Quagga/Zebra Mussel Artificial Substrate Monitoring Protocol*

California Department of Fish and Wildlife

*This protocol was adapted from the California Department of Water Resources *Monitoring Instructions for Zebra/Quagga Mussel Plate Samplers,* April 2, 2008.

Artificial substrates are employed alone or in conjunction with existing surface surveys to sample for juvenile and adult dreissenid mussels. Artificial substrates may be the only option when there is an absence of suitable existing surfaces, such as in open water, near a dam, or over soft substrates.

This protocol includes specifications to construct a standardized substrate sampler, however alternative dimensions and materials may also be used. The goal with any artificial substrate is to provide conducive surfaces and sheltered areas to promote mussel colonization. Should the substrate become infested, it is also helpful if it can be measured so the density of mussels can be quantified, but that is less important where early detection, rather than monitoring known populations, is the purpose.

When, Where, and How to Monitor

Artificial substrates should be checked monthly year-round, as access permits. The number deployed and placement would vary by waterbody, targeting the likely points of mussel introduction and drift of planktonic veligers.

Quagga and zebra mussels are transported between waterbodies by watercraft (e.g., boats, wave runners, etc.), water diversions, and the natural downstream flow of a river system. Monitoring sites should be selected with these factors in mind. Prime sites are those with high boat traffic and downstream of source water. If you are sampling at a waterbody that allows boating, select a site that has a lot of boat traffic. Examples are boat ramps, gas docks or dockside marina stores. Artificial substrates can also be used to monitor in streams and rivers, provided they are placed in low-flow conditions. Water flow across substrates greater than 2 meters/second preclude settlement of veligers, therefore will not be effective for monitoring.

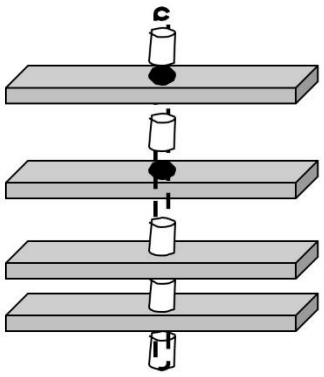
Within a site find a location with low flow and protection from vandalism. Marinas often offer both features. Within a marina, find a location with restricted public access. Avoid placing the artificial substrate at unsupervised boat ramps because of tampering and entanglement with the dock cabling system when the water level changes, or the ramp is moved. If these types of structures are not available, find a site downstream of the boat traffic that offers as much protection from vandalism as possible. Examples include water quality monitoring stations or towers and government agency boathouses. Always ask for permission before attaching artificial substrates to structures. Again, find a location that offers protection from vandalism and has low flow.

Artificial Substrate Construction and Assembly

To construct the artificial substrate, you will need the following materials cut to size:

- (4) 6 in x 6 in x 0.25 in black/grey PVC with 1 in hole through center
- (5) 1.5 in x 1.375 in (35 mm) exterior diameter PVC or ABS tube
- 8.5 in x 0.8125 in (21 mm) exterior diameter PVC or ABS tub
- ~25 ft plastic coated cable or rope
- Some form of attachment to keep plates from floating up
- Weight
- Laminated label with your contact information

To assemble the substrate, run the cable or rope through the 8.5-inch tube and secure at one end. From the loose end of the rope, string on the remaining pieces, alternating between the short segments of tube and the plates, beginning and ending with the short tubes (see figure). Secure the top tube to the rope to prevent the pieces from floating up. If necessary, attach a weight to the bottom of the assembly. Attach the label to the cable where the cable is secured to the structure.



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Biological Research
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For information about this study contact
XXXXXXXX, Environmental Scientist
(XXX) XXX-XXXX
SAMPLE

Deployment and Inspection of the Artificial Substrate

Depending on water clarity and depth, the artificial substrate should be set below the euphotic zone (below the depth of light penetration) or 2 meters, whichever is deeper, and at least 1 meter above the bottom. Deploy one to two substrates per site. If the site

is shallower than 2 meters, raise the substrate about 1 meter off the bottom. Record the actual sampling depth. At sites that are deep and have little vertical mixing, install a second substrate at a depth of approximately 15 meters below the surface (or one meter off the bottom if the depth is less than 15 meters).

A visual and tactile examination of the artificial substrate is conducted every month for attached quagga and zebra mussels. When mussels first attach, they are very small (invisible to the naked eye) and delicate (shells are thin and easily crushed). A single mussel may feel like a grain of sand. If many mussels cover a surface, the surface feels gritty like sandpaper. In approximately 1 to 2 months, a mussel grows large enough (0.5 cm) to be seen upon close inspection, but the shell is still very delicate. At this size, it feels like a small pebble or sunflower seed.

To check an artificial substrate, first carefully lift it out of the water and place it in a large plastic tub (the tub will capture any mussels that fall off). Avoid knocking the substrate as you pull it out of the water because you may dislodge or crush any attached mussels. First visually inspect each plate (top, bottom, and sides), the spacers, the cable, and the weight. After looking closely, attempt to gently push any attached organism that might be a mussel. Freshwater limpets and snails easily move or slide across the plate. Quagga and zebra mussels stick in place or are more securely attached. In all cases, if in doubt, bag it.

If no mussels are detected, lower the substrate back into the water and check again in a month. Quagga and zebra mussels are more likely to attach to a substrate that has some algal growth. However, if the substrate becomes too heavily coated, it may be unsuitable for mussel settlement. As necessary, gently remove heavy accumulations of algae to maintain suitable conditions for settlement.

Specimen Collection

If you suspect you have found a mussel, immediately contact the appropriate CDFW regional mussel contact. To aid identification, first take a close-up digital photograph of each specimen. Next, collect the specimen(s) and place in a vial with 70% ethanol. Label the vial with location, date, and name of collector. If ethanol is not available, place the sample in a rigid container (to prevent crushing) without water, label, and refrigerate. E-mail the photos to the CDFW contact and they will attempt to identify the specimens from the photographs and will request the actual specimen(s) to make a positive identification.

If the entire artificial substrate needs to be retained for laboratory processing, place the entire unit in a large Ziplock bag or small garbage bag and keep it in a cooler with ice while in the field. Store the substrate in the freezer until ready to mail. Mail it “overnight delivery” on ice.

Replacement of Artificial Substrate

Replace missing or broken artificial substrates as needed. If the substrate is repeatedly lost or damaged, look for a new deployment site that offers more

protection. Report any incidents and the action(s) taken.

To prevent any possibility of contamination between monitoring sites (should mussels be present and not yet detected), never take a substrate from one site and place it at a different site (even within a single waterbody).

Data Recording and Reporting

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

Datasheets are available at:

https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=194901

CDFW Regional Scientists

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

California Department of Fish and Wildlife
Artificial Substrate Datasheet

Waterbody:	**County:**
Date:	**Collector:**
Substrates	
Location Description:	**Substrate Depth** (m):
GPS (decimal degrees WSG 84):	
Substrate (circle one) Present Missing	**Substrate Condition** (circle one) Intact Damaged
Mussels (circle one): Present Absent	**Species** (circle one): Quagga Zebra Unkown
If present, approximate number of mussels (circle one): 1-10 11-100 100+	
Comments:	
Location Description:	**Substrate Depth** (m):
GPS (decimal degrees WSG 84):	
Substrate (circle one) Present Missing	**Substrate Condition** (circle one) Intact Damaged
Mussels (circle one): Present Absent	**Species** (circle one): Quagga Zebra Unkown
If present, approximate number of mussels (circle one): 1-10 11-100 100+	
Comments:	
Location Description:	**Substrate Depth** (m):
GPS (decimal degrees WSG 84):	
Substrate (circle one) Present Missing	**Substrate Condition** (circle one) Intact Damaged
Mussels (circle one): Present Absent	**Species** (circle one): Quagga Zebra Unkown
If present, approximate number of mussels (circle one): 1-10 11-100 100+	
Comments:	

Submit completed datasheets to the appropriate California Department of Fish and Wildlife Regional office.