

November 12, 2008

To: Chris Lee
Solano County Water Agency (SCWA)

Subject: Update: Dreissenid Mussel Surveillance Monitoring
in Solano System



Low water level exposes various infrastructure that are ideal for mussel colonization. Image at Rancho Monticello Resort, Lake Berryessa. October 2008.



Quagga mussel shells exposed by low water conditions at Lake Mead NV.



Quagga mussel shells exposed by low water conditions at Lake Mead NV.



Exposed lower end of launch ramp at Spanish Flat Resort, Lake Berryessa. Site statistically high as a settlement site for mussels.

Executive Summary Points:

1. To date all dreissenid mussel surveys in Lake Berryessa and the Solano System have been NEGATIVE.
2. Reliable information from suggests the Quagga Mussel infestation in Lake Mead was established 2-3 years earlier than originally represented.
3. Hypothetically, If mussels were transferred to Lake Berryessa in the last 2-3 years, settlement of the adults would have taken place in areas now exposed by the lower water levels.
4. Sites statistically vulnerable to mussel invasion in the Berryessa drainage - such as launch ramps and boat docks - have been identified and are being surveyed as baseline information.
5. The baseline surveys of the marinas on Lake Berryessa have been conducted under a partnership with the following:
 - a. Solano County Water Agency (funding for Markley and Capell coves.)
 - b. U.S. Bureau of Reclamation (provided a boat and operator and access to closed marinas)
 - c. Wildlife Survey & Photo (land and plankton surveys at closed marinas.)

Report:

- A. **Monitoring Sites:** Routine Dreissenid Mussel surveys in the Solano System are proceeding with the following:
 - a. Lake Berryessa:
 - > Markley and Capell coves are surveyed by boat 1-2 times per month using 64 micron mesh plankton tows.
 - > Capell Cove, Spanish Flat, Steele Park Resort, Rancho Monticello Resort, Putah Creek Resort, Pleasure Cove, and Headquarter's Cove have been sampled using routine plankton monitoring for baseline plankton information.
 - > Capell Cove, Spanish Flat, Rancho Monticello, Headquarter's Cove, and Putah Creek Resort have been inspected visually by land.



Exposed outcrop near Putah Creek Resort.



High and dry sunbathing dock. Putah Creek Resort. October 2008.



Abandoned Dock. Putah Creek Resort. Lake Berryessa. October 2008.



Dock. Putah Creek Resort. Lake Berryessa. October 2008.

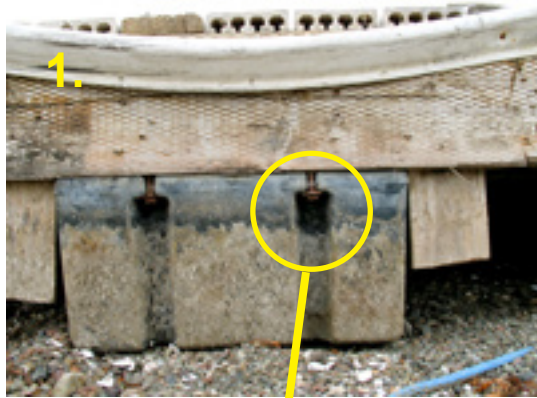
- > Colonization plates at Capell, Headquarter's Cove and Monticello Dam are checked every month.
- b. Monticello Dam:
 - > Routine checks of colonization plates, existing boulders, and plankton tows conducted monthly.
- c. Putah Diversion Dam:
 - > Colonization plates inspected monthly.
- d. Putah South Canal:
 - > During routine NZMS monitoring, gates and other infrastructure are quickly examined visually.
- e. Terminal Reservoir:
 - > Survey techniques remain the same for NZMS and dreissenid mussels. Existing cobble and colonization plates examined monthly.
- f. Putah Creek:
 - > Available information claims that most creeks will not have sufficient zooplankton and phytoplankton to support mussel populations.

B. Techniques (Monitoring for Dreissenid Mussels)

- a. Monitoring Theory:
 - > Mussel introductions typically occur first at high-risk sites such as launch ramps and boat docks. It's important to establish a baseline survey of existing infrastructure using known mussel preferences for adult settlement.
- b. Plankton tows:
 - > To date, this is possibly the most efficient method for early detection of mussel infestations. Vertical and horizontal tows are conducted using 63 micron mesh plankton nets.
- c. Taxonomy:
 - > A system of transmitting digital images and video footage to known experts on the identification of dreissenid mussel veligers and other similar organisms has worked efficiently. Dr. Robert McMahon (University of Texas) has been helpful with identifying the differences between Asian Clam and Dreissenid Mussel veligers. Asian clams are very common in the Solano System. It's important to establish taxonomic variations and spawning periods for Asian Clams. That task is being accomplished.



Exposed dock at Putah Creek Resort. Lake Berryessa.



(1). Exposed dock showing ideal area for mussel colonization and monitoring. Early colonization typically takes place in dark, recessed areas such as the bolt grooves shown above. (2) Enlarged and lightened using Photoshop CS3.



Abandoned dock. Putah Creek Resort. Lake Berryessa. October 2008.

- d. Life-Cycle Timing:
 - > Information from Lake Mead and Southern California suggests that mussels on the West Coast spawn year around. Until we receive more information, I will conduct plankton tows accordingly.
- e. Existing submerged materials:
 - > Examination of docks, buoys, pipes and other infrastructure.
- f. Settlement plates:
 - > Dreissenid mussels prefer certain materials, colors, and light exposures. Placement of colonization plates is important.
- g. Exposed materials:
 - Low water levels present a highly effective protocol for inspecting existing infrastructure.
- h. Photogrammetric Documentation:
 - > Digital cameras are used to examine small areas in boats, dark areas under docks, and to document inspections. Newer version of Photoshop are effective at enlarging images for closer examination in dark or confined areas. See images on left.

C. Education

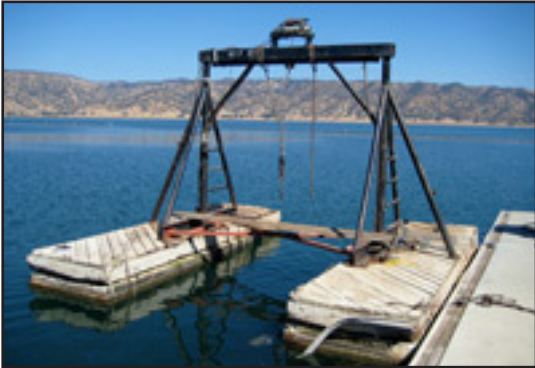
- a. Education and cooperation from known vector groups such as anglers and recreational boaters is crucial to preventing - or delaying - the introduction of dreissenid mussels into the Solano System.
- b. I routinely speak to regional angling groups about preventing the introduction of invasive species. Those programs are funded by the angling clubs and tackle manufacturers.

D. Boat Inspections, Decontamination, and Quarantine

- a. Risk / Benefit Concept: Watershed managers must weigh the benefit of allowing unmitigated access to water resources and the potential cost for mussel management.
- b. The development of a strict protocol for boat inspection and determination of "water-entry criteria" is paramount to protect the watershed
- c. Boat inspection protocol should consider:
 - out-of-state vessels
 - vessels from mussel infested counties
 - vessels recently in infested waterways
 - decontamination options
 - quarantine options (length of time)



Boat ramp - BOR Headquarters, Lake Berryessa.



Boat lift. Rancho Monticello. Lake Berryessa.
October 2008.



Monticello Dam monitoring site.



Putah Creek below Monticello Dam. Ideal mussel sample site due to large existing structure

- d. Actions taken by other agencies
 - > Lake Tahoe: TRPA now requires ALL boats to undergo mussel inspection prior to entry into the lake. Launch ramps are now closed (gated and locked) when inspectors are not available.

E. Early Detection Imperative to saving \$\$\$

- a. If the objective is to prevent adult settlement, early detection is imperative.
- b. The cost to prevent the settlement of larvae and eventually removing adult mussels is substantial. Metropolitan Water District of Southern California, has allotted approximately 10 million dollars for mussel control and removal since January 2007. At last discussion, some managers in the Metropolitan Water District believed that earlier detection would have significantly saved funds.

F. Current Recommendations

1. Complete the baseline surveys in Lake Berryessa
2. Consider staging a regional "Mussel Informational Workshop."
3. Continue present intensity of surveys with the objective of early detection and prevention of adult settlement.
4. Complete a cost analysis of mussel infestation in Solano System. (I will provide the name and contact information of individuals capable of competing such an analysis.)

Submitted to SCWA via e-mail on 11/12/08



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Putah Diversion Dam.

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Lake Mead Marina, Nevada, the site of a major quagga mussel infestation.



Lake Mead, Nevada. Heavily infested boat. Boat used for decontamination training at National Park Service Headquarters, Lake Mead. October 2008.

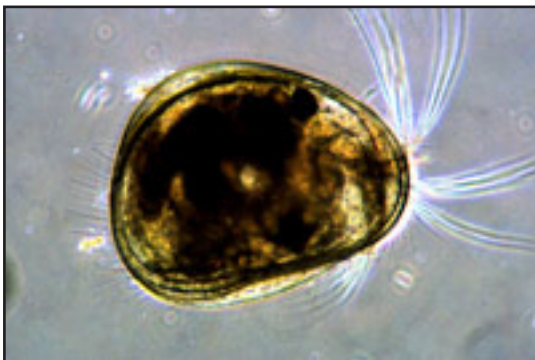


Decontamination Training at Lake Mead using portable decontamination unit.



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Asian Clam larvae (veliger) showing foot and "D" shaped hinge (shell). Certain life stages of this organism are confused with Dreissenid mussel veligers.



Seed Shrimp (Ostracod) that is commonly found in Solano System. Same shape as Dreissenid mussel larvae, but should not be confused as it has an eye spot and legs.



Seed shrimp (Ostracod) collected in plankton tows from Lake Berryessa. All specimens are examined under cross-polarized light (CPL)

END