


# Quagga/Zebra Mussel Surface Survey Protocol\*

## California Department of Fish and Wildlife

\*This protocol was adapted from the California Department of Water Resources *Zebra/Quagga Mussel Surface Survey Protocol*.

### Description of Quagga and Zebra Mussels

The quagga mussel, *Dreissena rostriformis bugensis*, and the zebra mussel, *Dreissena polymorpha*, are small mussels found only in freshwater. They look very similar to each other. They commonly have alternating light and dark brown stripes, but can also be solid light brown or dark brown. They have 2 smooth shells that are shaped a little bit like the letter “D”. These mussels are usually less than 2 inches in length. In new populations, most mussels are young and therefore very small (under ¼ inch long).

<b>Quagga Mussel</b> <i>Dreissena bugensis</i>	<b>Zebra Mussel</b> <i>Dreissena polymorpha</i>
	
<ul style="list-style-type: none"><li>• Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or dark concentric rings; paler near hinge</li><li>• Attaches to hard and soft surfaces</li></ul>	<ul style="list-style-type: none"><li>• Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or striped</li><li>• Attaches to hard surfaces</li></ul>



*Color variation in quagga and zebra mussels*

Quagga and zebra mussels are freshwater mussels that can physically attach onto hard substrates. Like the mussels found clinging to the rocks along the California coastline, quagga and zebra mussels attach onto hard surfaces (e.g. pipes, screens, rock, logs, boats, etc.). They form colonies made up of many individuals attached onto an object and even onto each other. Small newly settled mussels feel like gritty sandpaper when attached to a smooth surface. Larger mussels will feel coarser (like a small pebble or sunflower seed) or be visually apparent.

## Other Organisms Mistaken for Quagga/Zebra Mussels

### *Asian clam, Corbicula fluminea*

People often mistake the very common Asian clam (also introduced) for quagga or zebra mussels. The Asian clam is widespread and abundant in California. It is brown and has ridges in concentric rings on its shells. The shells of older clams or of dead clams are white at the hinge (where the two shells join together). These clams do not attach onto surfaces. They live in mud or sand.



### *Snails and Freshwater Limpets*

Small snails and freshwater limpets cling to hard substrates and can be mistaken for small juvenile mussels. They are similar in color and size to small quagga and zebra mussels. Snails have a spiral shape. Limpets have one shell and are flat. Quagga and zebra mussels attach on the edge of their shell and stick up and away from the surface.



## Visual and Tactile Search for Quagga and Zebra Mussels

Gently run fingers over smooth surfaces, checking for gritty feeling or small “seed-like” or “pebble-like” objects. Areas likely to harbor mussels, if they are present, include:

- Dock flotation, buoys, mooring line, cables, rocks, concrete, logs/drift wood, vegetation, and anything that has been in the water for a long time.

- Pull up and inspect any substrate that is under water.
- Trap lines and any line or cable hanging in water.

Visually inspect all hard and soft substrates. Fan areas covered with silt to expose mussels.

Inspect dark areas (dark substrates and low light/shaded areas). Do not disturb private vessels or property.

### **Prime Areas to Search**

Quagga and zebra mussels prefer dark substrates and low light/dark areas. They prefer concrete over other substrates. Search areas at or near boat ramps, gas dock, dock near marina store, other docks in high traffic areas, all concrete structures, and low flow areas.

### **Minimum Sample Size**

The minimum number of linear feet to be searched per substrate is defined below. You can stop before meeting the minimum linear feet if quagga/zebra mussels are found in 3 or more locations within the survey location, or if all available substrate has been searched.

- Boat ramp bottom – 100ft if the ramp is at a marina, 200ft if the ramp is the only structure at the survey location.
- Shoreline - 100ft if at a marina, 200ft if at a survey location with only a boat ramp
- Dock - 200ft
- Mooring/dock lines (portion hanging in water) - 200ft
- Anchor/dock cable or chain (portion under water) - 100ft
- Concrete structures - 100ft
- Logs and woody debris – 100ft
- All accessible buoys

Make a notation in “Comments” section if minimum sample size requirements could not be met.

### **If Mussels are Found**

Record the lat/long (in decimal degrees and use WSG 84) of the mussels’ location(s) and mark/describe location(s) on the back of the datasheet. Record the type of substrate(s) the mussel(s) was found on (for example, concrete, plastic, rope, chain, buoy, etc).

Make counts of mussels at up to 3 locations within the survey site. If more locations are found, make a note in the “Comments” section.

At each of the 3 mussel locations, take density estimates using one or both methods:

- Petri dish: place Petri dish over surface. Count all mussels within circle.
- Ruler: place ruler adjacent to mussels. Count all mussels within one inch of ruler.
- If you cannot see the mussels, count the mussels using touch. If entire ruler cannot be placed on surface, record the length of the ruler used.
- Collect 5 density estimates per mussel location.

Collect specimens (4-5). Place in Ziploc bag with label. Label should include location, lat/long, date, and name of collector. Seal and keep dry or put in freezer. Do not put water in the bag.

If other species of clams or mussels are found, collect specimens (1-2) and place in bag with collection label. Seal and keep dry or put in freezer. Do not put water in the bag.

### **Data Recording and Reporting**

Datasheets are available at:

<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=4949>

If mussels are found, immediately contact the appropriate CDFW regional mussel contact.

Every time a survey is made the data must be recorded on a datasheet before leaving the field. Absence information is as important to document as presence, so complete and submit a datasheet even if no mussels were found. Send datasheets to the appropriate CDFW regional contact. All data will be entered into a data reporting system and the datasheets will be retained on-site.

### **CDFW Regional Scientist Contacts**

For the current list of CDFW's Regional Quagga/Zebra Mussel Scientists and their contact information, please visit CDFW's quagga/zebra mussel webpage at

[www.wildlife.ca.gov/mussels](http://www.wildlife.ca.gov/mussels), or download the contact list here:

<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=4955>.

# Quagga/Zebra Mussel Surface Survey Data Sheet

(Use Pencil Only)

Waterbody \_\_\_\_\_

Date \_\_\_ / \_\_\_ / \_\_\_

Location \_\_\_\_\_

Crew

GPS \_\_\_\_\_

(Decimal Degrees, WSG 84)

Secchi Depth

Wave Chop

## # Linear Meters of:

Boat Ramp Bottom   
(30 m at marina, 60 m at ramp only)

Shoreline   
(30 m at marina, 60 m at ramp only)

Dock (60 m)

Concrete Structures (30 m)

Mooring Line (60 m)

Logs/Woody Debris (30 m)

Anchor/Dock Cable (30 m)

Other \_\_\_\_\_

% of Dock/Marina/Boat Ramp Searched

Quagga/Zebra Mussels Present? Y / N

Specimens Collected? Y / N

Exact GPS Location  
(if isolated occurrences):

Mussel Density (# of mussels):

Method  
(circle one):

1

Ruler / Petri

Ruler Length (if < 0.5 m) \_\_\_\_\_

Substrate Type

2

Ruler / Petri

Ruler Length (if < 0.5 m) \_\_\_\_\_

Substrate Type

3

Ruler / Petri

Ruler Length (if < 0.5 m) \_\_\_\_\_

Substrate Type

Corbicula Clams Present? Y / N

Snails Present? Y / N

Other Mussel/Clam Species Present? Y / N

Specimens Collected? Y / N

**Quagga Mussel**

*Dreissena rostriformis bugensis*



- Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or dark concentric rings; paler near hinge
- Attaches to hard and soft surfaces

**Zebra Mussel**

*Dreissena polymorpha*



- Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or striped
- Attaches to hard surfaces

**Asian Clam**

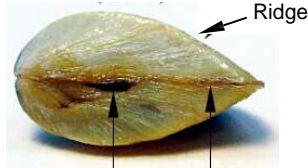
*Corbicula fluminea*



- Shell: fan-shaped and symmetrical; thick, hard; deep ridges; solid light to dark brown; may have a white patch near hinge
- Burrows into sand or mud; never attaches to structures
- Dead shells often found along shoreline



Asymmetrical; curved midventral line; shells do not join together tightly



Bilaterally symmetrical; join together in a midventral line

**Map of sampling location:**

Place empty circles (○) in areas that were surveyed but no mussels were found. Place circles with plus sign (⊕) where mussels were found, and number 1, 2, or 3 to correspond to GPS coordinates.

Did weather conditions negatively affect sampling conditions? Y / N

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_