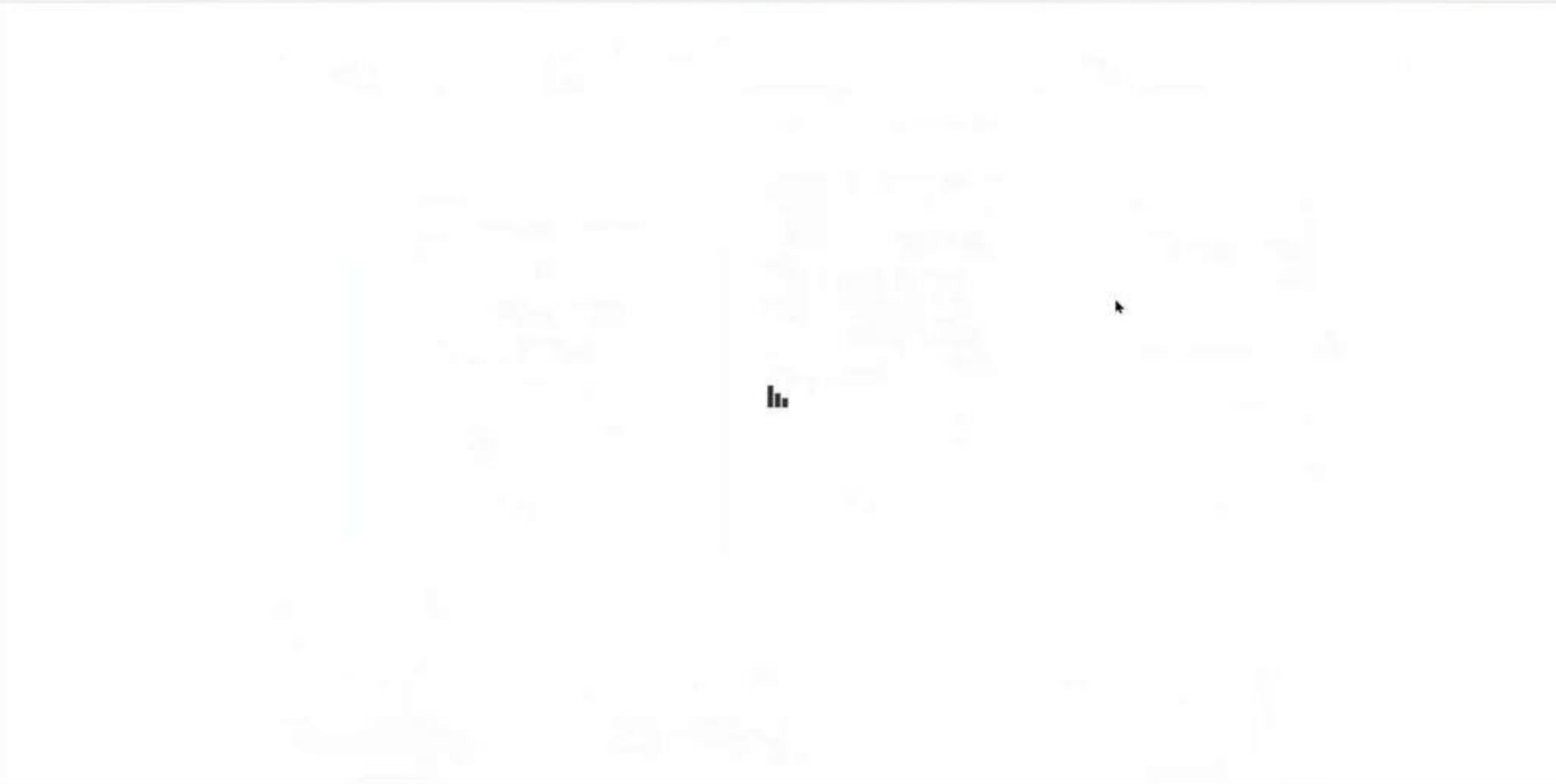


# KEY PROJECT DELIVERABLES AND TIMELINE



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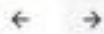


# KEY PROJECT DELIVERABLES AND TIMELINE



# Introductions and Expectations

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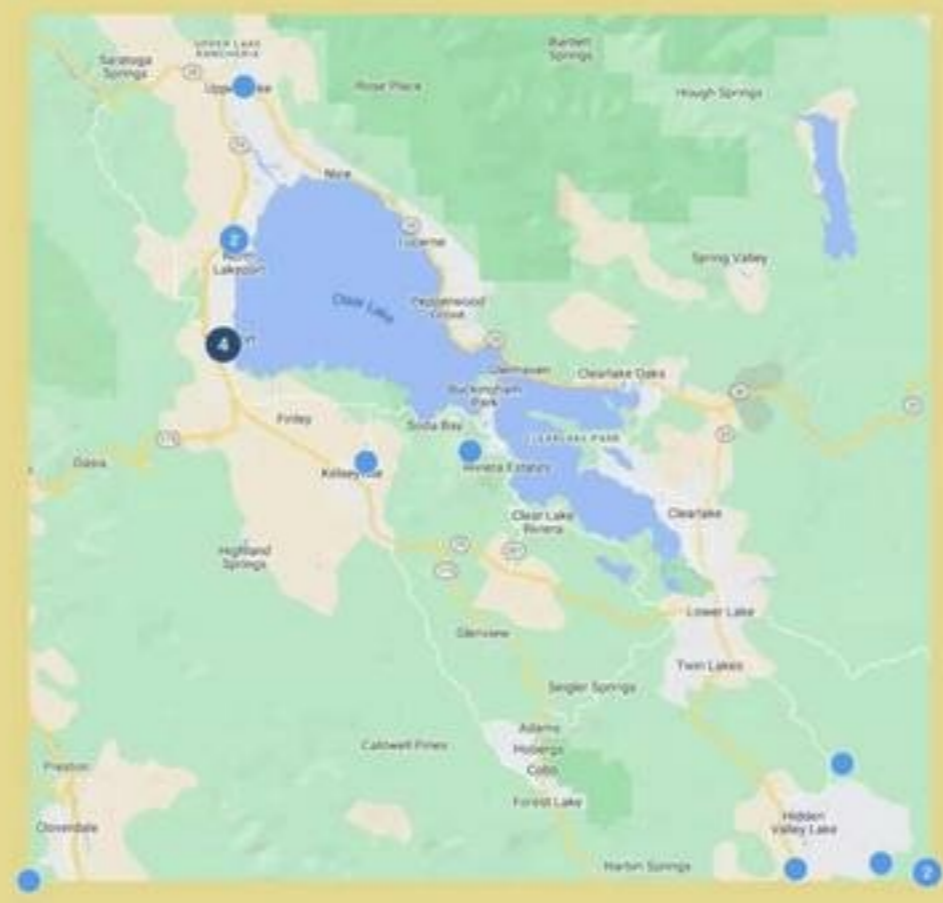




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# Exercise Agenda

## Tuesday June 20<sup>th</sup> 9 am – 2:45 pm

- Background – Preventing an Introduction
- Response Plan Review
- Steps Taken Upon Detection
- Legal Authorities, Jurisdictional Roles
- Explore Scenarios and Response Options
- Incident Command
- Communication

## Wednesday June 21<sup>st</sup> 9 am – 2:15 pm

- Exploring Treatment and Control Options
- Transition to Containment
- Impacts from Containment Management
- Public and Private Water Purveyor Responsibilities

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What would you like to learn/gain from participating in all or portions of this 2-day exercise?



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What would you like to learn/gain from participating in all or portions of this 2-day exercise?

8

Answers

To learn what the County is responsible for, and how Tribes and local governments support or lead.

Response planning

As much as I can get, nothing specific

Improve the Russian River watersheds rapid response

A written document /updated plan.

First steps in containment. Being prepared

Improve the Russian River Watershed Agency on

How best to respond when QZ are introduced to reduce ecologic and ecological impact - so we are not caught off guard



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What would you like to learn/gain from participating in all or portions of this 2-day exercise?

10 Answers

To learn what the County is responsible for, and how Tribes and local governments support or lead.

Response planning

As much as I can get, nothing specific

Improve the Russian River watersheds rapid response

A written document /updated plan.

First steps in containment. Being prepared

Coordinating with a water agency on creating a RR Plan.

How best to respond when QZ are introduced to reduce ecologic and ecological impact - so we are not caught off guard

Mechanisms that may be employed for a response to infestation.



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What would you like to learn/gain from participating in all or portions of this 2-day exercise?

12 Answers

Improve the Russian River watersheds rapid response

Coordinating with a water agency on creating a RR Plan.

Who are my main stakeholders involved in a response

How best to respond when QZ are introduced to reduce ecologic and ecological impact - so we are not caught off guard

I hope to gain a better understanding of what Lake County is doing to prevent a mussel infestation and the planned response. I also hope to be able to incorporate elements into the plan for IVR.

Mechanisms that may be employed for a response to infestation.

Making sure the public does not panic



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What would you like to learn/gain from participating in all or portions of this 2-day exercise?

15 Answers

Coordinating with a water agency on creating a RR Plan.

Who are my main stakeholders involved in a response

More collaboration with the surrounding body of waters around Clear Lake

introduced to reduce ecologic and ecological impact - so we are not caught off guard

I hope to gain a better understanding of what Lake County is doing to prevent a mussel infestation and the planned response. I also hope to be able to incorporate elements into the plan for IVR.

Hopina to see, learn, and understand

Mechanisms that may be employed for a response to infestation.

Making sure the public does not panic

But also making sure the public cares about the response :)



12



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# What words come to mind when you think of invasive mussels in Clear Lake?

Waiting for answers



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What words come to mind when you think of invasive mussels in Clear Lake?

3 answers

destruction

vegas

unusable



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2





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What words come to mind when you think of invasive mussels in Clear Lake?

9 answers

destruction

gross and smelly

cost

vegas

unusable

scary

damaging

fishery

takeover



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What words come to mind when you think of invasive mussels in Clear Lake?

15 answers



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What words come to mind when you think of invasive mussels in Clear Lake?

18 answers



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What words come to mind when you think of invasive mussels in Clear Lake?

27 answers



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What words come to mind when you think of invasive mussels in Clear Lake?

28 answers



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What words come to mind when you think of invasive mussels in Clear Lake?

31 answers





# Preparing for an Introduction of Invasive Mussels – Lake County's Prevention Program

Angela de Palma-Dow and Corey Hustead, Lake County



# Lake County Invasive Mussel Prevention Program



Angela De Palma-Dow  
*Invasive Species Program Coordinator*

Corey Husted  
*Water Resources Technician*

Lake County Water Resources Department



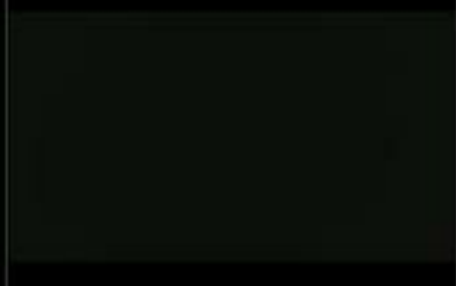
Photo credit: <http://www.marinesymbiomes.ca/2011/01/19/zebra-mussel-holdovers-fix-and-recycle-nitrogen/>



@lakecountywater

[www.nomussels.com](http://www.nomussels.com)





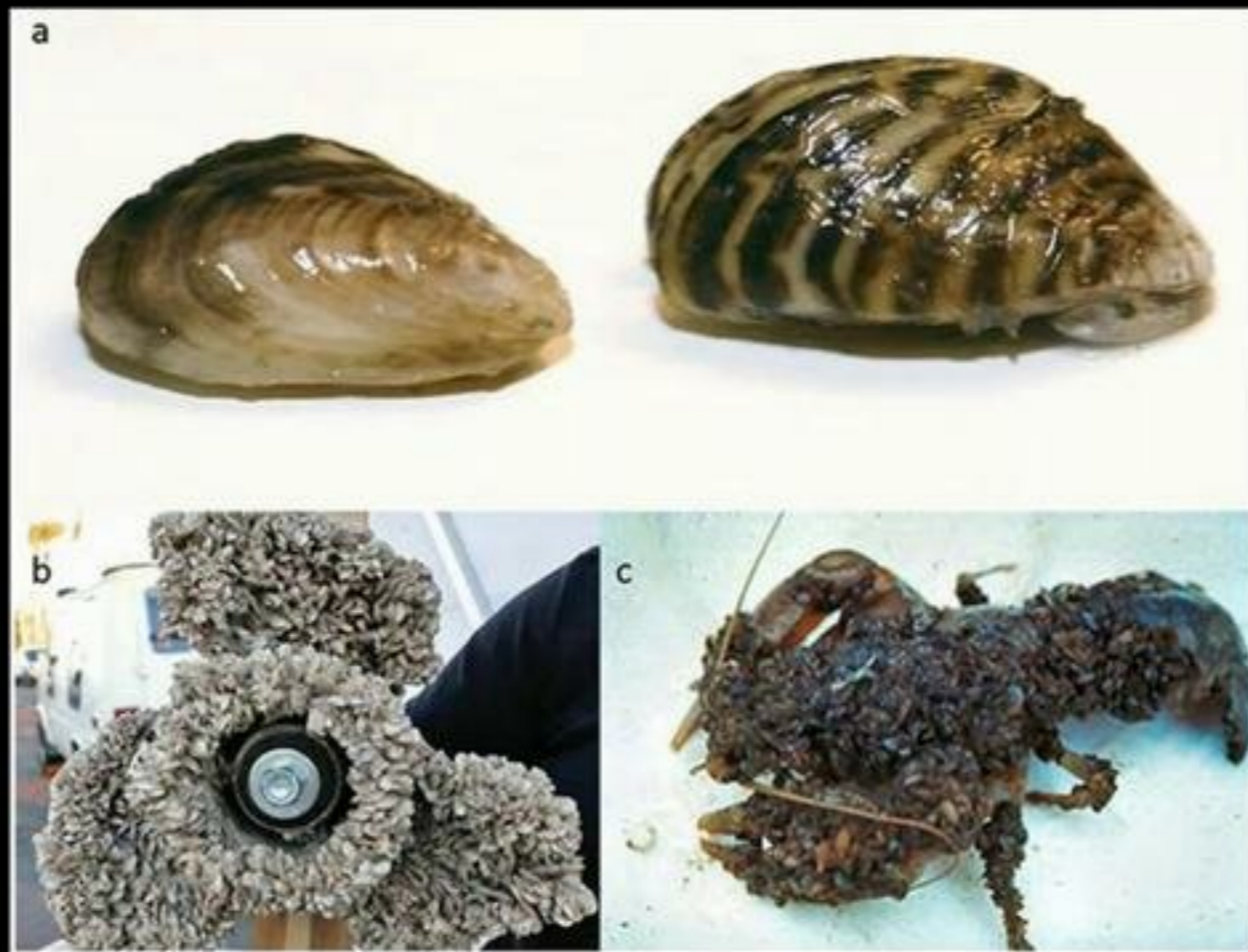
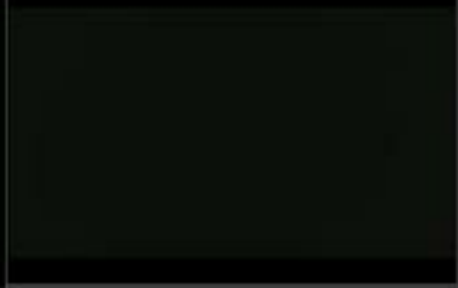
A BIG thank you to our ramp monitors!  
*This program only works because they do!*



Thank you Ramp Monitors: Bob, Scott, Al, Tony, Larry, Ken, Don, Brenda, Wayne, Jack, Frank, Christian, Linda, Gary, and Robert



# Quagga & Zebra Mussels

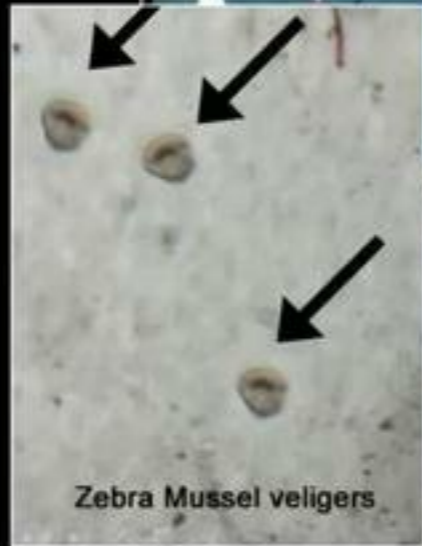
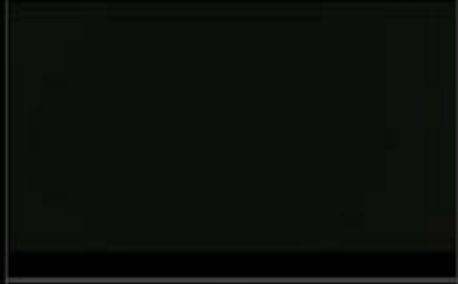


# Biology Basics

- Lifespan 3-5 years
- Low juvenile survival, but high  
reproductivity
  - Max 6 spawning cycles/yr
  - 30,000 + gametes / cycle
- Juveniles planktonic / free floating
  - Very Small
- Adults attach–byssal threads
- Not a palatable food for N.A. Fish



# Mussel Monitoring For adults and juveniles





**Where do they come from?**





Source: Kafisa P et al. *J. R. Soc. Interface* 2010;7:1093-1103

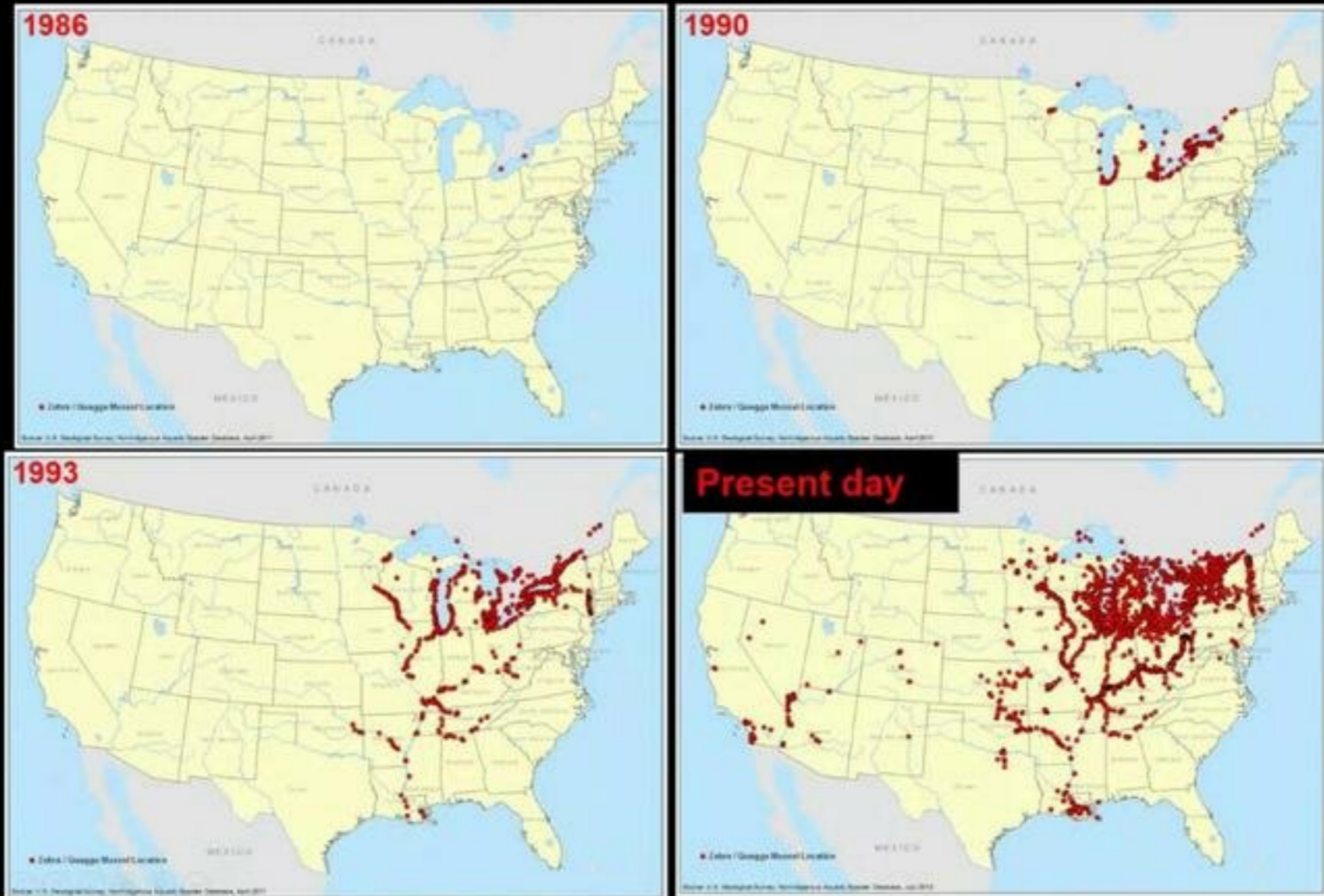
Copyright Stratfor 2012 www.stratfor.com







# Great Lakes invaders: Dreissenid mussels



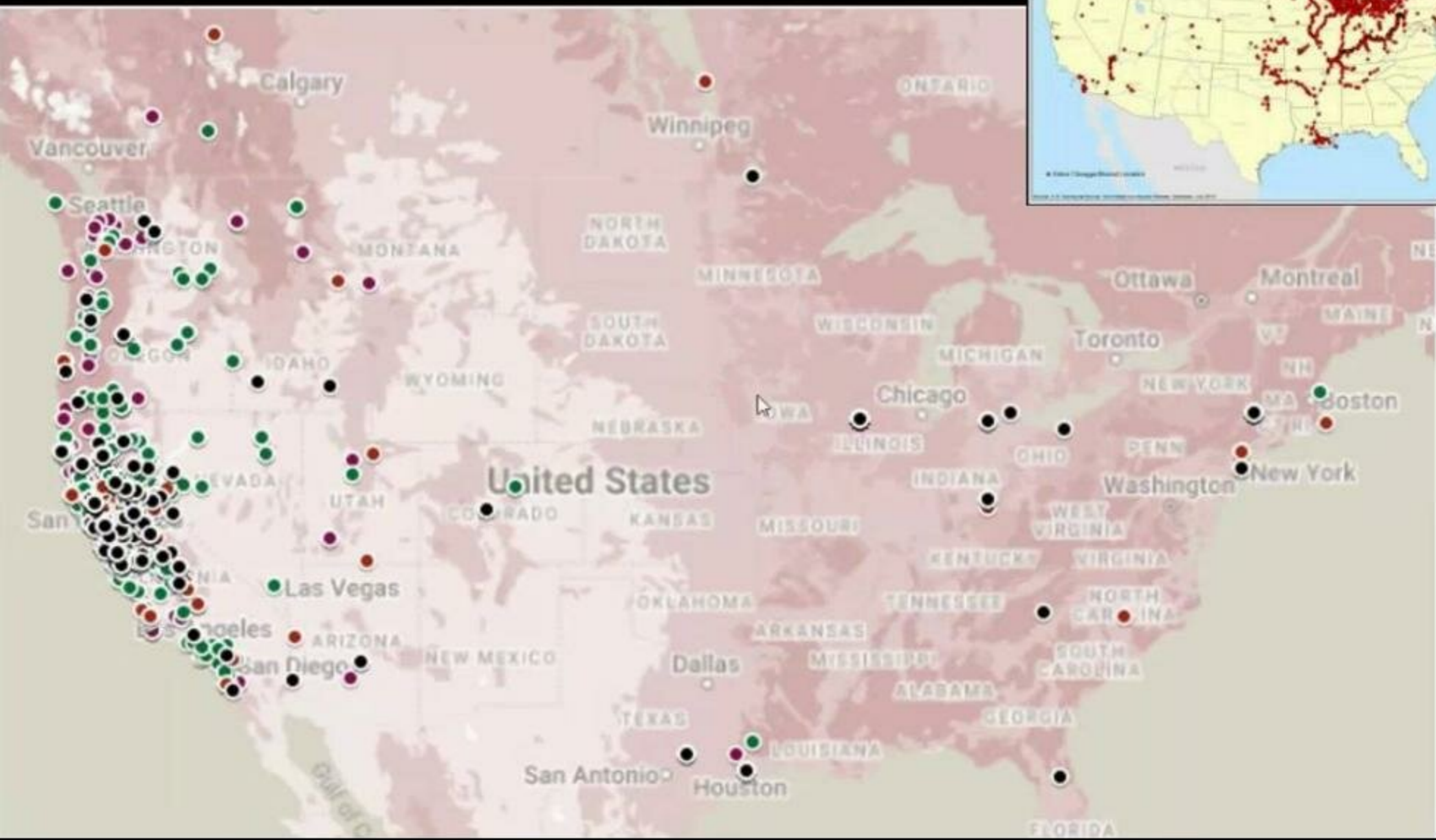
# 2018-2022

## Boat Visitors to Clear Lake

*Where were they last?*



# Where were they last?

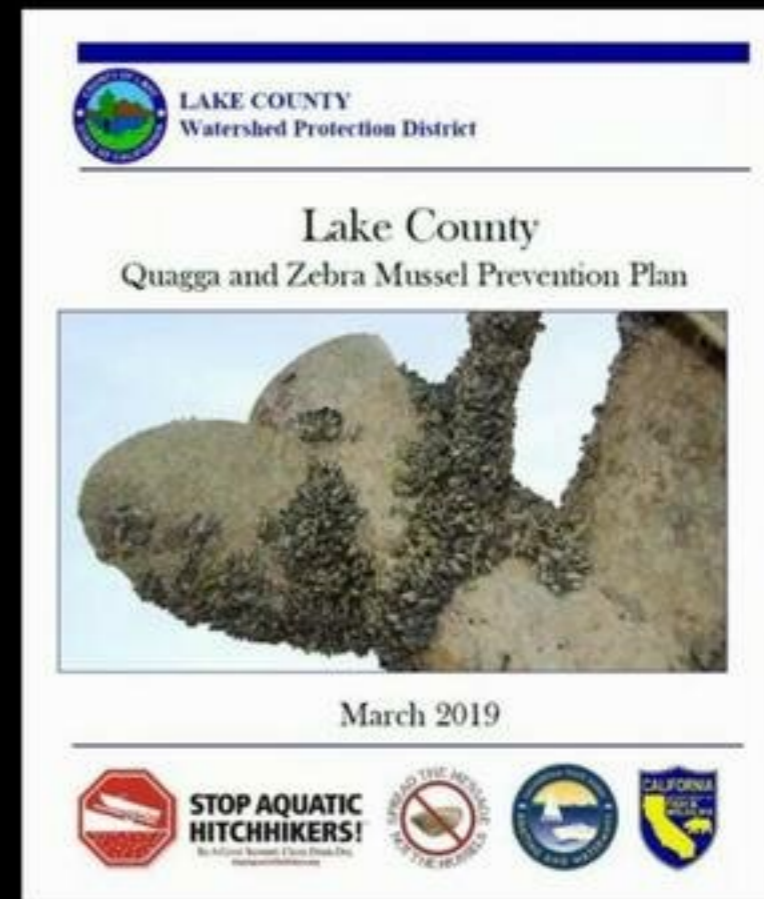


A wide-angle photograph of a large group of people on many small motorboats on a lake at sunset. The sky is a mix of blue and orange, and the water is calm. In the foreground, a white boat with the name "TERNA" is partially visible. A white box with a black border is overlaid on the bottom half of the image, containing the text "Our Prevention Program".

# **Our Prevention Program**

# Our Prevention Program Screening & Inspection

- Local Ordinance 2936
- Mandatory screening & sticker program
- All vessels must be clean, drain, dry before launching





Cleaning Procedures (PDF)

Inspection Process

Mussel Screening Application

Prevention Plans & Reports

Resident Screening

Screening Locations

Visitor Screening

Volunteer

NEW! Rapid Response Plan Website! Check it out!

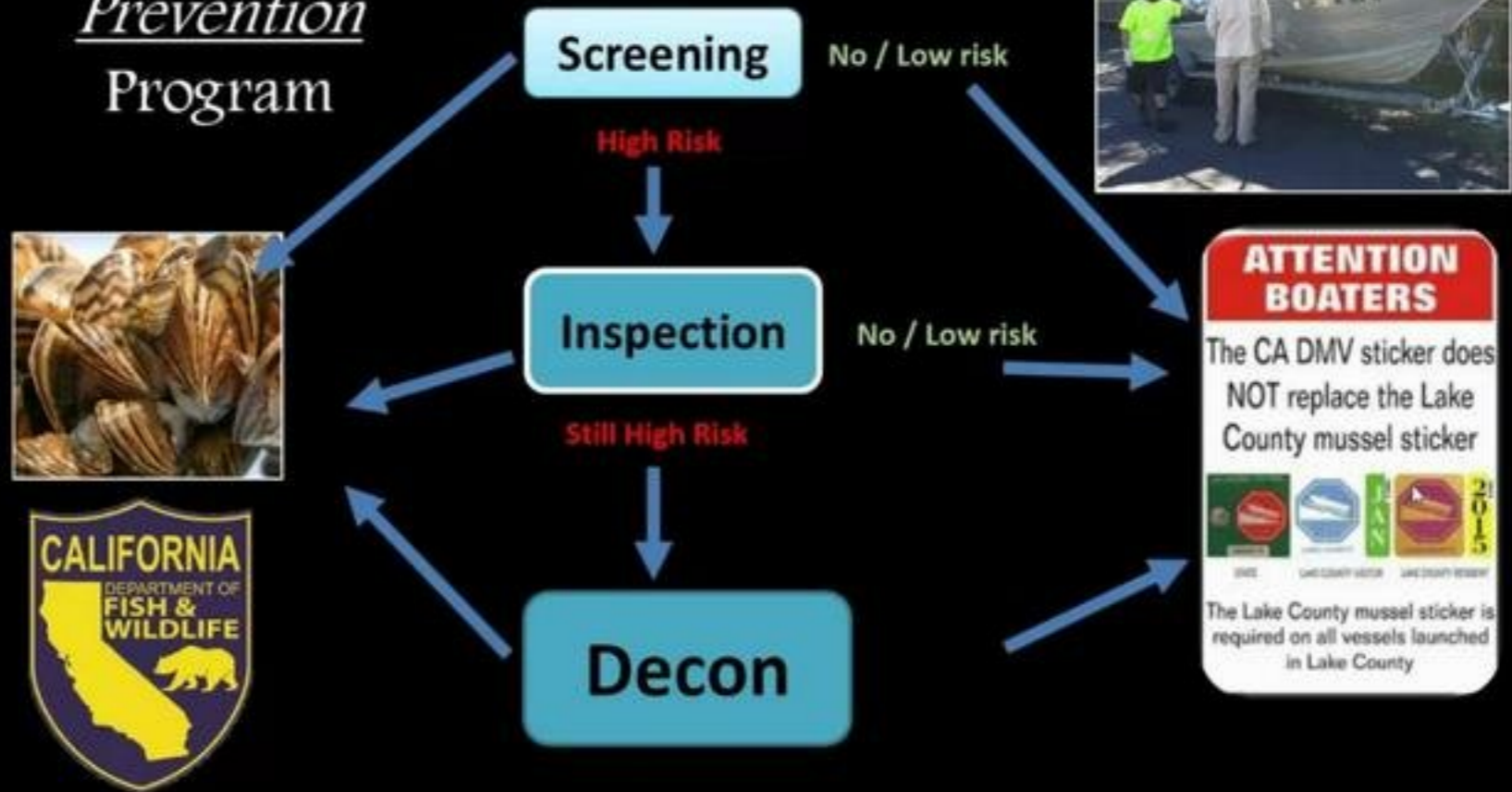
[Home](#) · [Departments](#) · [Water Resources](#) · [Programs & Projects](#) · [Invasive Mussel Prevention](#)

## Invasive Mussel Prevention



The Lake County Quagga/Zebra (QZ) Sticker is required, in addition to a State DMV sticker, for all vessels launched in Lake County water bodies. Remember to check in with a participating screener when you return from any out-of-county trips with your boat - it's the law! Program screeners have current information on counties and water bodies in the western United States infested with invasive mussels. Re-screening and inspections, when needed, are free. Resident

# Multi Step *Prevention* Program



2019 Inspections	2019 Decons
170	34





# QUAGGA MUSSEL SCREENING LOCATIONS

NAME OF LOCATION	ADDRESS OF LOCATION		DAYS/HOURS OPEN	PHONE
Indian Beach Resort	9945 Hwy 20	Clearlake Oaks	Everyday 7:00am- 7:00pm	707-998-3760
Limit Out Tackle	12607 E. Hwy 20	Clearlake Oaks	Mon-Thur 6am-5pm, Fri-Sat 5:30am- 5pm, Sun 5:30am-12pm	707-998-1006
Clearlake Bait & Tackle	14699 Lakeshore Dr.	Clearlake	Mon-Thur 5:30am-5pm, Fri-Sat 5:30am-6pm Sun 6am-2pm	707-994-4399
Clear Lake Campground	7805 Cache Creek Way	Clearlake	Sun-Thur 12pm-4pm, Fri 12pm-6pm	707-994-2236
McAtee's Marine Repair	3450 Hill Road	Lakeport	Mon-Sat 8am-5pm	707-263-0440
Hillside Powersports	460 S. Main St	Lakeport	Tues-Sat 8:30am-6pm	707-263-9000
Clearlake Outdoors	96 Soda Bay Rd.	Lakeport	Mon-Sat 6am-5pm, Sun 6am-12pm	707-262-5852
Lake County Chamber of Commerce	875 Lakeport Blvd.	Lakeport	Mon-Fri 9am-5pm	707-263-5092
Konocti Vista Casino Resort Marina	2755 Mission Rancheria Rd.	Lakeport	Seven days a week 7am-Midnight	707-262-1900
Skylark Shores	1120 N. Main St.	Lakeport	Seven days a week 7am-10pm	707-263-6151
Lakeport Bait & Tackle	1050 N. Main St.	Lakeport	6am-7pm daily	707-900-5101
Braitto's Marina	1555 East Lake Drive	Kelseyville	Mon- Fri 9am- 4pm, Sat - Sun 10am- 4pm	707-279-4868
Clearlake State Park	5300 Soda Bay Road	Kelseyville	Sun - Fri 8am- 4pm, Sat- 9am- 5pm	707-279-4293
Kelseyville Lumber & Supply Co.	3555 N. Main Street	Kelseyville	Mon-Fri 7am-7pm, Sat 8am-6pm, Sun 8am-5pm	707-279-4297
Borenbega	9080 Soda Bay Road	Kelseyville	Please call, by appointment	707-530-4541
Clear Lake Vista Resort	6190 Soda Bay Road	Kelseyville	Wed-Fri 11am- 9pm, Sat 9am- 9pm, Sun 8am-9pm	707-289-4017
Lake Builders Supply	3694 Highway 20	Nice	Mon- Fri 7:30am- 5:30pm, Sat-Sun 8am- 4pm	707-274-6607
Chris Hudgins, SeaDoo Dr	325- B Hwy 20	Upperlake	Mon - Fri 8:00am- 5:00pm <b>(Call Ahead)</b>	480-516-9239
Narrows Resort	5690 Blue Lakes Rd	Blue Lakes	Call Ahead	707-275-2718
Konocti Bait Shop	6199 Hwy 20	Lucerne	Call Ahead	707-349-8963
Lake Pillsbury Resort	2756 Kapronos Rd	Potter Valley	Call for summer 2020 hours	707-743-9935
Soda Creek Store	26853 Elk Mountain Road	Potter Valley	Seven days a week 9:00am-9:00pm	707-743-2148
Suzanne L-B	Indian Valley Reservoir	Mobile	Call for Appointment	707-489-6792
Bob Sullivan Screening/Inspection	Flexible	Mobile	Flexible, by appointment	707-337-0480
Conrad Clobrandt	Flexible	Mobile	Call for Appointment	707-245-9181
Mark Holloway	Flexible	Mobile	Call for Appointment	707-295-9112
Robert Valdez	Flexible	Mobile - Lakeport / Kville	Call for Appointment	408-691-7726

# Inspections





*Boat inspections are faster & fluffier!*







400 + Public / Private Boat Ramps  
-Open 24 hours day / 365 Days year  
\*No Launch Fees



Year	Temp (°C)	Conductivity (mS/cm)	pH*	D.O. (mg/l)	Total Hardness <sup>1</sup> (mg/L CaCo3)	Total Calcium <sup>1</sup> (mg/L)
2016 May	22.3	0.4	8.7	6.6	173.0	30.0
2016, Nov	16.7	243.0	9.5	3	131.0	23.0
2017, April	14.4	300.0	8.3	1.2	113.0	21.0
2017, July	26.0	263.0	10	7.0	123.0	22.0
2017, Oct	17.4	257.1	9.1	2.9	127.0	23.0
2018, April	16.0	243.3	8.6	1.6	N/A	N/A
2019, June <sup>1</sup>	25.3	269.0	8.4	7.8	116	22
2019, August <sup>1</sup>	25.9	287.2	8.0	8.0	125	23.5
<b>Preferred Range for Q/Z mussels</b>	<b>6-32<sup>2</sup></b>	<b>&gt;22µS/cm<sup>3</sup></b>	<b>6.5-9.5<sup>2</sup></b>	<b>&gt;2-6<sup>2</sup></b>	<b>100-420<sup>2</sup></b>	<b>&gt;12<sup>2</sup></b>





# Impacts to Ecology & Economy

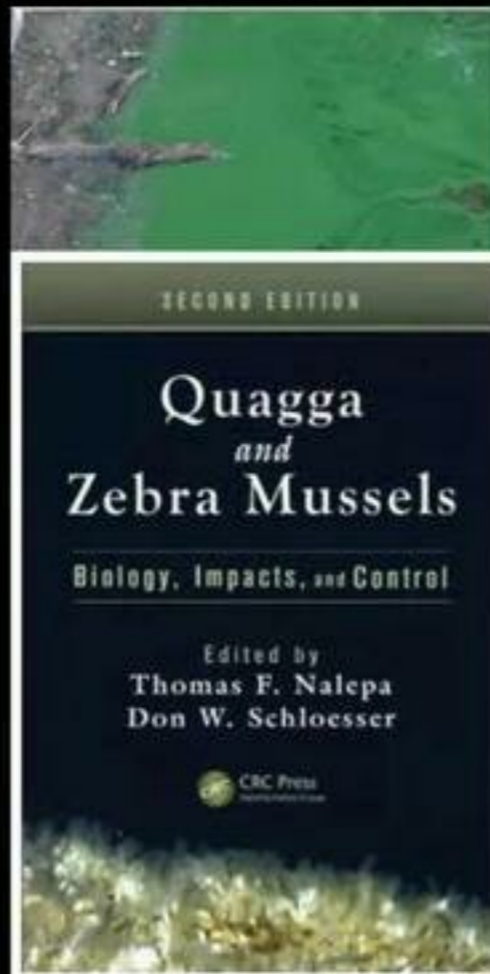
**Food (plankton)  
goes in**



**Dissolved  
nutrients come  
out**



# More Mussels = More Cyanobacteria (blue-green algae)



**“We observed that mussels can selectively reject *Microcystis* and simultaneously feed at high rates on high quality algae when available.”**

CHAPTER 32

**Role of Selective Grazing by Dreissenid Mussels in Promoting Toxic *Microcystis* Blooms and Other Changes in Phytoplankton Composition in the Great Lakes**

Henry A. Vanderploeg, Alan E. Wilson, Thomas H. Johengen, Julianne Dylle Bressie, Orlando Sarnelle, James R. Liebig, Sander D. Robinson, and Geoffrey P. Horst



Lake County relies on > \$1.3 million annual fishing dollars (resident and non-resident)



*(Giusti et al. 2016; Certified Tourism Ambassadors Lake County Program )*

# An QZ introduction

- Significant local economic losses ....



# An QZ introduction

- Significant local economic losses ....
  - Sticker sale losses (5 year period)
    - \$1 M in Public Revenue
    - \$500,000 Private Revenue
      - \$150,000 per year is from visitor sales
  - Grant funding (5 year period)
    - \$1.3 M in County Staff Support
    - \$50,000 in materials / training support
  - Drinking water rates would increase to consumers
    - \$100K - \$500K per year estimated



# Drinking Water Intakes

- Hoover, Davis, and Parker Dams cost over \$6,026,100 in 2016 alone
- Smell, bacteria, decay
- Constant cleaning, treatment, mitigation
- Filters, pipes, treatment
- \$\$\$ Passed down to the consumer
- 17 drinking water systems on Clear Lake
- Can we afford this?





**Next Steps to Improve the Program!**



# Next Steps

## Goals

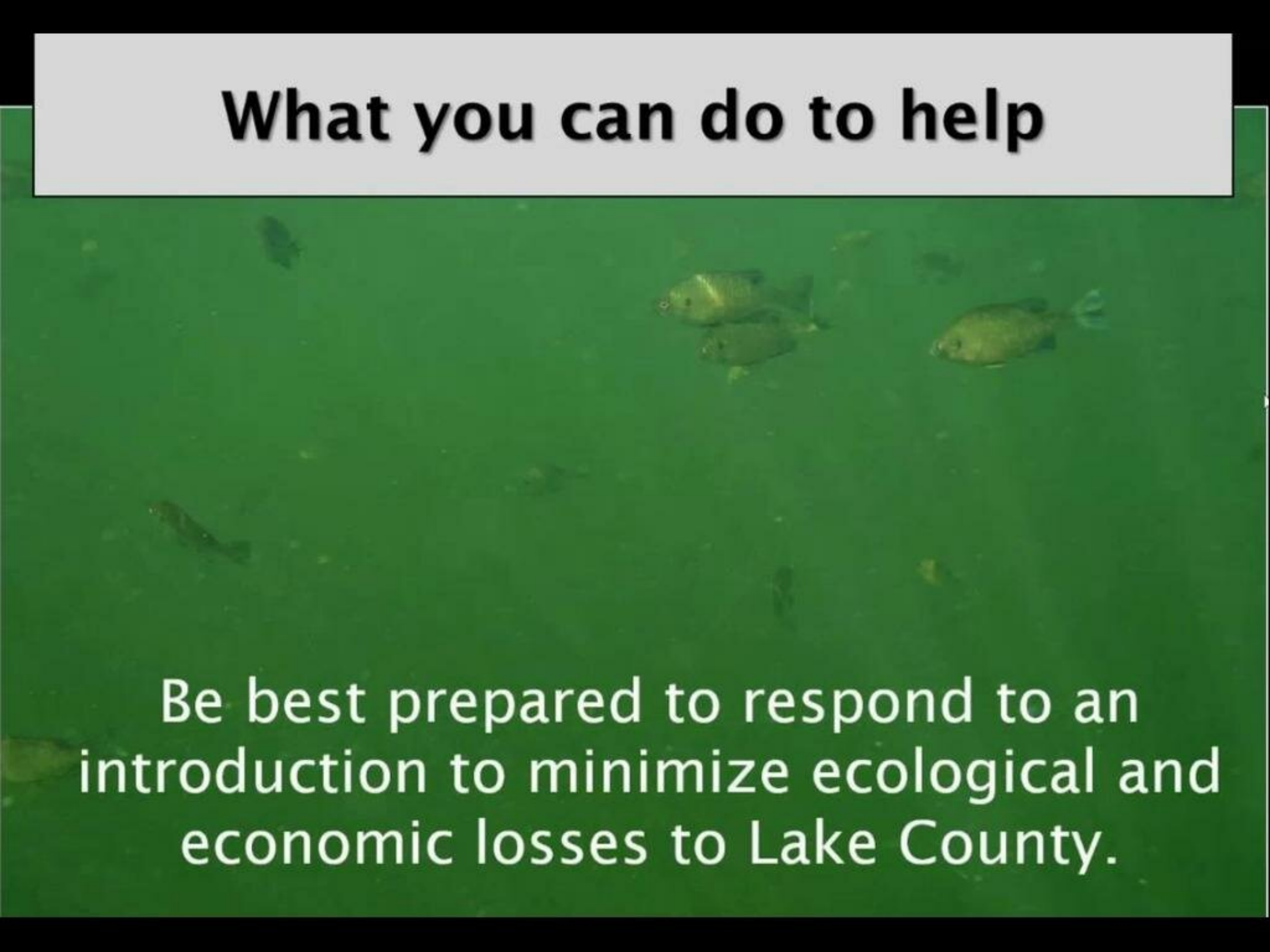
- Go Fully Digital!
  - Now it's "honor system"
  - Connect to Colorado Parks Western States Watercraft Inspection Database (WID)
- Improve Road & Ramp Signage
  - Hwy 5 Billboard being designed
  - Explore other funding
  - Boost Capacity of program
    - More Monitors



# What you can do to help



# What you can do to help

An underwater photograph showing several fish swimming in clear, greenish water. The fish are of various sizes and species, some appearing to be small, silvery fish, while others are larger and more colorful. The background is a soft, out-of-focus green, suggesting a natural aquatic environment.

Be best prepared to respond to an introduction to minimize ecological and economic losses to Lake County.

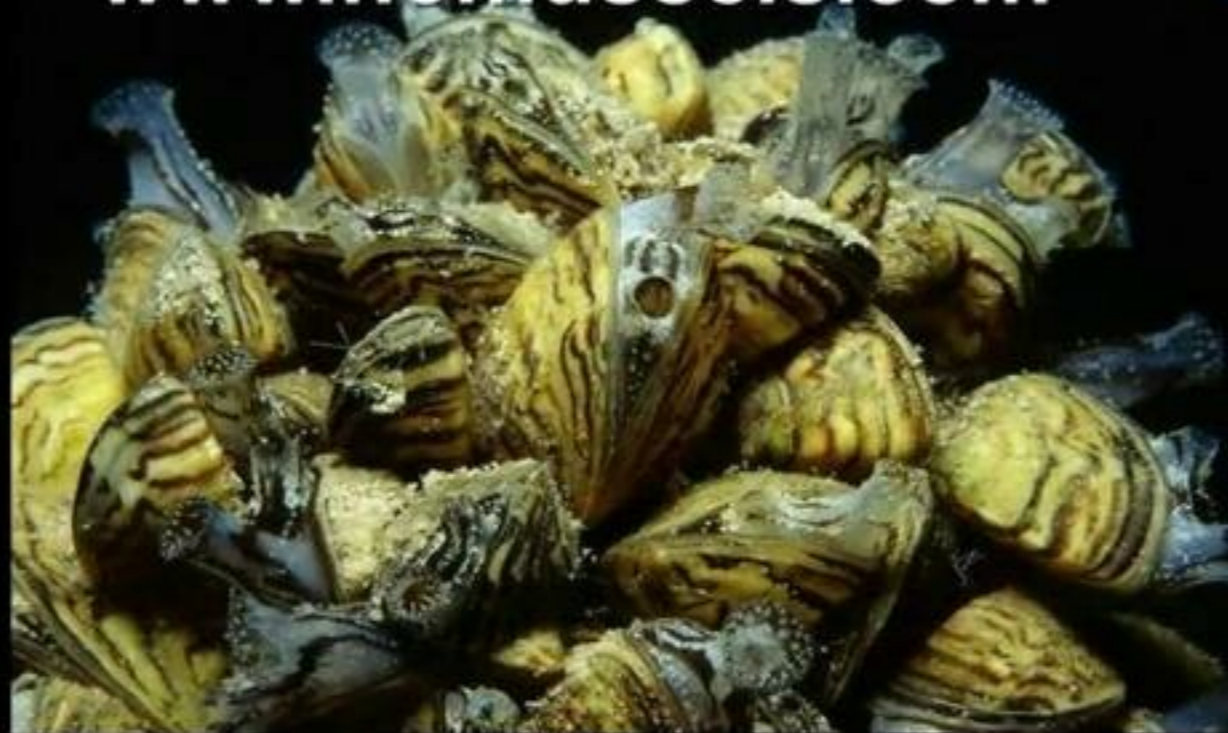


Thank you! Questions?

*Angela De Palma-Dow*  
*(707)263-2344*

*Angela.Depalma-Dow@lakecountyca.gov*

**www.nomussels.com**



We are hiring ramp monitors!  
Extra help  
25 hrs / wk

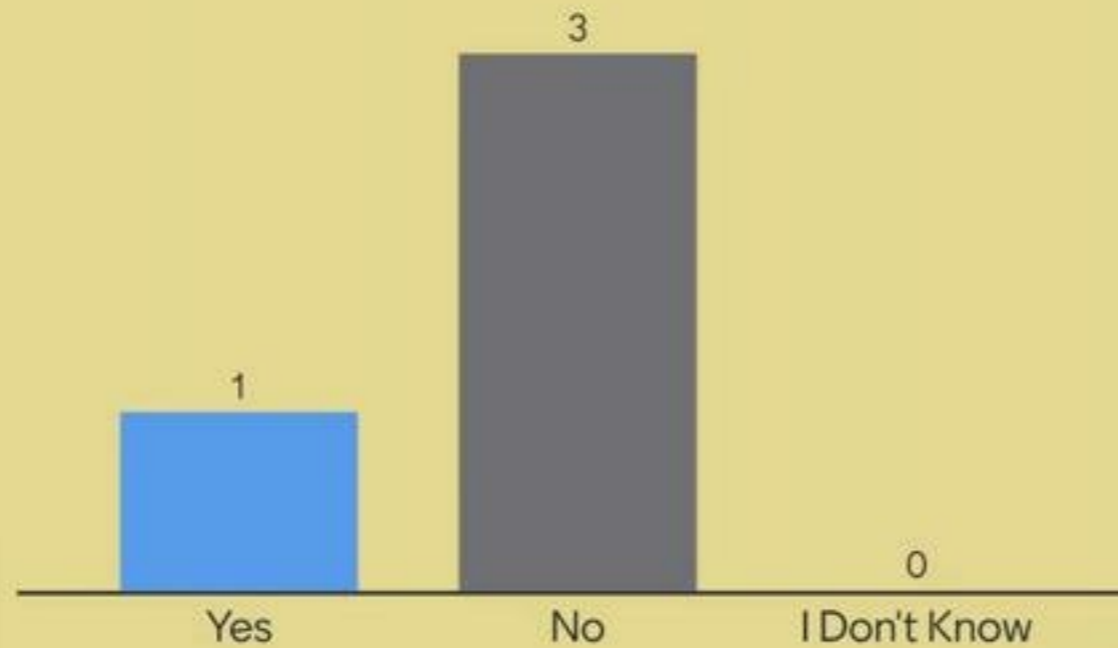


Lake County Water  
Resources  
Department  
@lakecountywater

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# Have you had an interaction with a ramp monitor while on Clear Lake?



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Review of Lake County  
Integrated Preparedness and  
Resilience Plan for Dreissenid  
Mussel Management Plan

Lisa DeBruyckere, Creative Resource Strategies, LLC  
Leah Elwell, Conservation Collaborations, LLC

# Clear Lake Plan Outline

- Background
- Legal Authorities, Current Statutes, Jurisdictional Roles
- Rapid Response Strategy
- Mechanisms of response
- Incident Command
- Communication
- Response Actions
  - Prevention
  - Control
  - Containment
  - Monitoring
- Transition to Containment
- Outreach materials
- Amendments to ordinances
- Transitioning existing prevention staff to containment
- Impacts to water purveyors
- Potential mitigation solutions
- Permanent Decontamination Station Feasibility Analysis
- Long-term Management Recommendations
- Funding

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[https://issuu.com/lalwell/docs/lakecounty\\_rr  
containment transition flipbook](https://issuu.com/lalwell/docs/lakecounty_rr_containment_transition_flipbook)





Press **Esc** to exit full screen

**Clear Lake Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management**  
**A Rapid Response and Transition to Containment Plan**

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Acknowledgements  
Citation

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Figure 1. Clear Lake Water System Area Boundaries. Source: California Water Boards Water System Area Boundaries map. Accessed 26 Dec 2022.

Figure 2. Likely changes from an invasive mussel invasion in Clear Lake.

Figure 3. Dreissenid management response decision matrix.

Figure 4. Three types of communication hubs, including the type of information shared, method of communication, frequency, and entities involved.

Figure 5. Outreach materials to share information about a detection of dreissenids in Clear Lake include a social media post, flier, and door hanger.

Figure 6. Mussel sticker sales to residents and visitors, 2016-2022.

Figure 7. Potential locations for permanent watercraft inspection and decontamination stations based on the criteria for establishing stations.

## List of Tables

Table 1. Total number of stickers sold to residents and visitors, and income received, from 2016-2022.

## Executive Summary

To be populated upon completion

## CHAPTER 1

### Purpose of the Plan

The purpose of this *Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management* is to improve the preparedness capabilities of Clear Lake water managers to protect Clear Lake water resources in the event of an invasive dreissenid mussel introduction and/or establishment. The plan provides guidance to prepare partners and other entities to efficiently and effectively respond to a dreissenid mussel detection to minimize spread within and beyond Clear Lake, and protect natural, recreational, cultural, economic, and other resources. This plan is intended to build upon the *Lake County Quagga and Zebra Mussel Prevention Plan (2019)*, which guides prevention efforts associated with an introduction and establishment of dreissenids in Lake County water bodies. The contents of this plan are limited to containment via overland transport (i.e., watercraft), which is within the jurisdiction of Lake County Water Resources Department (LCWRD) and acknowledges the critical role the LCWRD plays in preventing the spread of dreissenids through containment and potential control efforts.

### Objectives and Capability Targets

The plan will be used to routinely test core capabilities associated with prevention and response. Core capabilities include:

- **Planning** – Identify critical objectives, describe the sequence and scope of tasks to achieve objectives, ensure objectives are implementable, and develop and execute actions in coordination with regional jurisdictions.
  - **Capability Target** – Within one week of a dreissenid confirmation, describe the roles and responsibilities of partner organizations involved in incident management response across all jurisdictions, and sequence the scope of tasks needed to prevent, protect, mitigate, and respond to the introduction.
  - **Capability Target** – Maintain, on a regular basis (i.e., quick annual review and thorough 5-year review), this *Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management*, to ensure roles and responsibilities across jurisdictions as well as sequence and actions needed to prevent an introduction and/or establishment of dreissenids is understood.
- **Public Information** – Deliver coordinated, prompt, reliable, and actionable information to the whole community through clear, consistent, accessible, culturally competent and appropriate methods<sup>1</sup> to relay information regarding the dreissenid detection as well as actions being taken.
  - **Capability Targets**

<sup>1</sup> Based on best available science/labatory methods and standardized Gold methodologies.

- **Within 24 hours of a dreissenid detection, notify CDFW QZM-AIS Regional Coordinator (Environmental Scientist) and invasive species hotline @ [invasives@wildlife.ca.gov](mailto:invasives@wildlife.ca.gov) and/or Invasive Species Program @ 866-440-9530.**
- **Within one week of a dreissenid detection, and within three days of a dreissenid confirmation, deliver reliable and actionable messages with the public and collaborators that define the threat, describe actions being taken, and include required actions by the public and collaborators.**
  - **Capability Target** – One month prior to taking action to attempt to eradicate, or limit the spread of dreissenids, deliver reliable messages to the public and collaborators about potential control actions and any necessary temporary closures, or shutdowns (e.g., municipal water suppliers, self-supplied water users).
- **Operational Coordination** – Establish and maintain a unified and coordinated operational structure and process that appropriately integrates all critical collaborators.
  - **Capability Target** – Within one week of a dreissenid detection, establish and maintain an Incident Command Structure (ICS) and process with partner organizations.
  - **Capability Target** – Annually test and update the *Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management*, validating roles and responsibilities and other core plan elements.
  - **Capability Target** – Ensure adequate resources exist to respond to an introduction of dreissenids in Clear Lake and neighboring regional water bodies by coordinating and positioning equipment (e.g., booms) in an easily accessible location, establishing protocols and procedures for accessing and replacing that equipment.
  - **Capability Target** – Share information about water body surveillance results across regional water body jurisdictions. Within one week of a dreissenid detection, provide notification to decision makers and partners involved in incident management of the current and projected situation.
- **Screening, Search, and Detection** – Identify, discover, or locate dreissenids through active and passive surveillance and search procedures including assessments, surveillance methods, or physical investigation.
  - **Capability Target** – Monitor Clear Lake and other county water bodies on a regular basis using plankton tows, settling plates, and physical observations to detect an introduction of dreissenids.
  - **Capability Target** – Per Chapter 15, Article IX,<sup>2</sup> ensure all watercraft launched in Clear Lake have both local inspection stickers and state mussel fee stickers, and are clean, drained, and dry prior to launch.
  - **Capability Target** – Ensure all high-risk watercraft launched in Clear Lake are inspected prior to launch.

<sup>2</sup> [https://library.leginfo.ca.gov/lake\\_county/codes/code\\_of\\_regulations/nodeId=COOR\\_CH15RE\\_ARTIXWAVEINPR](https://library.leginfo.ca.gov/lake_county/codes/code_of_regulations/nodeId=COOR_CH15RE_ARTIXWAVEINPR)

- **Risk Management for Protection Programs and Activities** – Identify, assess, and prioritize risks to inform activities, countermeasures, and investments.
  - **Core Capability** – Annually conduct a review of relevant threats and hazards, vulnerabilities, and strategies for risk management covering publicly managed and/or regulated critical infrastructure (e.g., water delivery).
- **Response** – Implement appropriate actions to eradicate an introduction of, or limit the spread of, dreissenids within Clear Lake and other regional water bodies.
  - **Core Capability** – Per Title 14, Section 672.1(a)(1), within 60 days of a dreissenid detection, describe the suite of options available to eradicate, or limit the spread of, the dreissenid population, and obtain the necessary permits and marshal the necessary resources to effect action.

DRAFT

## CHAPTER 2

### Background

#### Preparing for an Introduction of Dreissenids in Lake County

In December of 2022, the County of Lake Water Resources Department launched this project to develop an *Invasive Mussel Introduction Rapid Response and Containment Transition Plan for Clear Lake, in Lake County, California*. The overall goal for the project is to improve the current aquatic invasive species prevention program while preparing for an invasive quagga or zebra mussel (“QZ”) introduction into Clear Lake, or neighboring Lake County water bodies.<sup>3</sup> Preparing for an introduction is a process to understand and determine potential control options and develop a containment strategy that can be implemented quickly and efficiently to reduce local economic, environmental, cultural, and social impacts as well as prevent the spread of invasive mussels in northern California and other uninfested western waters. Any potential response to an introduction of dreissenids to Clear Lake will vary based on a variety of factors, including the scope and extent of the infestation upon discovery. The materials and information provided in this report are guidelines and are not prescription relative to the actions that would likely be taken.

#### Clear Lake Water Management and History

Clear Lake and its associated 520 square mile watershed are a complex ecosystem consisting of a large, shallow, eutrophic lake that is used for recreation, tourism, and municipal, domestic, and agricultural water supply and provides important habitat for fish and wildlife. The lake is California’s largest, natural freshwater lake located entirely within the state, has 68 miles of surface area, and an average depth of 26 feet.

The lake drains into the Sacramento River via Cache Creek (Lake County 2010). The major tributaries to Clear Lake, which flow primarily during the winter months and contribute 73% of the total stream flow into Clear Lake, include Scotts and Middle Creeks (northwest) and Kelsey Creek in Big Valley (south) (Lake County 2010).

Extensive modifications of the lake, shoreline, and watershed since the mid-1800s have resulted in an 85% loss of natural wetlands as well as nitrogen and phosphorus cycling imbalance contributing to frequent cyanobacteria algal blooms (Giusti 2009). Several water purveyors have developed cyanotoxin management plans (Highlands Mutual Water Company 2016) to prepare for and mitigate risks from harmful algal blooms and cyanotoxins in Clear Lake to protect public drinking water. Clear Lake was added to the federal Clean Water Act Section 303(d) list of impaired water bodies for nutrients in 1986 (Lake County 2010). The Lake County Clean Water Program established a *Program Effectiveness and Improvement Plan* in 2021 to mitigate polluted stormwater runoff, and in particular, high priority pollutants of concern (phosphorus associated with sediment and nutrients) and increases

<sup>3</sup> Clear Lake, Indian Valley Reservoir, Lake Pillsbury, Blue Lakes, Hidden Valley Lake and Highlands Springs Reservoir.

in peak flows caused by development (EOA 2021). Drought, mining, chemicals, and invasive species have contributed to water and natural resource impairments:

- Extended periods of drought correlate with increases in phosphorus in all three arms of the lake (Suchanek et al. 2002, De Palma-Dow et al. 2022). A major factor in the stimulation and persistence of cyanobacteria blooms in Clear Lake relates to periods of anoxia (during periods of calm) that reduce dissolved oxygen and may act to release phosphorus from the sediments, followed by periods of active water column mixing (windy periods) which distribute those nutrients throughout the water column (Florea et al. 2022).
- Clear Lake contains elevated levels of mercury caused by the Sulphur Bank Mercury Mine, an open pit mercury mine on the Oaks Arm of Clear Lake. The mine opened in 1865, became an open pit mine in 1927, ceased operations in 1957, and is now a Superfund site (Lake County 2010).
- Dichlorodiphenyldichloroethane (DDD) was applied to Clear Lake in the 1940s and 1950s to control the Clear Lake gnat (*Chaoborus arcticopus*), a nuisance to residents and recreationists (Giusti 2009). Contamination of the ecosystem and collapse of Western Grebe populations occurred.
- Introduction and establishment of non-native fishes and invasive plants, such as Hydrilla (*Hydrilla verticillata*), have displaced native fish species (Giusti 2009, Feyrer 2019).

#### Drinking Water Systems that Draw Water from the Clear Lake Watershed

Clear Lake provides drinking water to 60% (serving ~40,000 people) of the population of Lake County and provides a reliable water source for nearby agriculture within the basin and downstream through Yolo County and to the California Central Valley. Clear Lake has been described as the county's most valuable asset, providing economic and ecological stability to the entire region. The popularity and accessibility of Clear Lake combined with its ideal water quality conditions suitable for mussel establishment, make the risk of an invasive mussel invasion extremely high (Lake County Watershed Protection District 2019).

According to the California Rural Water Association (CRWA), there are a total of 17 Clear Lake utility surface water systems with a total of at least 17,545 service connections that draw water from the lake (Appendix A).<sup>4</sup> Stored water is managed by Yolo County Flood Control and Water Conservation District.

The water level in Clear Lake has been manipulated by operation of the Cache Creek Dam since 1914 (Highlands Mutual Water Company 2016). The Yolo County Flood Control and Water Conservation District owns the rights to use the water in the lake (Suchanek et al. 2002) and regulates the depth of the lake (determined by the Rumsey gauge) between 0–7.56 feet, under non-flood conditions and 0–9.00 feet under flood conditions (Lake County 2010). Clear Lake can drop from 3–6.5 feet in any given summer and fluctuates 5.5 feet each year on average (Lake County 2010). If the lake falls below

<sup>4</sup> <https://www.waterboards.ca.gov/yuba/dwr/waterboards/waterboards/index.html?id=272131&0fd14432099642a06643a0f>

3.22 Rumsey on May 1, Yolo County receives no water; it receives increasing amounts of water up to 150,000 acre-feet, when the lake is full (Lake County 2010).



Figure 1. Clear Lake Water System Area Boundaries. Source: California Water Boards Water System Area Boundaries map. Accessed 26 Dec 2022.

There are numerous private self-supplied water users that extract water from Clear Lake. These entities are not required to report their water use, therefore no estimates exist for a number of users, nor the amount of water they obtain from Clear Lake.

The drinking water treatment rates in Clear Lake are among the highest in the state of California because of existing Clear Lake water quality issues and conditions, including harmful algal blooms, which are predicted to worsen with climate change stressors (Kennard 2021). Although Lake County surface water systems adequately remove microcystins from finished drinking water, the cost to treat the water is proportional to the presence of harmful algal blooms, and funding has not been identified to adequately address predicted water treatment costs (Kennard 2021).

### Clear Lake Recreation and Tourism

Lake County's economy is based largely on tourism and recreation. In 2021, travel-related spending totaled \$175.7 million, and state and local tax revenue totaled \$13.6 million (Dean Runyon Associates 2022). Travel-related industry employment in the county was the highest on record in 2021 and contributed to 1,820 jobs (Dean Runyon Associates 2022).

Clear Lake has about 100 miles of shoreline and nearly 10 miles of public access, including public parks, open space, Caltrans right-of-ways, road ends, islands, and county-owned property ([Konecni Regional Trails](#)). An online map provides access points with and without amenities. Appendix B lists the Clear Lake marinas, boat rental facilities, public boat launches, marine services, and sailing facilities on Clear Lake. There are currently 11 free public boat launches, and five marinas and harbors are open year-round to trailered vessels. Lake County Department of Public Services maintains 13 free public swim beaches on Clear Lake. California State Parks owns and operates Clear Lake State Park, which has both beach access and boat launch facilities, and Anderson Marsh State Historic Park, which boasts non-motorized water trails. Both parks are significant attractions for lake visitors. Clear Lake has at least 20 private resorts with launch ramps, and numerous private access points. There are at least 749 private or public access points on the lake; about 450 access points are accessible by motorized vessels.

Clear Lake hosts thousands of visitors, and their watercraft, each year. The pre-pandemic 2017 Lake County Q-Z mussel mandatory boater sticker program documented the sale of more than 6,000 resident vessel stickers and more than 9,000 non-resident vessel stickers. Although global pandemic and drought complications reduced travel and access to Clear Lake, about 15,000 stickers were sold annually in 2020-2022.

Bass Master Magazine has ranked Clear Lake one of the top six bass fishing lakes in the United States since 2013. By April of 2023, the California Department of Fish and Wildlife (CDFW) had approved a total of [91 fishing tournaments on Clear Lake](#) in 2023, including tournaments for catfish (2), black bass (72), crappie (00), and carp (2). Tournaments range from one to three days in length. According to the U.S. Fish and Wildlife Service and U.S. Department of Commerce (2011), each angler spends an average of about \$58 per day when fishing Clear Lake. Fishing on Clear Lake is at least a million-dollar-a-year activity (Giusti 2016).

### Climate Change Stressors: Lake County Water Bodies

Climate change adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2022). The goal of climate change adaptation is to reduce risk from climate-related hazards while seeking opportunities for other benefits and reducing vulnerabilities across community systems.

Physical changes drive change in individual species, communities, and whole lake ecosystems (Parmesan et al. 2022). Yet there remains high confidence that protection and restoration of natural and semi-natural ecosystems are key adaptation measures that can lessen the impacts of climate change on biodiversity and people (Parmesan et al. 2022).

Climate change is predicted to increase the frequency of 100-year storm events, which is projected to increase risk from natural flooding to lakeside real estate and public utilities as well as additional risk of increased sedimentation, nutrient inputs, and acid mine drainage from the Sulphur Bank Mercury Mine (Suchanek et al. 2002).

Conversely, climate change is forecasted to extend drought conditions. During the typically dry season, drought causes lowered lake levels that could condense and concentrate populations of dreissenids into smaller areas as shorelines become dry and exposed.

As diurnal temperatures (daytime highs/overnight lows) increase due to changing climate, water temperatures also will increase, keeping waters warmer and more hospitable to dreissenids. Although dreissenids prefer temperatures of 68-77 degrees F, which is a typical temperature range during the summer, dreissenids can persist in water temperatures up to 86 degrees F (Karateyev et al. 1998).

Lake County needs to consider climate change impacts as it prepares for an introduction of dreissenids. Factors that should be considered:

- Watercraft decontamination stations that minimize the use of water, or use waterless cleaning systems, which would be especially important during times of drought.
- Watercraft decontamination stations that are energy contained units (e.g., solar powered), which may be important during times of widespread power outages.
- Modification of surveillance techniques to ensure lake locations with high risk of dreissenid introduction are regularly sampled, including during periods of drought.
- Use of emerging technologies (e.g., eDNA and newly developed assays (Marshall et al. 2022)) to complement standardized prevention monitoring methods (e.g., veliger tows, visual surface surveys) to efficiently and effectively detect dreissenids.
- Human use patterns (e.g., boat ramp use) that change because of severe climatic events.

### Vulnerability of Clear Lake and Regional Water Bodies to Dreissenids

Clear Lake is at a high risk for introduction of dreissenids because of the volume of out-of-county boaters that use the water body, the reputation nationally as a blue-ribbon warm water fishery, numerous and free access points for visiting boaters, and water chemistry conducive to invasive mussel establishment (Lake County Watershed Protection District 2019).

It is open year-round with access for trailered vessels in all seasons, except during periods of extreme drought, when the water level becomes too low to provide adequate access to boaters. Clear Lake is a national fishing destination, hosting more than 100 tournaments annually, from local club contests to large-scale commercial events that can have more than 1,000 entries. A total of 1,094 approved fishing tournaments occurred between 1/1/2015 and 12/31/2022. The lake is also an attraction for water recreationist activities, including tubing, swimming, sailing, kayaking, paddle boarding, water skiing, jet skiing, and leisure boating. Because invasive mussels are primarily spread by adult mussels attached to boats or veligers in water within boat compartments (e.g., bilge, motor), there is a high probability of an invasive mussel introduction via one of at least 500 public or private boat ramps from a visiting vessel.

In addition, environmental conditions in Clear Lake and other water bodies located within Lake County, such as water temperature, calcium, pH, dissolved oxygen, turbidity, conductivity, and salinity, are well within the ranges preferred by dreissenids (Pacherelli et al. 2016, Whittier et al. 2008, Cohen 2005). The most important water characteristic that indicates a high risk of dreissenid 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<sup>3</sup>).

Increased water temperatures and nutrients in the water column (DePalma-Dow et al. 2021) with extended drought periods expose more shoreline making motorized access to designated Clear Lake launch locations more difficult. This results in more boats being hand launched or launched in illegal launching locations. Hand launched watercraft are not required to participate in the mussel fee sticker program. In addition, ramp monitors are not located at every potential launch location along the lake shoreline. These vulnerabilities expose Clear Lake to potential invasive mussel introductions.

#### Water Body Monitoring in Clear Lake and Other County Lakes

California Title 14, Section 672.1 requires that any agency with a dreissenid prevention program submit an annual report by March 31 for the previous calendar year that summarizes any changes in the reservoir's vulnerability, monitoring results, and management activities to the California Department of Fish and Wildlife (CDFW). The information included herein was extracted from 2018-2021 reports from Lake County to CDFW.

The Lake County Watershed Protection District administers the Q/Z mussel prevention program and monitors for Q/Z mussels in Blue Lakes, Clear Lake, Hidden Valley Lake, Highland Springs, Indian Valley Reservoir, and Lake Pillsbury per CDFW monitoring protocols.<sup>4</sup> The district monitors for Q/Z mussels using the following methods:

- Monthly artificial substrates are monitored per CDFW procedures, primarily near public boat ramps and access points. During extremely high or low water levels, some substrates are either removed, or not checked monthly.
- Infrastructure/surface structure (e.g., docks, buoys) are monitored by the district and citizens at the conclusion of the summer season, or when buoys are moved. During years of low water levels, shoreline surveys are conducted.
- Veliger tows using plankton nets are conducted per CDFW mussel tow protocols. These water samples, and others (e.g., Lake Pillsbury - Pacific Gas & Electric administers) are sent to CDFW's Shellfish Health Lab in Bodega Bay for analysis using cross-polarized light microscopy.
- District water purveyor (Appendix A) monitor for mussel presence when maintenance is performed on inlet pipes, screens, and filters.

<sup>3</sup> <https://wrl.water.ca.gov/waterdata/library/Maps.aspx>

<sup>4</sup> <https://www.wildlife.ca.gov/Conservation/Invasives/Quagga-Mussels>

The specific details of each of these methods, the locations of surveys, and the results are documented in reports the district completes and sends to CDFW annually.<sup>5</sup> Water levels, COVID, staffing, and other factors can affect the level of survey sampling, locations, and intensity on an annual basis.

#### Potential Effects of Invasive Mussels on Clear Lake

There are many factors to consider when estimating the potential effects of invasive mussels on a water body. System-wide effects of quagga and zebra mussels depend on water mixing rates, lake morphology, and turnover rates (Karatayev et al. 2015). Potential effects to Clear Lake (Figure 1) include:

**A disrupted food chain that negatively affects fisheries and wildlife**—Quagga and zebra mussels (*Dreissena* spp.) are known as ecosystem engineers because they control the availability of resources to other organisms by the physical changes they cause in the environment (Jones et al. 1994) and have profound effects on lake and river ecosystem function and structure (Zhu et al. 2006). The ecological effects of these mussels are considered the most far-reaching relative to other aquatic invasive species (AIS), causing local extinction of many native mollusks (Strayer and Malcom 2007; Burlakova et al. 2014), changing the structure of food webs and fish assemblages, and contributing to the collapse of valuable sport fish populations (Kelly et al. 2010; Bossenbrook et al. 2009; Strayer 2009; Pimentel et al. 2005). Increased occurrences of harmful algal blooms (Higgins and Vander Zanden 2010) can contribute to declines in fish populations (Knoll et al. 2008). Once established, invasive mussels commonly reach densities of more than 10,000 individuals per square meter (Depew 2021).

System-wide effects of quagga and zebra mussels depend on water mixing rates, lake morphology, and turnover rates (Karatayev et al. 2015). Quagga mussels can be found in all regions of a lake, form larger populations, may filter larger volumes of water, and may have greater system-wide effects (especially in deep lakes) compared to zebra mussels, which are restricted to shallower portions of lakes (Karatayev et al. 2015). After initial invasion, invasive mussels will primarily have direct effects on ecological communities whereas post-invasion, less predictable impacts will likely be indirect effects that cause ecosystem changes (Karatayev et al. 2015). Proactive, pre-invasion management investments that emphasize the importance of prevention and early detection are much lower than reactive, post-invasion expenditure (Cuthbert et al. 2022).

Quagga and zebra mussels filter particles from the water, resulting in improved water clarity (Karatayev et al. 1997, 2002), and corresponding increases in benthification (Mills et al. 2003). Scientists refer to this as "turning ecosystems upside down" because of the transfer of energy to littoral areas with concurrent increases in benthic biomass (Mayer et al. 2014; Rumzic et al. 2021).

**Boats, engines, docks, and other infrastructure (e.g., water delivery supply lines) encrusted with invasive mussels**—Dreissenid mussels grow on a variety of infrastructure systems, including water intake pipes for drinking water, irrigation, power plants, locks, and dams and canal systems, impacting operation and maintenance costs (ISAC 2016). Continual attachment can increase corrosion rates of steel and concrete (USGS 2016), leaving equipment and infrastructure vulnerable to failure.

<sup>5</sup> <https://www.lakecounty.ca.gov/Archive.aspx?AMID=77>



Additionally, the mussels grow on navigational buoys, docks, and hulls of boats and ships—increasing drag, affecting steering, and clogging engine intakes—all of which can lead to overheating and engine malfunctions (ISAC 2016).

**Beaches and shoreline encrusted with sharp shells**—The shells from dead dreissenid mussels can wash ashore, smothering beaches and potentially injuring swimmers and other water recreationalists from cuts sustained from the shells' sharp edges (Nelson 2019).

**Boating restrictions to reduce spread of mussels**—Mandatory watercraft inspections prior to launch, closures of boat ramps, restrictions on shore launching, mandatory Mussel Fee Stickers, and closed water bodies are examples of boating restrictions that have been implemented as a result of dreissenid introductions. In 2008, zebra mussels were detected in the popular recreational area, the San Justo Reservoir in California. The reservoir, operated by the Bureau of Reclamation (BOR), was closed to any public use and has remained closed, "resulting in a dramatic, detrimental impact on the community, economy, and environment in San Benito County."<sup>8</sup> In 2022, BOR was asked by two Congressional representatives<sup>9</sup> to prioritize and expedite an initial project scoping process for the \$2.1 to 3.1 million<sup>10</sup> Zebra Mussel Eradication Project at the San Justo Reservoir, which has an eradication plan that includes two years of reservoir treatment with potassium chloride followed by three years of monitoring.



Figure 2. Likely changes from an invasive mussel invasion in Clear Lake.

<sup>8</sup> <https://pswrts.house.gov/media/press-releases/top-pawetta-health-letters-req-budget-request-environmental-process-2008-2009>  
<sup>9</sup> Rep. Jimmy Panetta (D-CA-30) and Rep. Zoe Lofgren (D-CA-19)  
<sup>10</sup> Estimated costs in 2018.

**Increased cost and maintenance for clogged, fouled, or contaminated water delivery infrastructure**—Clear Lake is a source of water for several water districts, which treat and provide municipal drinking water for thousands of people. In addition, many individual homeowners with individual water systems draw water from the lake.

Invasive mussels pose serious threats to hydropower infrastructure and operations (Rumzie et al. 2021). Invasive mussels can affect all facility components exposed to raw water; mussels can clog pipelines and water intakes and disrupt operations at hydroelectric power plants, municipal water supply facilities, and conveyance systems used in irrigation, resulting in water lines incapable of supplying a consistent and reliable source of water (Vissicelli 2018). Smell, bacteria, and decay are other key issues associated with a mussel infestation; management response is continual cleaning, treatment, mitigation filters, and other actions. A 2021 study of costs associated with invasive mussel impacts and management at 13 hydropower facilities in Canada and the United States (Rumzie et al. 2021) documented costs associated with established invasive mussels in both preventative control measures and increased maintenance.

- Preventative control capital costs (one-time costs) ranged from \$100,000 to \$200,000 per facility
- Preventative control annual costs ranged from \$4,000 to \$141,700 per facility
- Increased maintenance re-occurring costs ranged from \$22,000 to \$305,000 per facility
- Increased maintenance annual costs ranged from \$26,000 to \$112,000 per facility
- Annual monitoring costs ranged from \$1,970 to \$47,245 per facility
- Unplanned outages cost per occurrence ranged from \$44,000 to \$80,000 per facility
- Unplanned outages total cost was \$849,000

Examples of preventative and maintenance costs include treating with chlorine, cleaning generator coolers 3–4 times per year to remove mussel debris, and increased labor costs to maintain all hydropower equipment.

The cost to remove mussels and manage drinking water intakes at Hoover, Davis, and Parker Dams, three facilities with invasive mussel infestations on the Colorado River, was more than \$6,026,100 in 2016. Mussel-related costs at Hoover, Davis, and Parker Dams through 2016 totaled \$6,025,100, and expected costs from 2017 to 2026 totaled \$10,372,108 (Boyd 2016). The State of Washington estimated direct impacts to dams from invasive mussels is \$42.9 million (Community Attributes 2017). The cost for the management response is passed to the consumer (Vissicelli 2018).

**Fishing tournament restrictions**—The CDFW *Guidance for Developing a Dreissenid Mussel Prevention Program* (2020) acknowledges that fishing tournaments are a common human-mediated pathway of dreissenid mussel introduction. The document further states that "conditions on fishing tournaments" are a potential management action to prevent a dreissenid mussel introduction.

**Loss of revenue to Lake County communities**—To date there are no studies estimating the impact of invasive mussels on tourism (Nelson 2019). However, the State of Montana used a scenario-based approach for recreational fishing to estimate the economic damages – 2 percent, 5 percent, and 10 percent reductions in visitation because of dreissenid establishment. Tourism spending was assumed to be proportional to visitation. They documented a 2-10% range of percent reductions in visitation and the corresponding reduction in spending. If visitation is reduced by two percent, the most conservative scenario, the amount of money spent by nonresident visitors would decrease by \$17.8 million, a half of a percent reduction in total tourist spending in 2017. At the 10 percent reduction in visitation, tourism spending would decrease by \$89 million or 2.6 percent of total tourist spending in 2017. The 2 percent and 10 percent reductions in visitation were used for the lower and upper bound estimates, respectively. The State of Montana calculated estimated per day expenditures for resident anglers multiplied by the number of days of fishing, total angler expenditures for 2013 amounted to approximately \$193 million (Swanson 2016).

**Reduction in property values**—The effect of dreissenid mussels on property values has not been explicitly estimated, however, the economic impacts of invasive aquatic plants, algal blooms, and degraded water quality due to excess nutrients on home sale price have been well documented (Horsch and Lewis 2009, Zhang and Boyle 2010, Baron et al. 2016, Walsh et al. 2011; Bingham et al. 2015; Ara et al. 2006).

- Results from multiple studies in Minnesota, New Hampshire and Maine demonstrated a 1-meter decrease in water clarity decreased property values from 3.1 to 8.6 percent with a median value of 5.8 percent (Jakus et al. 2013).
- In an assessment of the economic impact of harmful algal blooms to property values on Lake Erie, Bingham et al. (2015) used a 10 percent reduction in value to shoreline properties.
- A study of Ohio lakes found harmful algal blooms with microcystin levels more than 1 µg/L reduced lakefront property values by 22 percent (Wolf and Klaiber 2017).
- In northern Wisconsin, lakefront property values decreased by 8 percent, on average, after invasion of Eurasian milfoil (Horsch and Lewis 2009).
- The presence of milfoil and native aquatic vegetation in Vermont lakes decreased property value ranging from 0.3 percent to 16.4 percent depending on the degree of total macrophyte (aquatic plant) coverage (Zhang and Boyle 2010).
- Montana State General Fund and county governments where affected properties are located estimated a decrease in property tax revenue from the lowered property values (Nelson 2019). Predicted losses in property tax revenue from decreases in lakefront property value ranged from \$2.2 to \$3.8 million per year.

## CHAPTER 3

### Rapid Response Strategy

#### Mechanisms of Response

In the event of a detection of dreissenid mussels, deliberate actions will be taken to determine the scope of the detection, and appropriate containment, control, and eradication responses. The LCWPD is engaged in active monitoring to detect dreissenid mussels through regular sampling efforts for veligers and adults. Additional entities are also engaged in monitoring infrastructure or water delivery systems for adult dreissenids.

Key response activities may occur simultaneously at various stages of response but may also be influenced by the nature of the detection. The rapid response process begins the moment there is a report of a dreissenid detection made.

#### Confirmation of Detection

**Purpose:** Determine if the report of detection is factual and confirm the species identification  
**Lead:** LCWPD in collaboration with CDFW

The nature of the initial dreissenid detection may be from routine monitoring by LCWPD, partner monitoring, public surveillance, or public reporting. Regardless of the nature of the initial detection, per Fish and Game Code Section 2301 "any entity that discovers dreissenid mussels within the state shall immediately report the discovery to the CDFW". The discovery should be reported to the [CDFW Region 2 Quagga/Zebra Mussel Scientist](#) (or CDFW wildlife officers if Region 2 Mussel Scientist is not available) and via the CDFW online Quagga Mussel Observation Report Form (Appendix X).<sup>11</sup> CDFW will work with the reporting entity to confirm the detection once the report is received.

It may be possible that a detection is made of an adult or veliger, which will prompt action but methods of confirmation and speed at which actions are taken will vary. Further, depending on the nature of that detection, the dynamics of the situation may be highly variable.

- A detection of one or more adult mussels can be confirmed visually by CDFW and/or LCWPD.
- A detection of one or more veliger mussels will be verified by the best available laboratory methodologies. The independent identification methods will include cross-polarized light microscopy (CPLM) and polymerase chain reaction (PCR). The sample may also be sequenced. Veliger samples conducted by CDFW, LCWPD and PG&E in the county ( ) are analyzed by CDFW Shellfish Health Lab in Bodega Bay, California.

<sup>11</sup> <https://wildlife.ca.gov/Conservation/Invasives/Quagga-Mussels/Observation-Report>

Classification of waterbody following confirmation detection is important for communicating among regional managers, collaborators, and the public. The classification will also help determine the level of decision-making by LCWPD and CDFW.

#### Waterbody Classifications<sup>17</sup>

Based on sampling results, waters are given certain classifications related to their dreissenid mussel status:

- A water body that has not been sampled for aquatic invasive species is classified as *Unknown/Not Tested*. A water body at which sampling is ongoing and nothing has been detected (or nothing has been detected within the time frames for de-listing) is classified as *Negative*.
- A water body classified as *Inconclusive* has not met the minimum criteria for detection but evidence of dreissenids has been documented. This is a temporary classification and additional sampling of this water will be conducted to determine whether the water body is classified as *Negative* (no detections in subsequent sample) or *Suspect* (verified detection in subsequent sample).
- A water body classified as *Suspect* indicates a water at which one sample has been verified by visual confirmation (visual identification of adult or microscopy identification of veliger) and this sample was confirmed as dreissenid by DNA analysis (PCR and gene sequencing). Additional sampling will be conducted to determine whether another sample taken within 12 months detects evidence of dreissenids. If a subsequent sample does detect dreissenids, this water will then be classified as *Positive*.
- A water body classified as *Positive* indicates a water at which two or more sampling events within a 12-month period meet the minimum criteria for detection. For example, samples from two different sampling events are verified by both visual identification (including microscopy) and DNA confirmation (PCR and gene sequencing). Lake County may consider hiring a dive team to inspect for physical mussel presence.
- In many cases, a water classified as *Positive* will become *Infested*, which is a water body with an established (recruiting and reproducing) population of dreissenid mussels. For example, lakes Mead and Powell are considered infested waters as they have large populations of reproducing dreissenids and mussels are readily evident on the shoreline and submerged materials such as docks and buoys.
- In some instances, the classification of a water body can be downgraded over time. The exact reasons why dreissenids are detected at a water once, then not again in subsequent sampling, or are detected in a water classified as *Positive* but never establish a population, remains unknown.

<sup>17</sup> Classifications were developed by the Western Regional Panel on Aquatic Nuisance Species, Building Consensus in the West Committee (WRP 2019).

- A water body initially classified as *Inconclusive* can be de-listed to *Negative* status after one year of negative testing results including at least one sample taken in the same month of subsequent year as the initial positive sample (to account for seasonal environment variability). The time frame for de-listing a water body extends from there with a water body initially classified as *Suspect* requiring three years of negative testing to re-classify to *Negative*, a *Positive* water body requiring five years of negative testing to re-classify to *Negative*, and an *Infested* water body requiring a successful eradication or extirpation event and a minimum of five years of negative testing results post-eradication event to re-classify to *Negative*.

#### Declaration of Emergency in Lake County

**Purpose:** Brings situation of dreissenid detection and response into a countywide scale of response.  
**Lead:** LCWPD with Office of Emergency Services

Per Ordinance 31, Lake County may declare a local state of emergency. The scope of a dreissenid situation will influence the level of response and the scale of that response. An emergency declaration helps to inform the level of concern of the situation to all in Lake County and may be vital for the mobilization of funding to conduct response actions.

#### Notification Communication

**Purpose:** Ensure that factual and timely information is communicated with appropriate entities, including regional water body managers.  
**Lead:** LCWPD

With the confirmation of detection and species identification complete, there will be multiple notifications made to allow area partners to respond in tandem to the developing situation. Communications are needed early in the response process.

1. CDFW requires immediate notification of a dreissenid detection. Once LCWPD provides notification to CDFW, a recognition of that notification will be made by CDFW to ensure that it has been received.
2. Once the detection and species identification has been confirmed, detailed information will be provided to USGS Non-Indigenous Aquatic Species Database by CDFW. This information sharing allows for a broad distribution of information via the USGS national alert system.

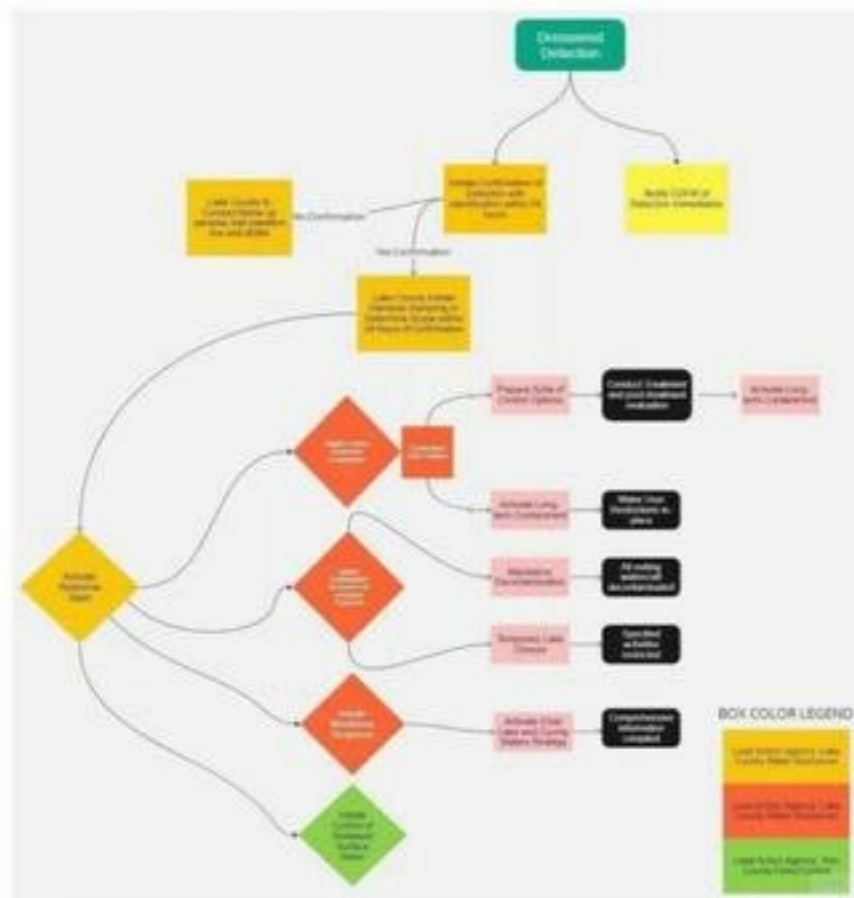


Figure 3. Dreissenid management response decision matrix.

### Delineate Scope of Response

**Purpose:** Determine the scope of the dreissenid detection to inform management response.  
**Lead:** LCWPD

Following the confirmation of detection, multiple strategies will be deployed to further delineate the scope of the infestation. To understand and characterize the nature of the detected population (e.g., if there are multiple age classes, multiple locations, or isolated populations), deliberate searches using canine shoreline teams, volunteer shoreline teams, eDNA samples, local lake water rights users (checks water filters), and dive teams may be deployed simultaneously. A coordinated strategy will capture all search information into digital visualization to better understand the management scope and subsequent management actions.

### Activate Incident Command System and Response Team

**Purpose:** Engage in process to adequately address scale of management situation.  
**Lead:** LCWPD

If it has been determined that there is potential to implement control options based on the scope and scale of the infestation, containment options and monitoring options must be initiated, then the incident command system (ICS) will be activated (Figure 3). The ICS brings structure and organization to a complex management situation. Moreover, if the incident has important legal, political, and public ramifications, then ICS will be needed to support the management of the situation. See Appendix A – ISC Assignment Structure. California Water Resources Department is the lead action agency.

The scope of the dreissenid infestation will influence the number of individuals needed for response. A veliger detection followed by unconfirmed results can be handled by several Lake County staff, however, a veliger detection that leads to an adult detection/established population likely will require staff from multiple agencies in addition to a cadre of volunteers.

Following the structure found within Appendix A, the Operations of the incident will take multiple pathways to formulate and explore control, containment, and monitoring options. Control options may include small- or large-scale chemical application (in combination with mechanical methods such as curtains) to attempt to eradicate or minimize a population of dreissenids.

### Containment

Containment options may include a suite of strategies to address watercraft, infrastructure, water delivery systems, and other human activities. Containment options will be weighed by a response team and will be determined based on the specific details of the detection and scope.

Monitoring options may include a strategy to understand dreissenid distribution within Clear Lake and relevant neighboring waterbodies. Monitoring options will be weighed by a response team and will be determined based on specific details of the detection and scope. Each category of management options must identify staff and resource needs, budget requirements, feasibility of success, and results of taking a no-action approach.

#### Activation of Communication

Communication Hub 1	Communication Hub 2	Communication Hub 3
<b>Type of information shared:</b> Initial confirmed detection Milestones	<b>Type of information shared:</b> Waterbody status Management actions	<b>Type of information shared:</b> Prevention requirements Closures Decontamination requirements and location
<b>Method of Communication:</b> Phone Briefing documents	<b>Method of Communication:</b> Online meetings Email briefings	<b>Method of Communication:</b> Social media, website, press releases
<b>Frequency:</b> Upon confirmed detection Weekly progress updates As needed with key decision points	<b>Frequency:</b> Weekly	<b>Frequency:</b> As new requirements are required
<b>Primary Entities:</b> Governor staff County officials State legislators	<b>Primary Entities:</b> Surrounding county managers Surrounding state AIS managers	<b>Primary Entities:</b> Local businesses Boaters Recreationists Homeowners Area residents

Figure 4. Three types of communication hubs, including the type of information shared, method of communication, frequency, and entities involved.

Upon assembling the ICS team, a communication strategy will be needed to provide information to key regional partners, collaborators, lake users, and the public (Table 3). Weekly public information sharing (e.g., meetings, webinars, or conference calls) and a web page will be created by the county. Press releases, social media, and other unique information products will be delivered to user groups. Clear communication among internal and external entities will ensure affected parties understand activities and roles of everyone involved.

#### Response Actions

An exploration of a variety of responses will help determine the transition to successful long-term containment and management. As a response progresses, existing prevention management actions will proceed in the protection of Clear Lake from all AIS, however, with modifications. Considerations that may inform response actions include:

- Anticipated costs of eradication effort and subsequent monitoring, coupled with available funding.
- Available resources (personnel, equipment, etc.) for all aspects of response (e.g., signage, barrier curtains, chemicals, grants to partners, increased monitoring, additional oversight of watercraft monitoring).
- Regional and local distribution of dreissenids.
  - single vs. multiple, continuous vs. patchy, isolated vs. widespread.
  - upstream vs. downstream, edge vs. interior, etc.
- Dreissenid age class structure or life stages present of infestation, if known.
- Pathways/source (if known) – identified, controlled, eliminated, etc.
- Species track record of eradication/control attempts.
- Ability to obtain required permits and permissions (e.g., Emergency ESA Consultation) in an expedited time frame.
- Survey and assessment confidence
- Affected native fish and wildlife habitats.
- Time of year in relation to reproduction, migration, etc.
- Amount of water in the system to be treated. Consider the following:
  - Potential for drawdown or flows reduced before treatment.
  - Flow sources, including springs, and the potential to regulate that flow.
- Land use patterns.
- Presence of state or federally listed rare, threatened, or endangered species.
- Presence of critical or significant habitats.
- Regulatory hurdles associated with control actions (e.g., use of chemicals).

#### Prevention Response Actions

**Purpose:** Address active prevention program needs and adjustments as response is implemented.

**Lead:** LCWPD

As Control and Monitoring response teams are examining options, actions that address the current program may be implemented in recognition of modifications or adjustments that may be needed to conform to new needs to manage waterbody users and water usage users. Considerations of the following areas of prevention will include:

- Directions and actions for local Lake County Mussel Sticker Program
- Alteration/amendments to Ordinance 15 of Lake County Code

### Control Response Options

**Purpose:** Determine the possible eradication or control options and their feasibility to minimize spread.

**Lead:** LCWPD

Implementation of any chemical response will require a full analysis of potential ecological, economic, cultural impacts to Clear Lake. An evaluation of all the possible actions or no-action will be needed to determine the best actions necessary.

Any control response using curtains/barriers (e.g., a response action in a marina would involve temporarily installing vertical curtains/barriers from the surface of the water to the sediment to create an enclosed area for chemical treatment) and chemicals will require a suite of permits (Appendix E) or compliance needs. If threatened or endangered species, or their critical habitats, exist within the geographic scope of the project, an Endangered Species Act consultation process will be triggered (see [Fish and Wildlife Service Section 7 Consultation](#) section).<sup>13</sup> There is a limited number of chemicals that currently exist for controlling dreissenid mussels, including potassium chloride (KCl or potash) and Earth TechQZ. Methods to contain chemical control applications with the use of a temporary physical barrier or boom will be required. Other considerations, including safety, best management practices, and tradeoffs associated with taking no action should be considered.

### Containment Response Options

**Purpose:** Determine containment response options and their feasibility to minimize spread.

**Lead:** LCWPD

Regardless of the scope of the dreissenid population, there will be a need to contain the mussels within Clear Lake to prevent further spread. Immediate containment will be implemented while Control Response Options are explored. See section on Containment for further details. Immediate containment response may require:

- Temporary closure of the lake to all motorized, non-motorized activity, including the installation of temporary signage and barriers. This could be achieved through Ordinance 31, Declaring a State of Emergency, in which the Sheriff of Lake County, or their designee, can issue Closure Orders for water bodies.
- Mandatory decontamination of all watercraft exiting Clear Lake (note: It has been recommended that Lake County modify its ordinance to mandate mandatory decontamination of watercraft exiting Clear Lake upon infestation by dreissenids).
- A moratorium of all current and future fishing tournaments permitted within Clear Lake.

LCWPD would make the determination if Clear Lake will be closed to use and will take the necessary steps. However, the purpose of this plan is to ensure steps are taken in advance of a dreissenid introduction to avoid the need for lake access closure.

<sup>13</sup> <http://www.caldwell.com/introduction>

### Monitoring Response Options

**Purpose:** Address active prevention program needs and adjustments as response is implemented.

**Lead:** LCWPD

Additional monitoring of the waterbody and nearby waters will be important for understanding the scope and scale of the infestation. Expanded monitoring efforts will also be needed during implementation of control options. These include, but are not limited to, monitoring within the following systems:

- Municipal water intakes
- Private water intakes
- Thurston Lake<sup>14</sup>, Hidden Valley Lake, Indian Valley Reservoir, Lake Pillsbury, Lake Mendocino, Highland Spring Reservoir, Blue Lakes
- Cache Creek dam infrastructure
- High priority water delivery systems within the watershed

### Termination of ICS Response

Understanding when an ICS led response is complete will be determined by a variety of factors, but will be at the discretion of the lead action agency. However, there are valuable indicators that may help determine that the incident has shifted to a long-term management situation, rather than a response situation. In general, when all the actions for monitoring, containment, and control have been exhausted, a response team is terminated. Factors that may indicate there is no longer a need to operate ICS for the incident include:

- A shift to long-term monitoring strategies to understand dreissenid population dynamics has been initiated (e.g., all municipal water users are actively participating in strategic sampling in cooperation with Lake County).
- A shift to long-term containment has been initiated.<sup>15</sup> Note: Lake County mobile watercraft decontamination stations (three) are operational and staffed in designated areas with drains to water treatment systems. Permanent decontamination stations are being considered.
- Control efforts have been conducted and post-monitoring efforts to understand the success/failure of control have been completed.
- The frequency of communication about the project to local collaborators becomes minimal. Communication about the status of the infestation will continue in perpetuity as part of ongoing containment efforts, however, the frequency of communications lessens.
- Emergency resources (e.g., signage, mobile watercraft decontamination stations) are dismantled/reassigned/returned.

<sup>14</sup> Thurston Lake is a private lake and would require discussions with landowners to expand monitoring efforts.

<sup>15</sup> Lake County mobile watercraft decontamination stations (3) are operational and staffed in designated areas with drains to water treatment systems.

A report post-response will be completed to help identify all aspects of the response and inform improvement of capabilities, capacity, and training. Documentation of the response will be a critical aspect to assist in improving response strategies for other natural resource emergency situations and may also be useful for surrounding jurisdictions to successfully respond to different dreissenid situations.

### Transition to Containment

Adequate financial and staff resources are needed to effectively plan for, implement, and evaluate dreissenid response and containment strategies. The Columbia River Basin website (<https://www.westernmns.org>) lists examples of dreissenid eradication projects and their costs<sup>15</sup>, however, cost and effectiveness will vary greatly depending on the water body and the scope and extent of the infestation.

Immediately after verification, short-term containment actions should be implemented. If dreissenids cannot be eradicated using chemical, biological, or mechanical methods, containment strategies must be implemented long-term to contain dreissenids to the source water body.

The following timeline illustrates verification of identification, accompanying tasks, and water body status following preliminary detection of dreissenid mussels (Figure 6). In this illustration, the assumption is that veligers were detected.

### Outreach Materials to Inform Public of Transition Strategy

To prepare LCWPD staff for an introduction of invasive mussels, this plan includes draft templates of outreach materials. The materials, which include an 8.5 x 11 flier, door hanger, and social media post, have been produced to allow district staff to modify and update the templates as needed. Appendix F includes a draft press release.



Figure 5. Outreach materials to share information about a detection of dreissenids in Clear Lake include a social media post, flier, and door hanger.

<sup>15</sup> <https://www.westernmns.org/rapid-response>

## CHAPTER 4

### Legal Authorities and Statutes

#### Current Statutes

The primary agency responsible for managing the dreissenid mussel prevention program in Lake County is the Lake County Watershed Protection District (LCWPD). The LCWPD, a management structure endowed with specific authorities by the U.S. Congress and the California State Legislature, is administered by the Director of Water Resources who reports to the County Board of Supervisors, which acts as its Board of Directors. The LCWPD plans, manages, maintains, implements, and evaluates all aquatic invasive species programs, such as the Aquatic Plant Management Program and the Q/Z Mussel Prevention Program. The LCWPD relies on several partners for program implementation, including Pacific Gas and Electric (conducts dreissenid veliger tows in Lake Pillsbury), citizen scientists (perform substrate monitoring in Blue Lakes, Lake Pillsbury, and Hidden Valley Lake), California Department of Fish and Wildlife North Central Region (conducting veliger tows, visual surface surveys, water quality, and calcium sampling at Clear Lake, Blue Lakes, and Indian Valley Reservoir), and the California State Parks Division of Boating and Waterways (provides grant funds to support the County's boat ramp monitor network for Clear Lake, inspection training and equipment, and all essential educational materials). The County of Lake accepted responsibility for the protection of Clear Lake's basin from the State Lands Commission in 1973; this transfer of responsibility resulted in lakebed management and shoreline protection ordinances in Lake County's Municipal Code. In 2009, Lake County's Department of Water Resources (DWR) separated from the Department of Public Works, and responsibility for the Watershed Protection District management was transferred to DWR.

California delegates the responsibility for preventing and managing dreissenid mussel infestations to local water body managers (Fish and Game Code Title 14). Local codes and ordinances are therefore critically important in establishing local authorities to establish prevention programs. Relevant regulations and their associated hyperlinks are included in Appendix C. In March 2008, the Lake County Board of Supervisors passed an emergency ordinance establishing an inspection program for all water vessels launched in Lake County. This program, in its emergency form, introduced a mussel sticker program based on the honor system. Eventually the emergency ordinance was replaced by Ordinances 2915 (2009), 2936 (2011), and 2976 (2012) that established a fee-based inspection program for all water vessels launched in the County of Lake. The mussel ordinance is also located in [Lake County Code Article IX of Chapter 15 \(Appendix X\)](#). The physical prevention program is a three-tiered system based on the risk level (tier 1 - screening, tier 2 - inspection, tier 3 - decontamination) of the vessel for transporting invasive mussels to Lake County.

#### Jurisdictional Roles and Responsibilities

Per Fish and Game Code Section 2301, in the event of a dreissenid introduction in Clear Lake, the lead entity in the implementation of the rapid response containment and transition plan and the development of a Control Plan is "a public or private agency that operates a water supply system).

**California Fish and Game Code Sections 2301 and 2302** include the following key components:

#### **Fish and Game Code, Section 2301**

- Makes it illegal to possess, import, ship, or transport in the state, or place, plant, or cause to be placed or planted in any water within the state, dreissenid mussels.
- Gives the CDFW Director, or his/her designee, the authority to conduct watercraft inspections and stop conveyances, mandate decontaminations, and impound or quarantine conveyances. This section also provides authority to conduct watercraft inspections within waters that contain dreissenids, to close or restrict access to affected waters or facilities, and to inspect, quarantine, or disinfect conveyances removed from, or introduced to affected waters.
- A public or private agency that operates a water supply system shall cooperate with the department to implement measures to avoid infestation by dreissenid mussels and to control or eradicate any infestation that may occur in a water supply system. If dreissenid mussels are detected, the operator of the water supply system, in cooperation with the department, shall prepare and implement a plan to control or eradicate dreissenid mussels within the system.
- Any entity that discovers dreissenid mussels within this state shall immediately report the discovery to the department.
- Provides penalties for entities that violate this section.

#### **Fish and Game Code, Section 2302**

- Any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir where recreational, boating, or fishing activities are permitted must assess the vulnerability of the reservoir for the introduction of dreissenid mussels and develop and implement public education, monitoring, and management of recreational, boating or fishing activities designed to prevent the introduction of dreissenids. The entity must also visually monitor for the presence of mussels.
- Provides penalties for entities that violate this section.

**California Code of Regulations, Title 14 Section 672** relates to the possession, importation, and transportation of dreissenid mussels. Key elements include:

- Dreissenid Mussel Permits authorize entities to possess, import, ship, or transport dead dreissenids for the purposes of outreach, education, species verification, training, or other purposes deemed by CDFW.
- Provisions are included relative to denial and revocation of permits as well as requests for reconsideration.



California Code of Regulations, Title 14 Section 672.1 relates to dreissenid control and prevention. Key elements include:

- **Control Plan** - Within 60 days of CDFW requesting, or within 60 days of dreissenids being detected, public or private agencies that operate water supply systems must immediately develop a dreissenid mussel control plan and implement measures to prevent further spread. The plans must include a description of the status of the dreissenid population at the time of plan development, control activities, and monitoring to determine dreissenid population changes. The plan may also include maintenance activities to maintain functionality of the water supply facility. Annual reports are submitted by March 31 of each year, including information on changes in dreissenid populations, control activities implemented, and monitoring results. This section provides penalties for violations of the section.
- **Prevention Program** - Entities that own or manage a reservoir where recreational, boating, or fishing activities are permitting must implement a dreissenid mussel prevention program that includes a vulnerability assessment for dreissenids, a monitoring program, and management of recreational activities that prevent the introduction of mussels, and to keep them from being moved from the waterbody. Annual prevention program reports are due by March 31. This section provides penalties for violation of the section.
- **Inspection of Conveyances** - Makes it unlawful for anyone to refuse to comply with or interfere with a CDFW employee or their designee re: impounding or quarantining a conveyance suspected to contain dreissenids, and makes it unlawful to tamper with a method used to identify a conveyance as quarantined. This section provides penalties for violation of the section.

California Code of Regulations, Title 14 Section 672.2 related to dreissenid mussel penalty and appeal procedures.

#### Recommended Amendments to Ordinances in Chapters 15 and 23 and other Code Ordinances

The National Sea Grant Law Center reviewed existing ordinances and proposed Lake County consider the following to strengthen dreissenid prevention and containment efforts:

- Add a definition for "pollutant" and explicitly include a reference to aquatic invasive species (AIS). Aquatic invasive species are pollutants under the federal Clean Water Act; thus the reference is probably not necessary from a legal standpoint.
- Add a definition of "significant impact" that includes the decision threshold. "Significant impact" is the term used in the "catch-all" permit procedure in Sec. 23-4.
- Consider mentioning AIS in Section 6.4(B) Construction (page 11) - e.g., materials used in construction should be free from AIS, materials should be decontaminated before moving to another site, etc.
- Ordinance sections that have the potential to include language associated with containment:
  - Sec. 6.8(D) for relocation of floating structures (page 14). Incorporate language that requires inspection and decontamination before relocation.
  - Sec. 23-8 for Marinas and Harbors (page 15) - The county could encourage/require marinas to offer decontamination facilities or require inspections before boats leave marinas, etc.
  - Section 23.13.4 Removal of improvements (page 20) - The county could require inspection/decontamination upon removal of an improvement if the structure is being moved to another location; or, the county could require proper disposal.
  - Section 12.4 - Littering and pollution (page 18) - Add a provision regarding AIS to reinforce that AIS are pollutants and introduction is prohibited.
  - Section 12.6 for discharge - Explicitly reference AIS and potentially require use of best management practices.
- As a condition of the shoreline encroachment permit, the county could require an annual inspection/monitoring and reporting of results, and then identify actions that needed to be taken if mussels are detected.
- In addition, and outside the scope of the shoreline ordinance, but potentially associated with other statutes, the county could impose an annual inspection of structures as part of routine county inspections; these inspections could incorporate both safety issues as well as AIS.
- The county could state in its ordinances that it is unlawful to launch a boat from any place other than a ramp, private dock, pier, designated beach. This would allow the county to cite or fine people who are launching their boats from any shoreline location and help to ensure that watercraft are inspected prior to launch. There are examples of counties that define "boat launch facilities" as being "a boat ramp, dock, pier or other facility designated by the

department for launching boats into the water" (e.g., Island County, Washington, Chapter 9.40). This Washington county states that "It is unlawful for any person to launch or recover a boat in any Island County park except in areas specifically designated and/or marked for that purpose; provided, that this provision does not apply in case of an emergency (9.40.165)." Tempe, Arizona mandates that "all public watercraft must be launched at a designated boat launch facility."

## CHAPTER 5

### Transition to Containment

#### Initial Actions

The following actions should be implemented upon verification of dreissenids:<sup>17</sup>

- **Per Section 2301**, any entity that discovers dreissenid mussels within this state shall immediately report the discovery to CDFW.
- **Per Section 2301**, public or private agencies that operate a water supply system shall cooperate with CDFW to implement measures to avoid infestation by dreissenid mussels and to control or eradicate any infestation that may occur in a water supply system. The operator of the water supply system, in cooperation with CDFW, shall prepare and implement a plan to control or eradicate dreissenid mussels within the system. In the case of Clear Lake, the County of Lake Water Resources Department has jurisdictional authority to manage Clear Lake per State Land Commission Chapter 639 (1973), including to act on behalf of the State Lands Commission to manage the water ways and water supply to protect the assets described in 639.
- Work with CDFW to evaluate the need to quarantine Clear Lake as needed to prevent spread by watercraft. If the determination is made that the lake should be quarantined, close boat ramps and access points, and conduct public outreach to notify visitors and residents.
- If infrastructure is in place to inspect and decontaminate all watercraft exiting Clear Lake, implement mandatory watercraft inspection and decontamination program. Mandatory exit inspections and decontamination would occur at designated locations around the perimeter of Clear Lake by staff trained in Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination procedures. All vessels inspected or decontaminated will be identified with paperwork and a seal.
- Identify dispersal vectors (including movement by humans, fish and wildlife, water traffic, water flow, and other processes). Assume measures are needed to prevent the release of veligers as well as movement of adult mussels.
- Assess the likely movement of boats and other watercraft that recently used the mussel detected water body to identify inspection needs in other water bodies.
- Develop and implement Hazard Analysis and Critical Control Point (HACCP) plans to ensure that personnel do not further spread the original introduction (see sidebar).
- Quarantine operations (e.g., hatcheries, aquaculture) that are likely to spread the species outside the affected watershed(s).
- Consider and implement any needed prevention of overland or aerial transport to other water bodies.
- Working in partnership with water purveyors, stop or slow water release to potentially uninfested sites.

<sup>17</sup> Modified from State of Missouri (2018).

- Consider special management measures for operations of locks and commercial vessel traffic, if appropriate.
- Stop all sanctioned water related events on the waterbody until appropriate containment protocols can be established.
- Watercraft inspection and decontamination stations
  - Establish inspection and decontamination requirements on boats and equipment (following Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination (UMPS) and CDFW Aquatic Invasive Species Decontamination Protocol)<sup>18</sup>, and provide for associated logistical support (e.g., decontamination units).
  - Initiate a post haul-out inspection of boats and equipment.
  - Ensure decontamination units are available at key points exiting the waterbody.
- Implement mandatory inspection and decontamination of boats upon entry and exit of waterbody.

#### Dreissenid Mitigation by Water Purveyors

Dreissenids can colonize any surface where flows are less than 6.5 feet/second (O'Neill 1993). Costs associated with the management and control of dreissenid mussels varies with the extent of the mussel infestation in the source water and associated water treatment facility(ies), the complexity and size of the water treatment plant, the treatment goals, and other factors (Chakraborti et al. 2022). Maintaining pipelines and intakes adds to capital and annual operations and maintenance costs for a drinking water treatment facility (Chakraborti et al. 2022).

Most facilities apply chlorine or KMnO4 to protect water intake structures, conveyance pipes, and pumps whereas less common control methods included the use of chloramines and copper ion treatment (Chakraborti et al. 2022). A total of 10 case studies of drinking water facilities addressing ongoing mussel infestations demonstrated operations and maintenance (O&M)-based unit costs of mussel control varied from \$34.32/mil gal for 1-mgd capacity to \$12.63/mil gal for 2,640-mgd capacity, capital cost and O&M-based equivalent annual unit cost for treatment varied from \$78.56/mil gal for 1-mgd capacity to \$13.41/mil gal for 2,640-mgd capacity, and costs for larger water treatment plants (i.e., >10 mgd) varied between \$1.00/mil gal and \$13.00/mil gal (Chakraborti et al. 2022). The Coachella Valley Water District, an irrigation supplier in Southern California, assesses a quagga mussel mitigation surcharge of \$3.18–4.31 per acre-foot (2022 rates<sup>19</sup>), which pays for monitoring and to prevent dreissenid colonization in the Coachella Canal infrastructure (Nelson 2019).

#### Dreissenid Mitigation by Self-supply Drinking Water Systems

Self-supplied water users that extract their water from Clear Lake are not required to report, therefore, there is no estimate of self-supply domestic users, or the amount of water they withdraw. Private residence water intake systems include an onshore component (pump and distribution pipes

to residence) and an offshore component (the pipe from its intake in the lake to the onshore pump) (O'Neill 1993). Two strategies can address mussels in these systems: whole residence in-line filters that remove mussel veligers, and in-line chlorine injection systems, which kills mussel veligers, juveniles, and adults drawn into the system, which also address taste and odor issues caused by mussels (O'Neill 1993). Costs per Mg of water withdrawn were \$1,345 for in-line filters and \$7,348 for chlorine injection systems (O'Neill 1993).

#### Potential Solutions to Mitigate, or Eradicate, Invasive Mussels from Clear Lake

The Columbia River Basin Dreissenid Incident Response Toolkit website (<http://www.crbdir.com>) documents commonly used control methods to eradicate dreissenids. The website notes that a suite of physical, biological, and chemical options exists for controlling invasive mussels (<http://www.crbdir.com/control-methods>). Some methods are appropriate solely for hydropower facilities and water delivery systems, in which fish and other aquatic species are not present and the water can be treated before being released into a sewage system. Other methods, which may have reduced toxicity to fish and living organisms, are more appropriate for open water situations. Although the website outlines potential control options, many treatments may not be appropriate, or feasible, for response in open-water systems because of their toxicity to other aquatic species, including fishes, native bivalves, shellfish, and aquatic invertebrates.

Dahlberg et al. (2023) documented lessons learned from a retrospective analysis of 33 open water dreissenid mussel control projects in 23 North America lakes. Open water treatments have included:

- Physical methods, such as manual removal by divers, creating anoxia with benthic mats, and desiccation from waterbody drawdowns (Wimbush et al. 2009, Hargrove and Jensen 2012, Leuven et al. 2014).
- Biological methods, such as the use of fish, crayfish, parasites, and microbes intended to reduce mussel populations by predation or infection (Molloy 1998, Kirk et al. 2001, Reynolds and Donohoe 2001). Zequanox®, a U.S. Environmental Protection Agency registered molluscicide for dreissenid control, is included in this category.
- Chemical methods, including copper-based pesticides (e.g., Natrix™ and EarthTec QZ® are copper-based products registered by the U.S. Environmental Protection Agency for dreissenid control); potassium chloride (KCl), which is not registered by the U.S. Environmental Protection Agency as a molluscicide, but has been used in open water to control zebra mussels through the use of a Section 24e Local Needs exemption and Section 18 Emergency Exemption. DeBruyckere (2019) documents scientific studies on the potential effects of dreissenid chemical treatments on listed species and critical habitats.

The potential methodology Clear Lake water managers would use to mitigate, or eradicate invasive mussels would depend on the extent of the infestation, whether or not adults were detected, the chemicals registered for use as a molluscicide by the U.S. Environmental Protection Agency, and numerous other factors, not the least of which is the Clear Lake Hitch and any potential effects on this species and its habitats. The website, [www.crbdir.com](http://www.crbdir.com), documents the potential steps

<sup>18</sup> Lake County will modify operations as standards protocols are updated (if needed).

<sup>19</sup> <http://www.cvwsl.org/documents/items/view/5381>

associated with a dreissenid response. Although the website is focused on the Columbia River Basin states, similar steps would occur for any jurisdiction, and include the steps described in this report (e.g., Initial Detections and Notifications, Verification, Activate Incident Management System, etc.).

#### **Transition Goal**

Upon an introduction of dreissenid mussels to Clear Lake, the initial goal is to avoid the risk of spreading mussels to other water bodies while follow-up sampling determines the extent of infestation. During this estimated six-week period, all watercraft leaving Clear Lake would be inspected and decontaminated at four inspection stations located around the perimeter of Clear Lake. Ideally, these would be permanent watercraft inspection and decontamination stations already established prior to an introduction of dreissenids. However, if these are not established stations, check stations would be created at four optimal locations to intercept all watercraft leaving Clear Lake. Nightly boat ramp and shore launching closes would be implemented to ensure all watercraft are inspected.

The results of sampling efforts post-detection will determine if Clear Lake remains Suspect, or is elevated to Positive, or Infested, status. Regardless, longer-term response would require administration and oversight of check stations to inspect and decontaminate all watercraft leaving Clear Lake. Implementation of a Local Boater Program, which identifies watercraft that recreate only in Clear Lake, would reduce staffing, equipment, and maintenance costs.

Most costs to operate the check stations includes initial capital costs for equipment and staff costs associated with training staff and operating check stations.

#### **Short-Term Suspect Status**

If Clear Lake is confirmed positive for dreissenid mussels, the lake will be considered *Short-term Suspect*. After the initial detection, follow-up sampling will occur, and results will take about six weeks to be reported. During that time, it will be necessary to minimize the risk of spreading mussels to other waters. Within one week, available resources will be necessary to perform required *Clean, Drain, Dry* exit inspections of all boats leaving the lake and decontamination of undrainable areas, such as ballast tanks. All watercraft leaving Clear Lake will receive a seal and seal receipt to verify the watercraft received an exit inspection. Quick action will be needed to mobilize the necessary personnel and resources to effectively meet these obligations.

At Short-term Suspect Status, existing resources must be used to inspect, decontaminate, and seal boats, however, all financial support from the State of California ceases immediately upon detection, therefore it is imperative Clear Lake take steps now to create an emergency fund that can be used upon an initial detection. Immediately after initial detection, job announcements and requisitions should be prepared so personnel can be hired, and additional equipment can be purchased as quickly as possible once follow-up results are available.

#### **Closures**

Temporary, full closure of Clear Lake boat ramps and long-term closure of individual boat ramps to concentrate boating traffic are not recommended during the Short-term Suspect Status period. However, closure of shore launching is recommended during Short-term Suspect Status because vehicles accessing these areas do not encounter a check station. Night closure of boat ramps is recommended at this status level to ensure every vessel leaving Clear Lake receives an exit inspection. Boat ramps should be closed with a gate, or cable, and sign indicating the purpose and estimated duration of the closure. Hours when Clear Lake boat ramps are open will be ½ hour before sunrise to ½ hour after sunset. If a boat has not exited the water by ½ hour after sunset, it will remain in the water until the next day.

Temporary full closure of Clear Lake boat ramps is recommended if the lake is immediately classified from Short-term Suspect Status to Infested Status.

#### **Staffing Plan**

Check stations will need to be staffed by a minimum of two inspectors per station per day. Staffing levels will depend on the time of year and anticipated boating traffic but could require 3–14 individuals per week based on a 40-hour work week (Long-term Suspect Staffing Plan).

#### **Supplies and Equipment**

If Lake County does not have four established permanent watercraft inspection and decontamination stations upon detection of dreissenids, existing trailered and other decontamination units within the county can be used. Camper trailers may need to be secured to accommodate personnel during Short-term Suspect Status.

Dynamic messaging signs (DMS) will be rented (one sign for each check station) to direct boaters to the exit inspection locations. Additional signage will explain boat ramp nightly closures, shore launch closures, and mandatory exit inspections.

#### **Rapid Response – Long-Term Suspect Status**

If initial follow-up sampling does not yield a positive result, Clear Lake would enter Long-term Suspect Status and remain at this level for up to three years if no additional positive samples are found. The goal during the Long-term Suspect Status period is to minimize the risk of spreading mussels to other waters. During the first year (from initial detection through the following boating season), capacity must exist for all non-local boaters existing Clear Lake to efficiently obtain a required clean, drain, dry inspection, motor flush, and decontamination of ballast tanks and other undrainable areas. All watercraft leaving Clear Lake will receive a red seal and seal receipt to verify the watercraft received an exit inspection. Red seals will be designated for use on a suspect, positive, or infested water.

If there is no confirmation of dreissenid mussel presence after the first full boating season, efforts will switch to a lower-level response, with a goal of contacting a significant number of boaters leaving the water, but shifting the onus of received a required inspection to the boater. Inspectors will still conduct clean, drain, dry exit inspections on boats leaving the water and

closure. Clear Lake boat ramps will be open will be 1/2 hour before sunrise to 1/2 hour after sunset. If a boat has not exited the water by 1/2 hour after sunset, it will remain in the water until the next day.

#### **Rapid Response – Infested Status**

Clear Lake will be considered Infested if an established (recruiting and reproducing) population of adult dreissenid mussels is found. The goal during Infested Status is to minimize the risk of spreading mussels to other waters by ensuring all boaters exiting the water have inspections and undergo full decontamination. All watercraft leaving Clear Lake will receive a red seal and seal receipt to verify the watercraft received an exit inspection. Boat ramp hours will undergo hour restrictions to ensure that decontaminations do not occur during darkness (e.g., ramps close 2 hours prior to sunset). Lake County staff should consider an alternative method for identifying boats that cannot be decontaminated because check stations are understaffed.

#### **Estimated Costs Table to be Completed)**

Supplies (signs, additional decon unit rental, water tanks, etc.)

Personnel

Vehicles

Travel

Camp trailers

decontaminate ballast tanks and other undrainable areas. If feasible, they will continue to flush all motors. If not, they will drain outboard motors and only flush inboard/outboard and inboard motors. Public outreach will increase via multiple outlets to highlight the potential threat at the suspect water.

**Closures**

Except for shore launching, no closures of individual boat ramps are recommended during year 1 of a Long-term Suspect Status period. During years 2 and 3 of Long-term Suspect Status, shore launching may be allowed in some areas. Shore launching prohibited signs will be changed to communicate that an exit inspection is required.

Night closure of boat ramps is also recommended during year 1 of a Long-term Suspect Status to ensure that every vessel leaving Clear Lake receives an exit inspection. Hours when Clear Lake boat ramps are open will be 1/2 hour before sunrise to 1/2 hour after sunset. If a boat has not exited the water by 1/2 hour after sunset, it will remain in the water until the next day.

**Check Stations**

During years 1 through 3 of Long-term Suspect Status, the number and location of the four exit inspection stations will remain the same as for Short-term Suspect Status. Check station hours of operation will coincide with boat ramp hours (1/2 hour before sunrise until 1/2 hour after sunset).

**Local Boater Program**

A local boater program would minimize staffing levels and reduce wear and tear on equipment (fewer decontaminations). A local boater program should be implemented during year 1 of Long-term Suspect Status.

**Rapid Response – Positive Status**

Clear Lake will be considered positive for dreissenid mussels if two or more sampling events within a 12-month period meet the minimum criteria for detection (defined above). The goal during the Positive Status period is to minimize the risk of spreading mussels to other waters by providing capacity for all boaters coming off the water to efficiently obtain a required clean, drain, dry inspection, motor flush, and decontamination of ballast tanks and other undrainable areas. If live mussels are found on any boats during exit inspections, they will be fully decontaminated, and consideration will be given to upgrading Clear Lake to Infested. All watercraft leaving Clear Lake will receive a red seal and seal receipt to verify the watercraft received an exit inspection. All four permanent watercraft inspection stations will remain open from 1/2 hour before sunrise to 1/2 hour after sunset.

**Closures**

All shore launching is prohibited during Positive Status. Night closure of boat ramps is also recommended during Positive Status to ensure that every vessel leaving Clear Lake receives an exit inspection. Boat ramps will be closed with a gate, or cable, and sign indicating the reason for

closure. Clear Lake boat ramps will be open will be 1/2 hour before sunrise to 1/2 hour after sunset. If a boat has not exited the water by 1/2 hour after sunset, it will remain in the water until the next day.

**Rapid Response – Infested Status**

Clear Lake will be considered Infested if an established (recruiting and reproducing) population of adult dreissenid mussels is found. The goal during Infested Status is to minimize the risk of spreading mussels to other waters by ensuring all boaters exiting the water have inspections and undergo full decontamination. All watercraft leaving Clear Lake will receive a red seal and seal receipt to verify the watercraft received an exit inspection. Boat ramp hours will undergo hour restrictions to ensure that decontaminations do not occur during darkness (e.g., ramps close 2 hours prior to sunset). Lake County staff should consider an alternative method for identifying boats that cannot be decontaminated because check stations are understaffed.

**Estimated Costs Table to be Completed)**

- Supplies (signs, additional decon unit rental, water tanks, etc.)
- Personnel
- Vehicles
- Travel
- Camp trailers

## Sources of Funding for Dreissenid Response and Containment

Numerous existing and potential sources of funding can support dreissenid efforts in Clear Lake. Some of the sources of funding listed below have specific uses, e.g., some cannot be used for anything other than prevention efforts. These are listed here because there is potential for Lake County to solicit funding from these sources to amplify prevention efforts, e.g., permanent watercraft decontamination stations, which could also be used in the future should Clear Lake become infested with dreissenids.

### • Federal

- U.S. Fish and Wildlife Service Quagga and Zebra Mussel Action Plan (QZAP) grant funding—The pool of grant funding funds proposals listed in principal areas towards the fulfillment of the top priorities in the QZAP for western U.S. waters, including limiting the spread of invasive mussels via containment (e.g., inspection and decontamination of watercraft moving from invaded water bodies to jurisdictions free of dreissenids). Maximum grant award is \$600,000. Grant announcement contact: Barak Shemai, [barak\\_shemai@fws.gov](mailto:barak_shemai@fws.gov)
- U.S. Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) Small Grants—This program is a competitive, matching grants program that supports public-private partnerships implementing projects in the United States that further the goals of NAWCA. Maximum grant award is \$100,000. Grant announcement contact: Rodecia McKnight ([Rodecia\\_McKnight@fws.gov](mailto:Rodecia_McKnight@fws.gov)).

### • Regional

- The Westside Sacramento Integrated Regional Water Management (IRWM) Plan<sup>20</sup> provides grant funding for water management as well as emergency disasters. This small grant program provides a maximum of \$25,000 per projects that align with its regional priorities, which include protecting and enhancing habitat and biological diversity; preserving, improving, and managing water quality for beneficial uses; and improving watershed and ecosystem education and awareness. Response and containment may qualify for this funding source.

### • State

- Currently, no state funding sources exist for Lake County/Clear Lake to transition to containment. Upon an initial detection, all prevention funding from the state ceases immediately.

### • Fee-based, user funding

<sup>20</sup> <https://www.westsidecsm.com/>

### ○ Recreational registered watercraft

- Per California Code of Regulations, Title 14, Section 5201, the State of California requires owners of motorized recreational vessels used in freshwater to purchase from the Department of Motor Vehicles an annual sticker, which is separate and in addition to the vessel registration. Funding from these stickers supports prevention efforts via a grant program administered by the California Division of Boating and Waterways.
  - The mussel fee amount shall be \$8 when first paid during an even-numbered calendar year and \$16 when first paid during an odd-numbered calendar year. The mussel fee amount shall be \$16 thereafter and shall be valid for a period of two calendar years. The mussel fee sticker shall be valid through December 31 of every odd-numbered year.
- Per Lake County regulations, all vessels launched in Lake County water bodies must have a Lake County Quagga/Zebra sticker (in addition to the sticker noted above) (<https://www.nomussels.com/>). Resident and visitor stickers are \$20. The total number of stickers sold to residents and visitors and the total income received from 2016–2022 was \$832,180 and \$1,124,580, respectively (Table 1, Figure 8). The average income in 2016–2022 from sticker sales to residents and visitors was \$166,436 and \$224,916, respectively. These funds could be used for response and containment.

Table 1. Total number of stickers sold to residents and visitors, and income received, from 2016–2022.

	# Resident Stickers Sold	# Visitor Stickers Sold	Total Income from all sticker sales
2016	6,987	9,561	\$330,960
2017	8,978	6,279	\$305,140
2018	5,849	7,763	\$272,240
2019	6,282	8,872	\$303,080
2020	4,981	8,480	\$191,233
2021	4,939	8,851	\$186,501
2022	3,593	6,423	\$135,577

2016-2022 Mussel Sticker Sales - Residents and Visitors

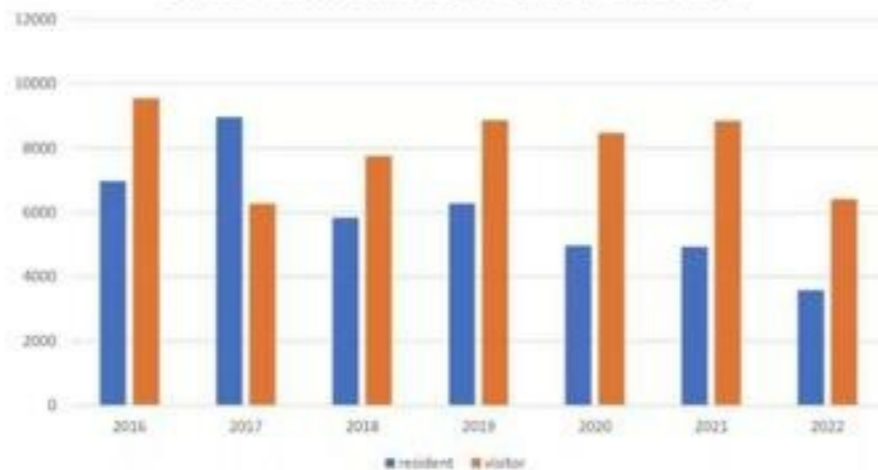


Figure 6. Mussel sticker sales to residents and visitors, 2016-2022.

- Seaplanes
  - Seaplanes have the potential to introduce or spread dreissenids and other aquatic invasive species. An event, called the *Clear Lake Splash In: Wings, Water & Wine* (<https://www.facebook.com/splashin/about>), is hosted annually at Clear Lake (excluding 2022, when the event was canceled, in part because of the exceptionally low water level of Clear Lake). The Splash-In is one of the largest seaplane fly-ins on the West Coast. The event is organized by the Lake County Chamber of Commerce. The same stickers that are issued to watercraft are issued to seaplane pilots.

## CHAPTER 6

### Permanent Decontamination Station Feasibility Analysis

If eradication of dreissenids is not possible upon detection, actions must be taken to prevent spread of mussels from Clear Lake to other water bodies. Installation of adequate water/energy efficient watercraft decontamination stations must be completed to ensure that all watercraft leaving Clear Lake have no mussels on board, either attached to the vessel or floating in vessel/engine compartments, bilges, and other places that hold water. Options for decontamination stations:

- Fixed base systems (\$225,000 to \$450,000)—Hydro Engineering, LLC (<https://www.hydroblaster.com>) produces high-capacity fixed based systems consisting of a Hydrosite insulated equipment building connected to utilities (water, power, and fuel) as well as portable systems. Their permanent decontamination stations range from \$225,000 (single station systems with one wash pad – drive on, drive off ramp) to \$400,000-plus multiple (4-station) systems (e.g., 2 wash pads).
- Clean Wake Dip Tank (\$800,000)—Clean Wake LLC (<https://www.cleanwake.net/>) developed a dip tank that lowers a boat into the tank and fills and empties the ballast tank while the watercraft engines are running. This type of system was first used in Utah in 2021, and decontaminates vessels faster than manual decontamination, including those with complex systems.

Criteria to be considered for locations of permanent watercraft decontamination stations:

- Volume of watercraft launched from individual locations on Clear Lake.
- Locations where fishing tournament watercraft are launched.
- Proximity or accessibility to water, power, and sewer connections.
- Surface, slope, and distance to Clear Lake.
- Traffic patterns that capture major/preferred routes.
- Traffic patterns at proposed station location (e.g., safety considerations including preventing left-hand turns across lanes, overflow of waiting watercraft, surrounding speed limit allows ease of access if not then adequate signage).
- Area surrounding station has clear control points to prevent boats from launching/leaving until they have been decontaminated.
- Security - ability to “lock down” the decontamination unit when it is not being used.
- Minimal disturbance to natural landscape.
- Adequate space to house decontamination unit, structure for staff to remain safe, structure to house operational equipment, etc.
- At least one near interstate roads coming into county from direction of infested waterbodies (hwy 20 by hwy 53)
- Near or at County- or City-owned property or empty/vacant parcel that could be acquired



- Near city/county services to tap into municipal water and special districts water treatment lines for the discharge
- A location that is easily accessible and county/city owned in Lakeport

Based on these criteria and ingress and egress associated with Clear Lake, the most likely locations for permanent watercraft inspection and decontamination stations are Upper Lake Park or Upper Lake Roads Yard, Moose Lodge, Konocti USD Bus Yard or the industrial area north of the town of Clear Lake, the Vista Point Shopping Center or the Lakeport Public Works Yard (Figure 10).



Figure 7. Potential locations for permanent watercraft inspection and decontamination stations based on the criteria for establishing stations.

**Suggested Training Requirements for Watercraft Inspection and Decontamination Program Staff**

All staff that will be conducting watercraft inspection and decontamination (WID) will require comprehensive training to ensure consistency of protocol adherence and performance of high-quality work. A minimum training program will provide information on general invasive species focused on dreissenid mussels, and protocols and standards for inspection and decontamination, data management of inspections and decontaminations conduction and familiarity with boat design and function.

Most active WID programs will conduct training in-person that requires 1.5 days of classroom instruction and a 1/2 day of hands-on outdoor training with trailered watercraft. Consider the use of on the job training that could follow immediately after hire to enforce objectives that were covered during the training.

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What other information could we add to the rapid response plan to improve it?



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3 Answers

probably already in there, but a step by step process for the response and implementing management or mitigation measures.

Overview of responsibilities.

Different responses to different initial findings...ie: eDNA vs veligers vs adults found



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# Clear Lake, California Invasive Mussel Rapid Response and Containment

Project Funded By



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## WHY THIS IS IMPORTANT

Click the arrow to learn about the economic, environmental, and other effects invasive mussels can have on Lake County waters



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Click the arrow to find out how you can get involved, from participating in webinars, to sharing your perspectives via surveys, to volunteering



<https://www.clearlakemusselprevention.org/>



# Make a Difference.



## WHAT WE'RE DOING

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## GET INVOLVED IN YOUR BOAT

Click the arrow to find out how you can get involved, from participating in webinars, to sharing your perspectives via surveys, to volunteering



# Clear Lake, California Invasive Mussel Rapid Response and Containment



### WHAT WE'RE DOING

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→

### WHY THIS IS IMPORTANT

Click the arrow to learn about the economic, environmental, and other effects invasive mussels can have on Lake County waters

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### GET INVOLVED

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→

invasive mussels. Photo to the right, Lake Natoma dam in Northern California. An introduction of invasive mussels to this lake could significantly increase operational costs.



### Recreational boating and public use

Lake County relies on more than \$1 million annually from resident and non-resident fishing licenses. In locations outside of Lake County where mussel infestations occur, boaters face increased costs from mussels growing on hulls, engines, and steering components. Beaches can become unusable due to the sharp shells and pungent odors of dead mussels washing ashore. Detrimental ecological changes and changes in some fish species, have occurred in lakes where invasive mussels have become established (Nelson et al. 2022). The potential exists for disastrous collapse of native fish populations in water bodies in which invasive mussels become established (Nelson et al. 2022).

The estimated cost to remove mussels from boat launch infrastructure is \$170,000 (\$750/boat launch) (Community Attributes 2017). Estimates of additional boat maintenance expenses resulting from AIS in Lake Tahoe ranged from \$200 to \$400 per year per boat (USACE 2009). A 2% to 10% reduction in recreational fishing revenue (residents only) as a result of an invasion of mussels would cost Montana between \$3.8 and \$19.3 million annually (Nelson 2019). The potential effects to fisheries, hatcheries, and spawning runs as a result of mussels becoming established is significant (Sumpter et al. 2023). Examples include a \$19 million/year reduction in sport fishing revenues in Michigan's Lake Huron (Michigan DNR 2019) to an estimated hundreds of millions of dollars annually to the Columbia River Basin or Snake River (SEAB 2019).



Top left: Lake Sonoma marina. Bottom left: Outboard motor encrusted with invasive mussels. Right: Person walking along lake shoreline infested with invasive mussel. Mussel photo credit: www.westermis.com/mug.com.

### Tourism

Montana estimated the top three stakeholder groups facing the largest potential economic impacts from dreissenid mussel invasion were tourism, hydropower, and irrigation accounting for 60 to 75 percent of the total potential damages statewide (Nelson 2019). In Montana, the estimated 2% to 10% potential annual loss in revenue from reduced tourism as a result of invasive mussel introductions equates to \$17.8 million to \$89 million (Nelson 2019).

### Property Values

Most of the invasive mussel-induced alterations to a lake ecosystem are detrimental to lake aesthetics, which can affect nearby property values (TRPA 2014, DeBruynckere 2019, Nelson 2019). The estimated 5.8% to 10% potential reduction to privately owned



Top left: Lake Sonoma marina. Bottom left: Outboard motor encrusted with invasive mussels. Right: Person walking along lake shoreline infested with invasive mussel. Mussel photo credit: www.westmarica.com/mug.com

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**Property Values**

Most of the invasive mussel-induced alterations to a lake ecosystem are detrimental to lake aesthetics, which can affect nearby property values (TRPA 2014, DeBruyckere 2019, Nelson 2019). The estimated 5.8% to 10% potential reduction to privately owned lakefront property values as a result of a mussel invasion equates to \$208 million to \$497 million, with an additional corresponding potential annual loss in property tax revenue (5.8% to 10%) of \$2.2 to \$3.8 million annually (Nelson 2019). Expanded invasive aquatic plant coverage reduced property values in King County, Washington lakefront homes by 19% (Olson and Tamayo 2016), and in Vermont, property values were reduced by 7% to 16% (Zhang and Boyle 2010).



Properties along the shoreline of Clear Lake could experience declines in property value if invasive mussels become established in the lake. Trickle-down effects to the county would likely occur, with reductions in annual property tax revenue.



QZ Containment & Transition Plan  
Feasibility Analysis - Decon Stations  
Regulations & Ordinances  
June 2023 Exercise

# QZ Containment and Transition Plan

The QZ Containment and Transition Plan is a work in progress. To see the latest version of the DRAFT plan, posted on 25 May 2023, click on the document below.



Would you like to share your perspectives and comments as the plan is developed? If so, please feel free to fill out the Comment Card below:

## Give Us Your Feedback on the Draft Plan

We'd love to hear your thoughts on Lake County's efforts to prepare for an invasive mussel introduction.

First name: \_\_\_\_\_ Last name: \_\_\_\_\_



residents, get your monthly mussel inspection sticker. Visit <https://www.lakemussel.com> for more information.



### Spread the message, not the mussels!

Invasions of quagga and zebra mussels are costing communities across the United States millions of dollars annually. Help spread the word about the devastating effects of invasive mussels and what everyone can do to prevent their spread.

### How is the funding from the sale of mussel prevention stickers spent?



## Resources

### Videos

[County of Lake Water Resources - Quagga Mussel Program](#)

Keeping invasive quagga and zebra mussels out of the nation's favorite bass fishing lake - Clear Lake, California

### Current Distribution of Quagga and Zebra Mussels in the United States

The U.S. Geological Survey Nonindigenous Aquatic Species website maintains current online maps depicting the current distribution of quagga and zebra mussels in the United States. Click on the species below to access these maps.



Quagga Mussel Distribution Map



Zebra Mussel Distribution Map

### Literature Cited on this Website

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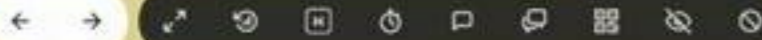
What other information would be helpful to include on the website – for the general public, for water managers, etc.?



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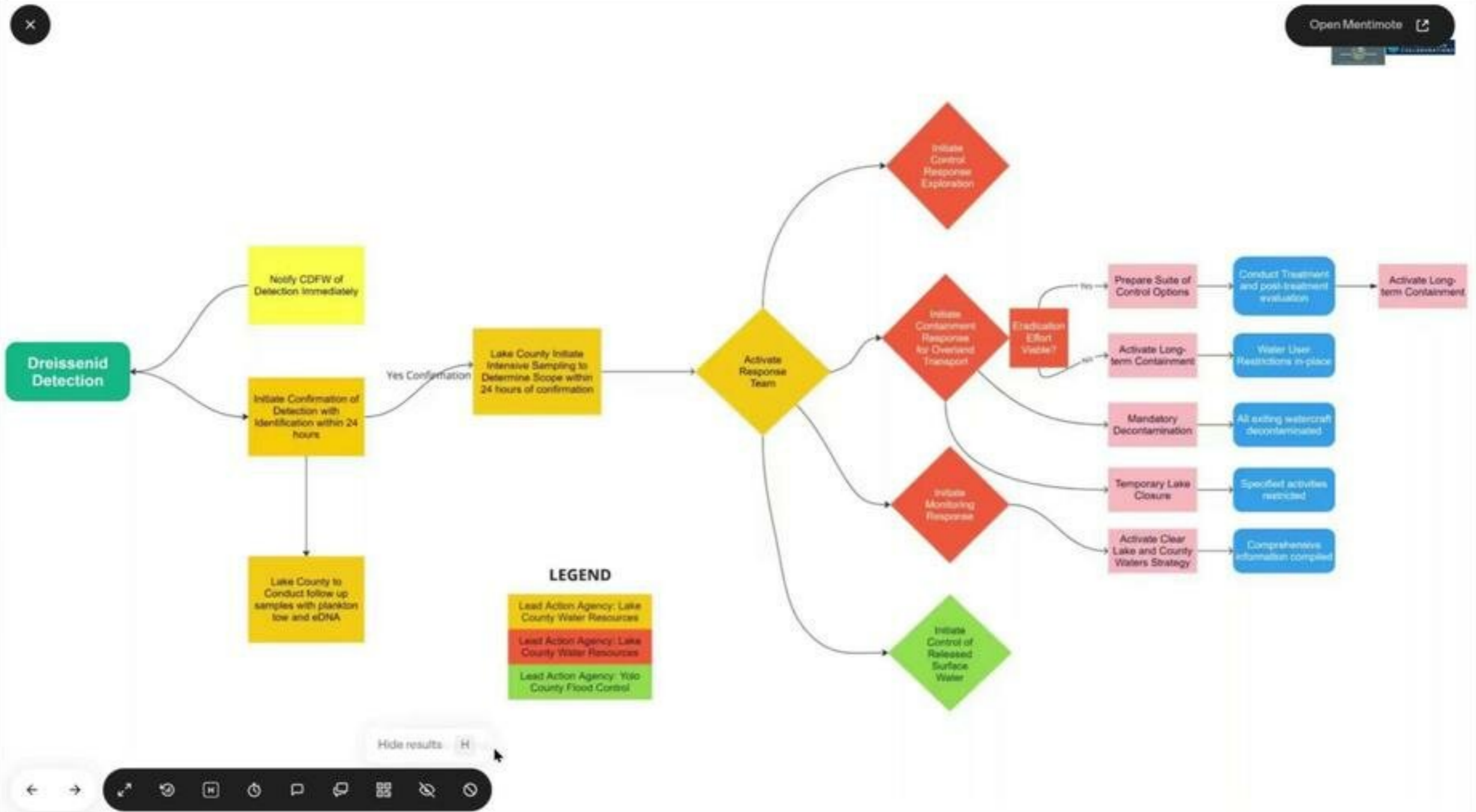


# The First Steps Taken When Invasive Mussels are Detected

# Immediate Steps

- **Confirm detection**
- **Notification of detection**
- **Identification of lead/shared lead entity(ies) and roles**
- **Local declarations of emergency**
- **Delineate extent of infestation**
- **Communication internal and external**
- **Obligations to report**



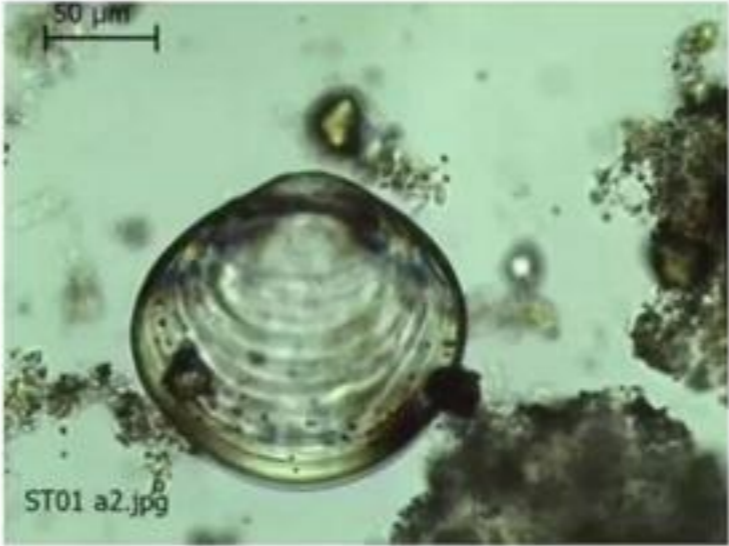


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# Confirmation





# Confirmation

## Confirm the detection

- Minimum criteria for detection of invasive mussels, an adult or juvenile
  - specimen must be verified by two independent experts and confirmed by DNA,
  - veliger must be identified and verified using cross-polarized light microscopy by two independent experts and confirmed by DNA analysis (PCR and gene sequencing).
- After the initial detection, follow-up sampling will occur




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What do you believe your role would be in the first steps after a detection of invasive mussels?



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What do you believe your role would be in the first steps after a detection of invasive mussels?

5 Answers

Communicating with CDFW to confirm the detection, planning further sampling to get idea of the extent throughout the water body or other water bodies in the county

re-sample, re analyze, report confirmation to CDFW

helping scan more samples using the dogs

Open the Response Plan and follow the steps!

Outreach on containment and possible changes to the ecosystem.



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# Notification

## Notify key individuals/organizations

- Contact California Department of Fish and Wildlife (CDFW) within 24 hours
- Regardless of the nature of the initial detection, per Fish and Game Code Section 2301 “any entity that discovers dreissenid mussels within the state **shall immediately report** the discovery to the CDFW”.
- The discovery should be reported to the CDFW Region 2 Quagga/Zebra Mussel Scientist (or CDFW wildlife officers if Region 2 Mussel Scientist is not available) and via the CDFW online Quagga Mussel Observation Report Form



Photo: Microsoft Stock



# Key authorities - Background

- **Lake County Watershed Protection District – primary entity responsible for invasive mussel prevention in Lake County.**
  - Authorized by U.S. Congress and California State Legislature
  - Administered by Director of Water Resources, who reports to the County Board of Supervisors
  - **Plans, manages, maintains, implements and evaluates all AIS programs, working with partners**
- County of Lake accepted responsibility for the protection of Clear Lake's basin from the State Lands Commission in 1973; this transfer of responsibility resulted in lakebed management and shoreline protection ordinances
- In 2009, Lake County's DWR separated from the Dept. of Public Works, and responsibility for the WPD was transferred to DWR.
- **California delegates responsibility for preventing and managing invasive mussel infestations to local water body managers** (Fish and Game Code Title 14), making local codes and ordinances important in establishing authorities.
- Fish and Game Code Section 2301 – in the event of an invasive mussel introduction to Clear Lake, **the lead entity in the implementation of a RR containment and transition plan and the development of a Control Plan is a public or private agency that operates a water supply system.**

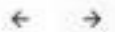
# Fish and Game Code, Section 2301

- Makes it illegal to possess, import, ship, or transport in the state, or place, plant, or cause to be placed or planted in any water within the state, dreissenid mussels.
- Gives the CDFW Director, or his/her designee, the authority to conduct watercraft inspections and stop conveyances, mandate decontaminations, and impound or quarantine conveyances. This section also provides authority to conduct watercraft inspections within waters that contain dreissenids, to close or restrict access to affected waters or facilities, and to inspect, quarantine, or disinfect conveyances removed from, or introduced to affected waters.
- A public or private agency that operates a water supply system shall cooperate with the department to implement measures to avoid infestation by dreissenid mussels and to control or eradicate any infestation that may occur in a water supply system. If dreissenid mussels are detected, the operator of the water supply system, in cooperation with the department, shall prepare and implement a plan to control or eradicate dreissenid mussels within the system.
- Any entity that discovers dreissenid mussels within this state shall immediately report the discovery to the department.

# Fish and Game Code, Section 2302

- Any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir where recreational, boating, or fishing activities are permitted must assess the vulnerability of the reservoir for the introduction of dreissenid mussels and develop and implement public education, monitoring, and management of recreational, boating or fishing activities designed to prevent the introduction of dreissenids. The entity must also visually monitor for the presence of mussels.

Next slide





# California Code of Regulations, Title 14 Section 672.1

- **Control Plan** - Within 60 days of CDFW requesting, or within 60 days of dreissenids being detected, public or private agencies that operate water supply systems must immediately develop a dreissenid mussel control plan and implement measures to prevent further spread. The plans must include a description of the status of the dreissenid population at the time of plan development, control activities, and monitoring to determine dreissenid population changes. The plan may also include maintenance activities to maintain functionality of the water supply facility.
- **Prevention Program** – Entities that own or manage a reservoir where recreational, boating, or fishing activities are permitting must implement a dreissenid mussel prevention program that includes a vulnerability assessment for dreissenids, a monitoring program, and management of recreational activities that prevent the introduction of mussels, and to keep them from being moved from the waterbody. Annual reports re: the prevention program are due annually by March 31.

Next slide



# Filling the Gaps – Code and Ordinance Recommendations

- Add a definition for “pollutant” and explicitly include a reference to aquatic invasive species (AIS).
- Add a definition of “significant impact” that includes the decision threshold. “Significant impact” is the term used in the “catch-all” permit procedure in Sec. 23-4.
- Consider mentioning AIS in Section 6.4(B) Construction (page 11) – e.g., materials used in construction should be free from AIS, materials should be decontaminated before moving to another site, etc.
- Several sections in ordinances that have the potential to include language associated with containment:
  - Sec. 6.8(D) for relocation of floating structures (page 14). Incorporate language that requires inspection and decontamination before relocation.
  - Sec. 23-8 for Marinas and Harbors (page 15) – The county could encourage/require marinas to offer decontamination facilities or require inspections before boats leave marinas, etc.
  - Section 23.13.4 Removal of improvements (page 20) – The county could require inspection/decontamination upon removal of an improvement if the structure is being moved to another location; or, the county could require proper disposal.
  - Section 12.4 – Littering and pollution (page 18) – Add a provision regarding AIS to reinforce that AIS are pollutants and introduction is prohibited.
  - Section 12.6 for discharge – Explicitly reference AIS and potentially require use of best management practices.

## Filling the Gaps – Code and Ordinance Recommendations

- As a condition of the shoreline encroachment permit, the county could require an annual inspection/monitoring and reporting of results, and then identify some actions that needed to be taken if mussels are detected.
- The county could likely impose an annual inspection of structures as part of routine county inspections; these inspections could incorporate both safety issues as well as AIS.
- The county could state in its ordinances that it is unlawful to launch a boat from any place other than a ramp, private dock, pier, designated beach. This would allow the county to cite or fine people who are launching their boats from any shoreline location and help to ensure that watercraft are inspected prior to launch. There are examples of counties that define “boat launch facilities” as being “a boat ramp, dock, pier or other facility designated by the department for launching boats into the water” (e.g., Island County, Washington, Chapter 9.40). This Washington county states that “It is unlawful for any person to launch or recover a boat in and Island County park except in areas specifically designated and/or marked for that purpose; provided, that this provision does not apply in case of an emergency (9.40.165).” Tempe, Arizona mandates that “all public watercraft must be launched at a designated boat launch facility.”

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Are there any other code/ordinance recommendations you have for Lake County to consider to fill any existing gaps?



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Are there any other code/ordinance recommendations you have for Lake County to consider to fill any existing gaps?

4 Answers

Shoreline Property owners are responsible for boats launching from their property comply with QZ ordinance and if they don't both the boat owner and property owner get cited

property owners with access are required to post signs stating the QZ program requirements - signs can be provided by County but posting is responsibility of property owners.

ALL water vessels (including kayaks, canoes) have to be clean, drained, dry and get screened and stickered.

Is there a way to permit property owners private docks and ramps to



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Are there any other code/ordinance recommendations you have for Lake County to consider to fill any existing gaps?

6 Answers

Shoreline Property owners are responsible for boats launching from their property comply with QZ ordinance and if they don't both the boat owner and property owner get cited

property owners with access are required to post signs stating the QZ program requirements - signs can be provided by County but posting is responsibility of property owners.

ALL water vessels (including kayaks, canoes) have to be clean, drained, dry and get screened and stickered.

partner shops conducting inspections and selling stickers can be cited if they are not following procedures

Is there a way to permit property owners private docks and ramps to engage them in the education and prevention effort?

clearly state in the ordinance who the authority in the County is for enforcing boats get decontaminated when they leave a waterbody - if we get mussels. Is this sheriff, city police, county who?



# Declaration of Emergency

## Why:

- Create Awareness
- Generate possible funding support
- Mobilize activities

## Tools

- Create ready materials (e.g., press release)

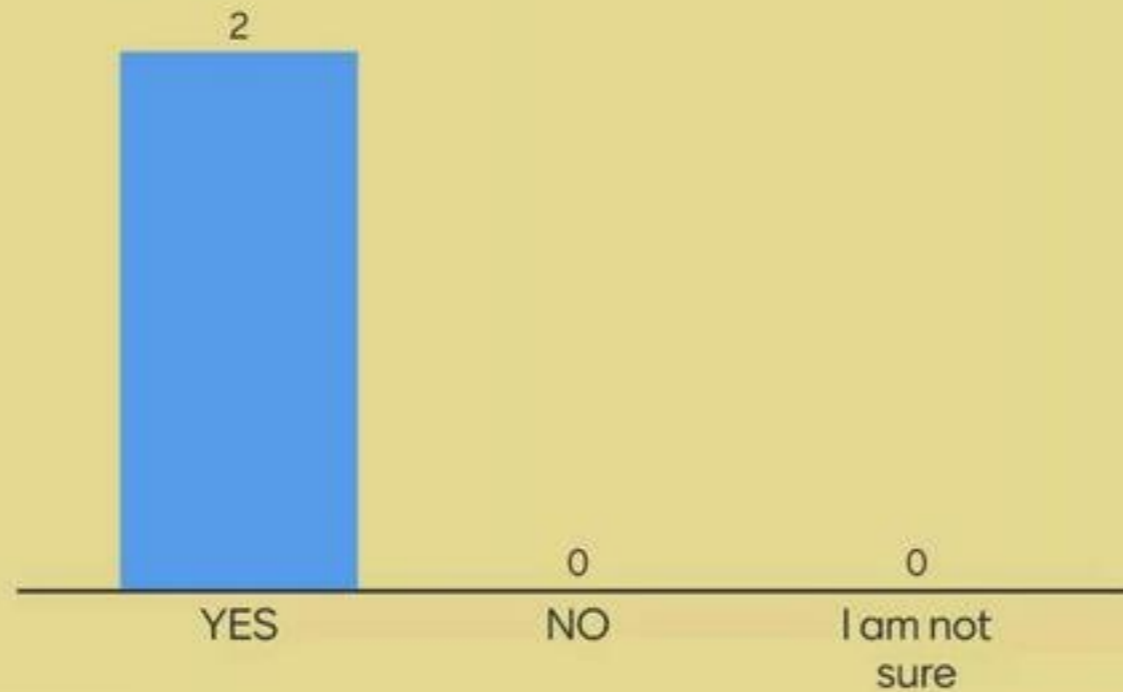
## How

- Per Ordinance 31, Lake County may declare a local state of emergency.



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# Do you believe the County should declare an emergency should invasive mussels be found?



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# Are you enjoying learning about Clear Lake and the potential for invasive mussels?

0

No

0

Somewhat

0

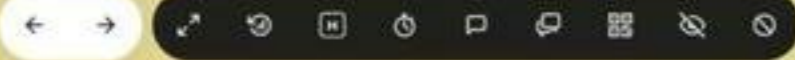
Yes



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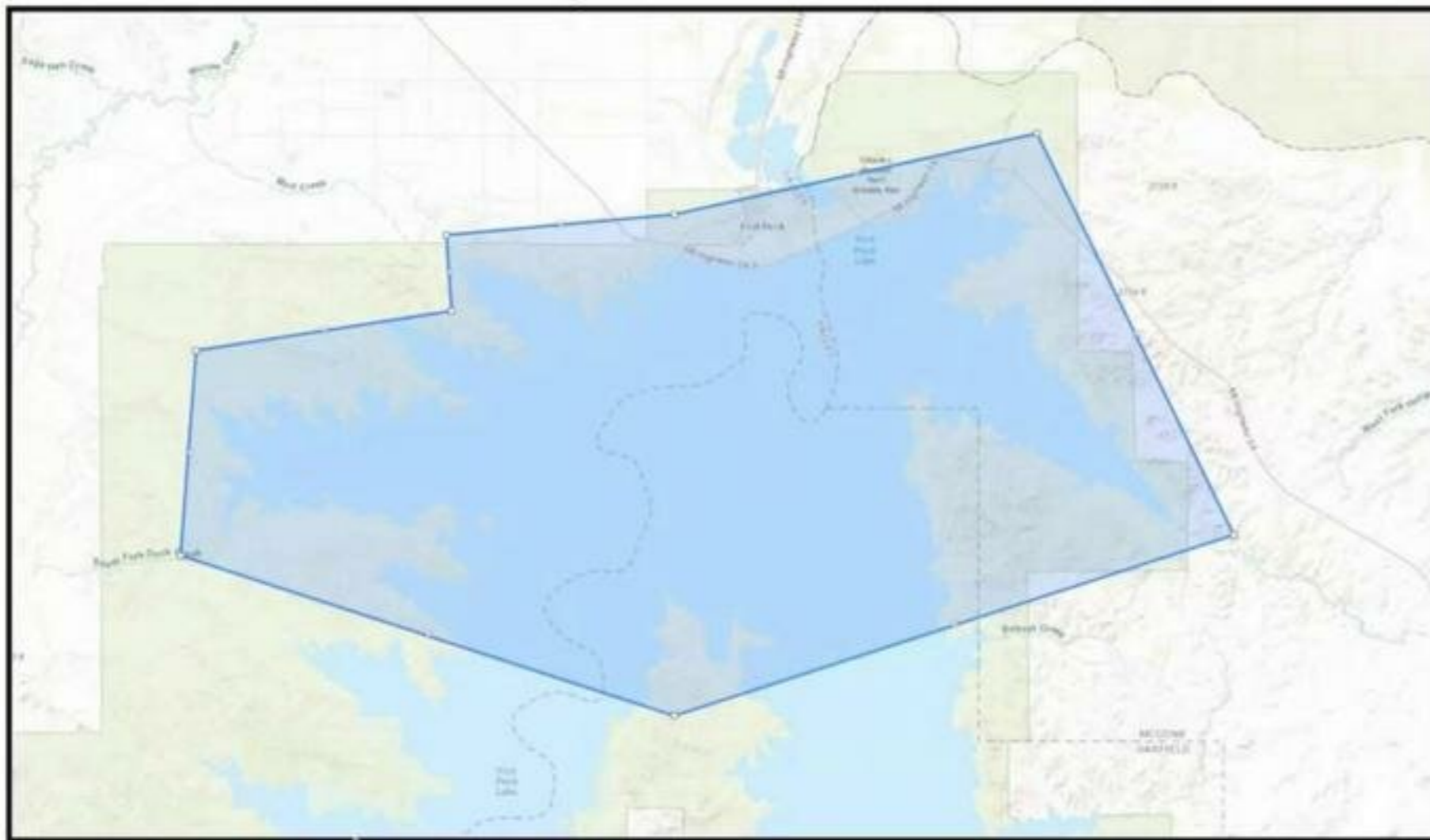
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# Delineation

Determine the scope and scale of the infestation



Open Mentimeter



# Delineation

- Suite of tools that may be considered
  - Sniffing dogs
  - Shoreline walking
  - Dive team
  - Exhaustive plankton tow
  - eDNA
- Nearby waterbodies
- Sites downstream of water body



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# How can you/your organization help in the delineation phase?

Waiting for answers



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How can you/your organization help in the delineation phase?

8 answers

mobilizing

shoreline walks

sampling

monitoring

communication

plankton tows

survey nearby waterways

communicate the emergency



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How can you/your organization help in the delineation phase?

11 answers

communicate the emergency

shoreline walks

communication

prevention monitoring

plankton tows

monitoring

outreach and education

research and studies

sampling

survey nearby waterways

mobilizing



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# How can you/your organization help in the delineation phase?

13 answers

communicate the emergency  
plankton tows

sample  
sampling

communication  
prevention monitoring  
monitoring

outreach and education

research and studies

educate

nearby waterways

mobilizing  
shoreline walks



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How can you/your organization help in the delineation phase?

19 answers



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# WATER BODY CLASSIFICATIONS

- **Not Sampled**—Waters that have not been monitored.
- **Undetected/Negative**—Sampling/testing is ongoing and nothing has been detected or nothing has been detected within the time frames for delisting.
- **Inconclusive** (temporary status)—Water body has not met the minimum criteria for detection.
- **Suspect**—Water body that has met the minimum criteria for detection.

## TRIGGER FOR MANAGEMENT ACTION

- **Positive**—A minimum of one subsequent sampling event that meets the minimum criteria for detection. Positive must include the initial detection plus at least one subsequent detection for a total of 2 verified detections.
- **Infested**—A water body that has an established (recruiting or reproducing) population of ANS.

# Internal & External Communications

Communication Hub 1	Communication Hub 2	Communication Hub 3
<b>Type of information shared:</b> Initial confirmed detection Milestones	<b>Type of information shared:</b> Waterbody status Management actions	<b>Type of information shared:</b> Prevention requirements Closures Decontamination requirements and location
<b>Method of Communication:</b> Phone Briefing documents	<b>Method of Communication:</b> Online meetings Email briefings	<b>Method of Communication:</b> Social media, website, press releases
<b>Frequency:</b> Upon confirmed detection Weekly progress updates As needed with key decision points	<b>Frequency:</b> Weekly	<b>Frequency:</b> As new requirements are required
<b>Primary Entities:</b> Governor staff County officials State legislators	<b>Primary Entities:</b> Surrounding county managers Surrounding state AIS managers	<b>Primary Entities:</b> Local businesses Boaters Recreationists Homeowners Area residents

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How can we best communicate an introduction of mussels to Clear Lake residents and visitors?



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How can we best communicate an introduction of mussels to Clear Lake residents and visitors?

7 Answers

Facebook

Press release, social media

Radio ad

Signage

KPFZ

Nixel alerts

social media, signage, outreach...



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6



# Report Obligations



**USGS**  
science for a changing world

## NAS - Nonindigenous Aquatic Species

Home | Alert System | Database & Queries | Taxa Information | **Report a Sighting** | Screening Tool (Beta)

### Mollusks



Mollusks (Phylum Mollusca) are found in marine, brackish, and fresh waters. They include a diverse group of animals such as clams, mussels, oysters, scallops, abalone, conchs, shipworms, snails, mudflatworms, chitons, squids, and octopuses. Common methods of introduction include ballast water introductions, aquarium releases, and accidental release from aquaculture facilities. Displacement by competition is the most frequently observed impact on native species. The most notable nonindigenous mussel introduction is the zebra mussel (*Dreissena polymorpha*), a native of eastern Europe.

We welcome any contributions or comments you may have.

### Data Queries and Species Lists



[Data Queries](#)  
[Species List of Nonindigenous Mollusks](#)  
(links to species profiles and collection information)  
[New Zealand Molluscal Distribution](#)

### Zebra and Quagga Mussel Information



[Zebra and Quagga Mussel Home Page](#)

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What suggestions do you have for topics or information we should add to the plan based on the discussion and presentations from this morning?



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What suggestions do you have for topics or information we should add to the plan based on the discussion and presentations from this morning?

9 Answers

Coordination between other counties

How involved would Office of Emergency Services be if a infestation would occur?

How do we communicate with rentals on the lake? New home owners?

Maybe create a task force for north bay if an infestation were to occur

Is there a investment funding pathway to prepare a savings plans to afford a response?

What amount of the sticker sale is "too much" where people wont pay and try to skip the sticker all together?

flow chart/checklist of who gets notified

Require property owners with Airbnb rentals to include verbage about ais inspections in their house rules

What about a more general AIS sticker, will that make people more or less engaged and supportive of the program?



4

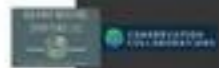




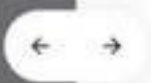
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# Scenario Exploration





## Scenario A.

Observation of adult invasive mussel at Lakeport launch site by a county employee trained to conduct boat inspections.

SCENARIO A: Observation of adult invasive mussel at Lakeport launch site by a county employee trained to conduct boat inspections.

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
WHO			Survey area for more adults				
WHEN							
WHAT							
FUNDING							
RESOURCES							
ADDITIONAL THOUGHTS							

conduct boat inspections.

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
<b>WHO</b>	Lake County staff (A. D-D. & C. H.); Mussel Dogs; regional CDFW scientists (A.M.)	Contact CDFW Regional Biologist	Survey area for more adults; check boats				
<b>WHEN</b>	Immediately	Immediately					
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation					
<b>FUNDING</b>	None needed	None needed					
<b>RESOURCES</b>	Camera/smart phone/tablets						
<b>ADDITIONAL THOUGHTS</b>							

<b>WHO</b>	<b>staff</b> (A. D-D. & C. H.); Mussel Dogs; regional CDFW scientists (A.M.)	Regional Biologist	for more adults; check boats				
<b>WHEN</b>	Immediately	Immediately	Immediately				
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks				
<b>FUNDING</b>	None needed	None needed	Staff \$				
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples, etc. using staff				

**ADDITIONAL:** *Seasonal on hour pathway?? and off hour pathway?? should be described in plan*

STEPS	CONFIRM	NOTIFICATION	DELINEATE	INTERNAL	EXTERNAL	EMERGENCY	RESPONSE
<b>WHO</b>	Lake County staff (A. D-D. & C. H.); Mussel Dogs; regional CDFW scientists (A.M.)	Contact CDFW Regional Biologist	Survey area for more adults; check boats				
<b>WHEN</b>	Immediately	Immediately	Immediately				
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks				
<b>FUNDING</b>	None needed	None needed	Staff \$				
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples, etc. using				

	CDFW scientists (A.M.)						
<b>WHEN</b>	Immediately	Immediately	ASAP				
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks; control Lakeport location for accidental information leaks				
<b>FUNDING</b>	None needed	None needed	Staff \$				
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples,				



<b>WHAT</b>			checks; control Lakeport location for accidental information leaks				
<b>FUNDING</b>	None needed	None needed	Staff \$				
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples,				

			etc. using staff <sup>1</sup>				
<b>ADDITIONAL THOUGHTS</b>	<b>“normal on-hour pathway” and “off-hour pathway” should be described in plan</b>						

STEPS	CONFIRM	NOTIFICATION	DELINEATE	INTERNAL	EXTERNAL	EMERGENCY	RESPONSE
<b>WHO</b>	Lake County staff (A. D-D. & C. H.); Mussel Dogs; regional CDFW scientists (A.M.)	Contact CDFW Regional Biologist	Survey area for more adults; check boats		Lake County		
<b>WHEN</b>	Immediately	Immediately	ASAP		Within a few days		
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks;		Press release; Control Lakeport location for accidental information leaks		
<b>FUNDING</b>	None needed	None needed	Staff \$		None needed		
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples, etc. using staff; CDFW		Press release		

**SCENARIO A: Observation of adult invasive mussel (attached or not – 2 different scenarios) at Lakeport launch site by a county employee trained to conduct boat inspections.**

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
<b>WHO</b>	Lake County staff (A. D-D. & C. H.); Mussel Dogs; regional CDFW scientists (A.M.)	Contact CDFW Regional Biologist	Survey area for more adults; check boats	CDFW wardens; city staff; ramp monitors . . .	Lake County	Not until confirmation and collaboration with CDFW connection	
<b>WHEN</b>	Immediately	Immediately	ASAP	ASAP	A few days		
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks;		Press release; Control Lakeport location for accidental information leaks		
<b>FUNDING</b>	None needed	None needed	Staff \$		None needed		
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for		Press release		

<b>WHO</b>	& C. H.); Mussel Dogs; regional CDFW scientists (A.M.)	regional Biologist	for more adults; check boats	city ramp, ramp monitors ...		communication and collaboration with CDFW connection	
<b>WHEN</b>	Immediately	Immediately	ASAP	ASAP	A few days		
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks;		Press release; Control Lakeport location for accidental information leaks		
<b>FUNDING</b>	None needed	None needed	Staff \$		None needed		
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples, etc. using staff; CDFW can issue a verbal quarantine band		Press release		

<b>WHO</b>	Staff (A.M.); Mussel Dogs; regional CDFW scientists (A.M.)	Regional Biologist	For more adults; check boats; use mussel dogs (private pay and CDFW dogs)	City staff, ramp monitors . . .		Communication and collaboration with CDFW connection	Memorandum protocol with focused resources
<b>WHEN</b>	Immediately	Immediately	ASAP	ASAP	A few days		
<b>WHAT</b>	Confirm siting – take a photo	Share photo and details of observation	Look at ramps, parking lot checks;		Press release; Control Lakeport location for accidental information leaks		
<b>FUNDING</b>	None needed	None needed	Staff \$; \$ for mussel dog hire		None needed		
<b>RESOURCES</b>	Camera/smart phone/tablets; Google Lens	Communication devices (to text, phone, etc.); Google Lens	Staff (on hours); Ramp monitors and others (off hours); boats for samples, etc. using staff; CDFW can issue a		Press release		

## Scenario B.

Observation of an adult invasive mussel on mid-lake settling plate by CDFW employee.



STEPS	CONFIRM	NOTIFICATION	DELINEATE	INTERNAL	EXTERNAL	EMERGENCY	RESPONSE
WHO	CDFW	Reach out to Angela	All <u>hands on deck</u>				
WHEN	ASAP	ASAP	ASAP				
WHAT	Confirm existence of adult mussel on plate		Scrape plate for larvae; look at all other plates, docks, buoy lines, etc.; photos; veliger tows in area of plates; extensive monitoring				
FUNDING							
RESOURCES							

<b>WHO</b>	CDFW	Reach out to Angela	All hands on deck				
<b>WHEN</b>	ASAP	ASAP	ASAP				
<b>WHAT</b>	Confirm existence of adult mussel on plate		Scrape plate for larvae; look at all other plates, docks, buoy lines, etc.; photos; veliger tows in area of plates; extensive monitoring (zones)				
<b>FUNDING</b>		I					
<b>RESOURCES</b>			Survey equipment and resources				



<b>WHO</b>	CDFW	Reach out to Angela	All hands on deck	County staff			
<b>WHEN</b>	ASAP	ASAP	ASAP	ASAP			
<b>WHAT</b>	Confirm existence of adult mussel on plate		Scrape plate for larvae; look at all other plates, docks, buoy lines, etc.; photos; veliger tows in area of plates; extensive monitoring (zones)	Marinas and water purveyors to serve as "volunteers" to assist			
<b>FUNDING</b>							
<b>RESOURCES</b>			Survey equipment & resources;				

SCENARIO B: Observation of an adult invasive mussel on mid-lake settling plate by CDFW employee.

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
WHO	CDFW	Reach out to Angela	All hands on deck	County staff	County staff		
WHEN	ASAP	ASAP	ASAP	ASAP	ASAP (esp. given it was found in the middle of the lake)		
WHAT	Confirm existence of adult mussel on plate		Scrape plate for larvae; look at all other plates, docks, buoy lines, etc.; photos; veliger tows in area of plates; extensive monitoring (zones)	Marinas and water purveyors to serve as "volunteers" to assist	Update Board on status of discovery, expanded monitoring efforts, potential outreach campaign		Temporary closure?

			monitoring (zones)				
<b>FUNDING</b>							
<b>RESOURCES</b>			Survey equipment & resources; potentially				

			reallocate resources				
<b>ADDITIONAL THOUGHTS</b>	Emergency would only be declared if veligers were discovered, and if additional adults were found and likely would be found on property owners infrastructure.						

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
WHO	CDFW	Reach out to Angela	All <u>hands on</u> deck	County staff	County staff		
WHEN	ASAP	ASAP	ASAP	ASAP	ASAP (esp. given it was found in the middle of the lake)		
WHAT	Confirm existence of adult mussel on plate		Scrape plate for larvae; look at all other plates, docks, buoy lines, etc.; photos; veliger tows in area of plates; extensive monitoring (zones)	Marinas and water purveyors to serve as "volunteers" to assist	Update Board on status of discovery, expanded monitoring efforts, potential outreach campaign; notify other water body managers in region		
FUNDING							

			monitoring (zones)				
<b>FUNDING</b>							
<b>RESOURCES</b>			Survey equipment & resources; potentially				

			reallocate resources				
<b>ADDITIONAL THOUGHTS</b>	<p>Emergency would only be declared if veligers were discovered, and if additional adults were found and likely would be found on property <u>owners</u> infrastructure.</p> <p>Update all regional water body contracts – include in latest version of the plan.</p>						

## Scenario C.

Observation by a local resident of an adult mussel on a boat at a Lakeport gas station.



SCENARIO C: Observation by a local resident of an adult mussel on a boat at a Lakeport gas station.

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
WHO	Resident	CDFW			County		
WHEN	ASAP	ASAP			ASAP (before a discovery)		
WHAT	Calls County, City, Sheriff, or CDFW; take picture of license of vehicle and trailer, CF#	CDFW to quarantine (intercept prior to launch)			Signs at boat ramps and gas stations on who to call; ads at gas station electronic kiosks (\$\$\$\$); billboards		
FUNDING					\$ for signs & billboards		
	Smartphone/camera						

## Scenario D.

Observation by a fishing tournament participant of a boat with adult mussels attached in the water (during the tournament).





SCENARIO D: Observation by a fishing tournament participant of a boat with adult mussels attached in the water (during the tournament).

RESPONSE STEPS	CONFIRM	NOTIFICATION	DELINEATE	COMMUNICATE INTERNAL	COMMUNICATE EXTERNAL	DELEGATE EMERGENCY	RESPONSE
WHO	Fishing tournament participant						CDFW
WHEN	Immediately						
WHAT	Contact CDFW						Quarantine boat
FUNDING							
RESOURCES							
ADDITIONAL THOUGHTS	<p>Is liability for tournament directors built into local ordinances? Liability is on individual who purchased sticker. Tournament directors and participants are liable.</p> <p>Fishing tournament participants must launch at designated boat ramps – CDFW will issue violation letter if these protocols are violated.</p>						

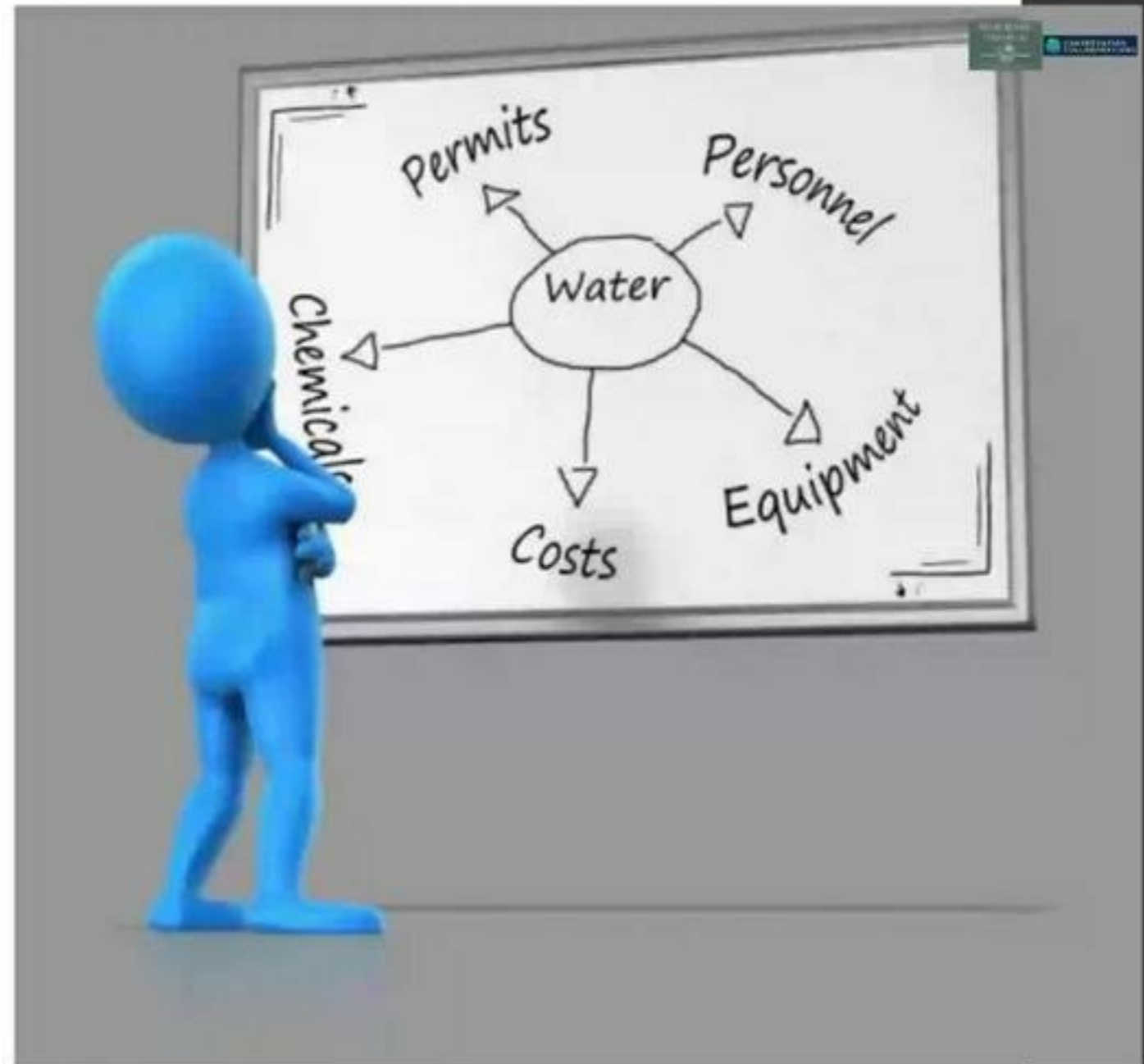
## Scenario E.

Observation of invasive mussels in water system of local resident.



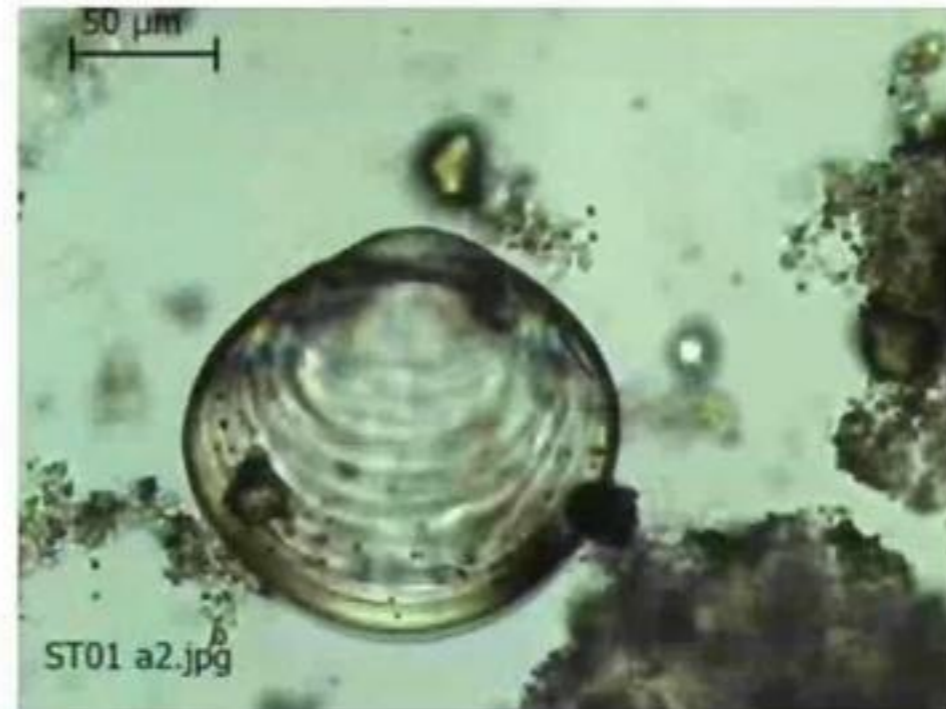
# Response Considerations

- Anticipated costs of eradication effort and subsequent monitoring, coupled with available funding
- Available resources (personnel, equipment, etc.) for all aspects of response (e.g., signage, barrier curtains, chemicals, grants to partners, increased monitoring, additional oversight of watercraft monitoring)
- Amount of water in the system to be treated. Consider the following: Potential for drawdown or flows reduced before treatment. Flow sources, including springs, and the potential to regulate that flow



# Response Considerations

- Regional and local distribution of invasive mussels (single vs. multiple, continuous vs. patchy, isolated vs. widespread, upstream vs. downstream, edge vs. interior, etc.)
- Invasive mussel age class structure or life stages present of infestation, if known
- Pathways/source (if known) – identified, controlled, eliminated, etc.
- Species track record of eradication/control attempts
- Ability to obtain required permits and permissions (e.g., Emergency ESA Consultation) in expedited timeframe



# Response Considerations

- Survey and assessment confidence
- Affected native fish and wildlife habitats
- Time of year in relation to reproduction, migration, etc.
- Land use patterns
- Presence of state or federally listed rare, threatened, or endangered species or critical habitats (e.g., Clear Lake Hitch)
- Regulatory hurdles associated with control actions (e.g., use of chemicals)



Photo credit: USFWS.

# Activation of Response Teams / Incident Command System (ICS)



# Triggers for Activation of Incident Command System



Previous slide



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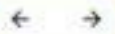
# What do you think would trigger activation of the Incident Command System?



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What do you think would trigger activation of the Incident Command System?

5

Answers

finding a mussel in / on the lake and it's confirmed by CDFW.

Confirmation of a mussel infestation

Confirmation of reproductive stages of dressenid mussels

Confirmed infestation from CDFW

Confirmed finding of living in the Lake, or finding at multiple locations. ICS is always good.



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What do you think would trigger activation of the Incident Command System?

8 Answers

finding a mussel in / on the lake and it's confirmed by CDFW.

Confirmation of a mussel infestation

Confirmation of reproductive stages of dreissenid mussels

Confirmed infestation from CDFW

Confirmed finding of living in the Lake, or finding at multiple locations. ICS is always good.

When there is a need to coordinate next steps and to control public information

many mussels discovered attached to infrastructure in the lake

verified population of viable & reproducing QZ mussels

Next slide



7



- Skill Sets

- GIS
- Other needs

- Resources

- FTE assignments
- Available equipment

Maximizing  
Skill Sets,  
Resources  
and Priorities

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What role do you believe you/your organization would play in an ICS response to invasive mussels?



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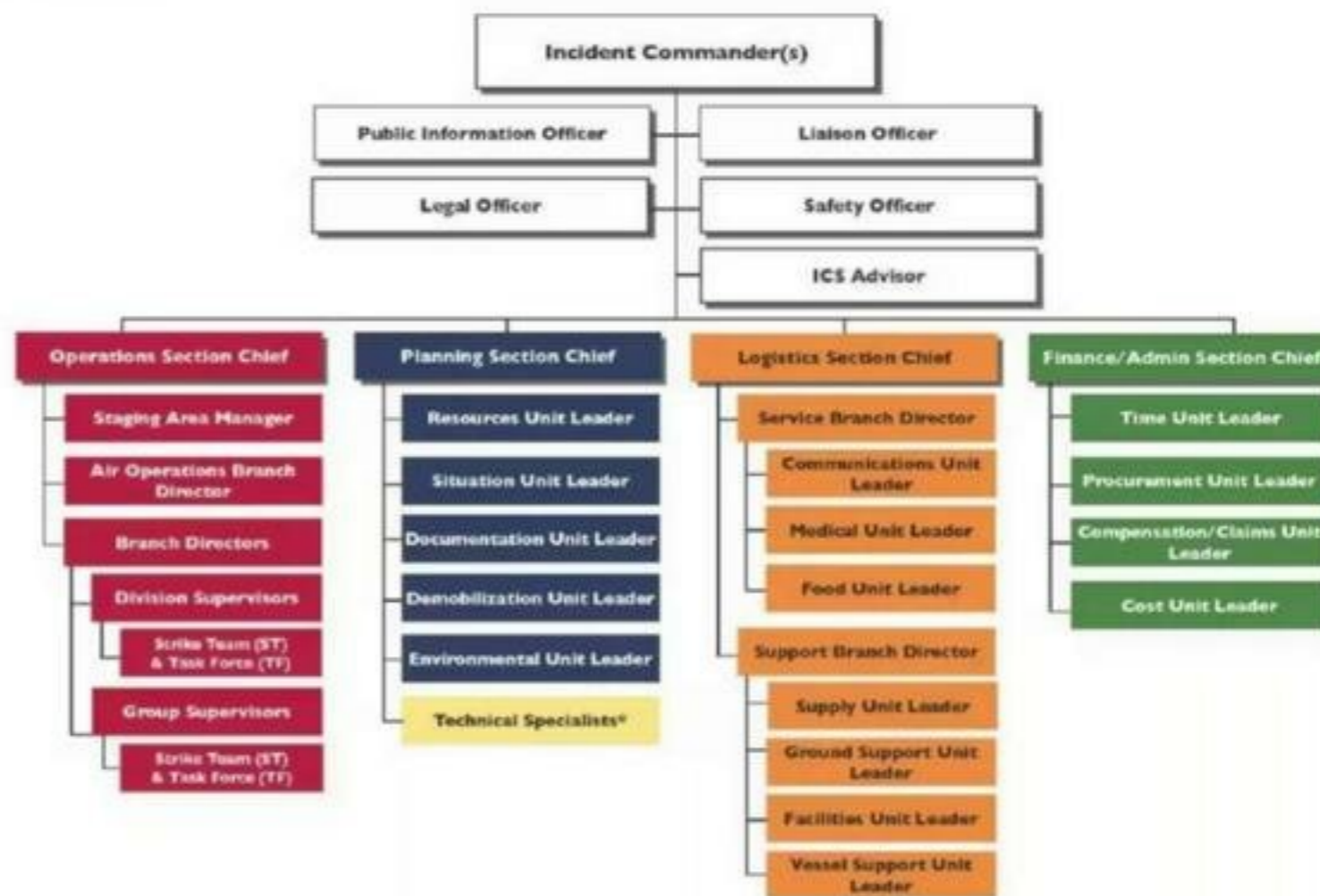
Next slide



# ICS and Clear Lake

**EMSI**

## Incident Command System Organization Chart



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What role do you believe you/your organization would play in an ICS response to invasive mussels?



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What role do you believe you/your organization would play in an ICS response to invasive mussels?

3 Answers

Delineation and notification

provide logistics, boats, monitoring support, mobilizing, communicating to officials

coordination, permit applications



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What role do you believe you/your organization would play in an ICS response to invasive mussels?

4 Answers

Delineation and notification

provide logistics, boats, monitoring support, mobilizing, communicating to officials

coordination, permit applications

Our office (County Admin) would assist in PIO functions at the very least.



4





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## NEXT STEPS

- Prep for Control / Eradicate
- Control/Eradicate
- Contain

Photo credit: PSMFC Smugmug Photo Archives.

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## What role do you believe you/your organization would play in an ICS response to invasive mussels?

9 Answers

Delineation and notification

provide logistics, boats, monitoring support, mobilizing, communicating to officials

coordination, permit applications

Our office (County Admin) would assist in PIO functions at the very least.

on the ground support, training

Communication, CDFW discourse, etc

recruiting partners to provide detection / monitoring support if needed

I think it will be more challenging for mussels; people can "see" a fire or flood from their home/commute. Harder for mussels in lake.

Mobilization of equipment/personnel.



7



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What role do you believe you/your organization would play in an ICS response to invasive mussels?

10 Answers

Our office (County Admin) would assist in PIO functions at the very least.

support, mobilizing, communicating to officials

on the ground support, training

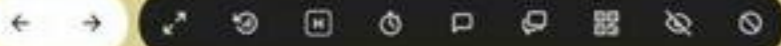
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Restore removed inputs  
n, CDFW discourse, etc

Mobilization of equipment/personnel.

Scott DeLeon would be very involved in ICS or if EOC was activated for invasive mussels.



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What role do you believe you/your organization would play in an ICS response to invasive mussels?

10 Answers

Delineation and notification

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coordination, permit applications

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Mobilization of equipment/personnel.

Scott DeLeon would be very involved in ICS or if EOC was activated for



8



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Scott DeLeon would be very involved in ICS or if EOC was activated for invasive mussels.

support, mobilizing, communicating to officials

recruiting partners to provide detection / monitoring support if needed

Mobilization of equipment/personnel.

on the ground support, training

I think it will be more challenging for mussels; people can "see" a fire or flood from their home/commute. Harder for mussels in lake.

