

RECLAMATION

Managing Water in the West

Water Operation and Maintenance Bulletin

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In This Issue . . .

Miniature Pest, Giant Problem Causing Havoc
in Southwest



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This *Water Operation and Maintenance Bulletin* is published quarterly for the benefit of water supply system operators. Its principal purpose is to serve as a medium to exchange information for use by Bureau of Reclamation personnel and water user groups in operating and maintaining project facilities.

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For further information about the
Water Operation and Maintenance Bulletin, contact:

Jerry Fischer, Managing Editor
Bureau of Reclamation
Technical Service Center (86-68360)
PO Box 25007, Denver, CO 80225-0007
Telephone: (303) 445-2748
FAX: (303) 445-6381
Email: jfischer@do.usbr.gov

Cover photograph *Appearing almost as nutshells, nearly 100 shells of dead quagga mussels fit on a person's hand. In the background is a fishnet that should be transparent, but is encrusted with quagga mussel remains and is now a solid curtain.*

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<http://www.usbr.gov/pmts/infrastructure/inspection/waterbulletin>

Miniature Pest, Giant Problem Causing Havoc in Southwest¹

by Steve León, Lower Colorado Region Public Affairs Specialist

They have been clogging powerplant and water system intakes throughout the Great Lakes and Mississippi River system for several years, but were unknown in the waterways of Western States. Then, in January 2007, they were discovered in Lake Mead.

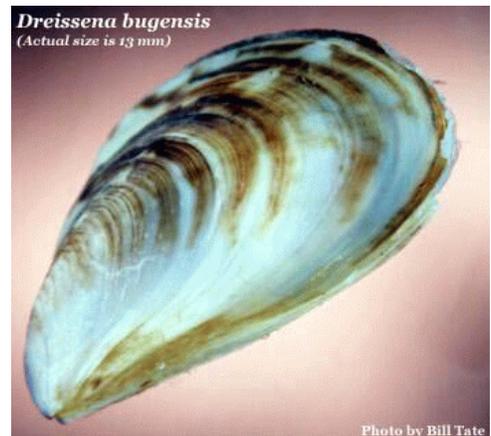
“They” are the ecosystem-threatening, pipe-plugging, menacing aquatic pests that threaten to wreak havoc on the West’s drinking water systems.

Are you confused about this group called “they”?

“They” are the fast-growing mollusks known as quagga mussels, which have apparently out-hitchhiked their pesky cousin – the zebra mussel – to inhabit the Western States.



Young quagga mussels.
LCR photo by Leonard Willett.



Quagga mussel. Photo courtesy of
U.S. Geological Society.

Native to Ukraine, the mussels were first found in North America 18 years ago in Lake Erie. They apparently hitchhiked to the United States in the ballast water of oceangoing ships.

¹ This is an April 2008 update of an article that appeared originally in the January 17, 2008, edition of the Lower Colorado *Regional Report*.

Where Are They?

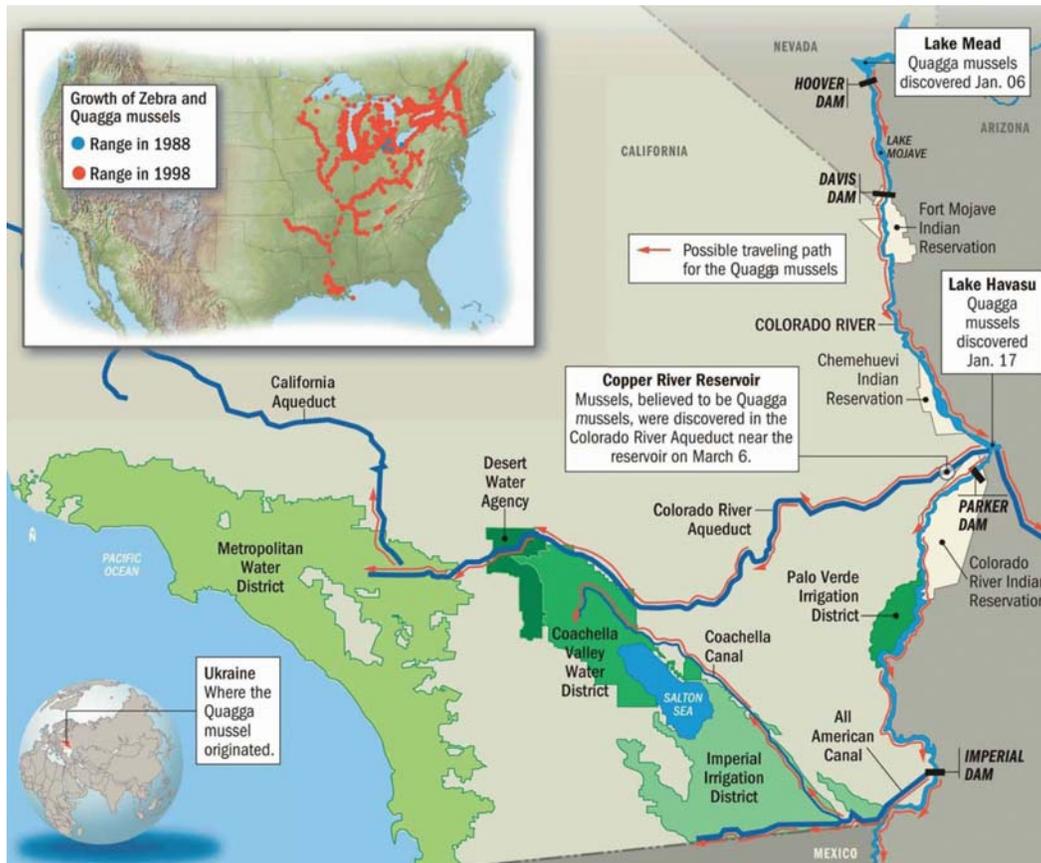
Since being discovered in January 2007 at Lake Mead, quaggas have spread downstream to several locations along the Colorado River; the Colorado River



Appearing almost as nutshells, nearly 100 shells of dead quagga mussels fit on a person's hand. In the background is a fishnet that should be transparent, but is encrusted with quagga mussel remains and is now a solid curtain. LCR photo by Steve León.

Aqueduct, which receives untreated water from the river; and reservoirs in Arizona and northern and southern California.

To combat their spread, tight restrictions have been imposed. At one southern California lake, boat operators have been banned until a high-powered, heated sprayer has been obtained by the marina to kill quagga mussels attached on vessels.



Regional Report graphic courtesy of Coachella Valley Water District and Leonard Willett.

At another lake, officials have banned float tubes, private motors, anchors, and live-bait containers with bait from any source other than the lake concession.

In Nevada, water managers launched a crash program to keep the pesky creature out of the Las Vegas city water system after it was found at Lake Mead. But efforts to control the spread of the diminutive water creatures have not halted its spread to Lakes Pleasant and Powell in Arizona, as well as a Central Arizona Project canal in Scottsdale.

These little clam-like mollusks attach themselves to any hard surface and reproduce “like crazy,” fouling water pipes and pumps, experts say.

A full-fledged invasion “could be lasting impacts on the ecology and infrastructure of the region,” said Jim Stolberg, a general biologist in the Lower Colorado River Multi-species Conservation Program Office (LCR MSCP).

Researchers say quagga mussels prefer still water, which makes reservoirs their preferred habitat rather than flowing rivers. They also need a route of entry. Usually, that means hitchhiking on a boat or in the bilge water of a boat transported from lake to lake.

“It’s young, known as ‘veligers,’ require calcium to build shells and plankton for food, said Stolberg. So, certain areas of the Colorado River make ideal breeding locations for them.”

Appearance

The quagga is small, rarely more than an inch long, and it looks like a little clam, which attaches itself with a viciously tight grip to any solid surface.

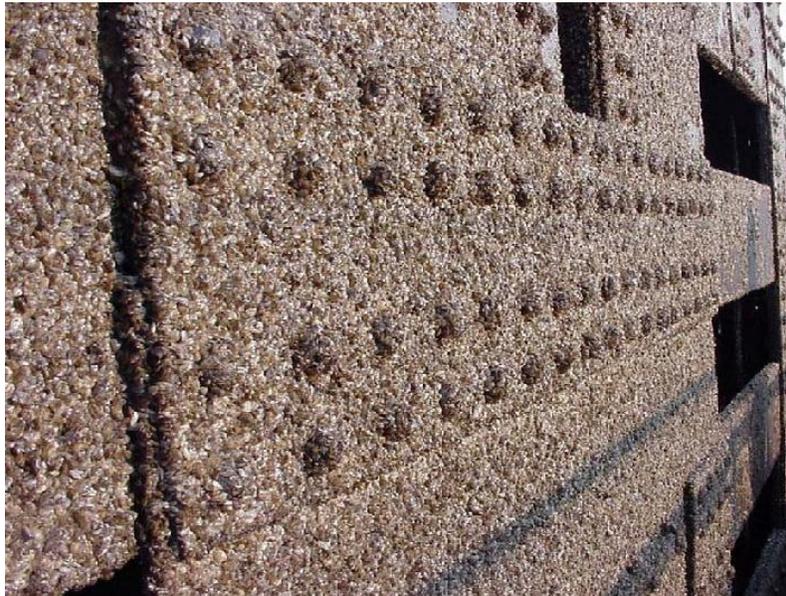
Veligers, invisible to the naked eye and seen only with the aid of a microscope, are captured, in what are probable habitat, with plankton nets equipped with a 64-micron mesh – that is, each opening in the net is 64 microns in size. For comparison, a micron is equal to one millionth of a meter, or 1/25,000th of an inch; a typical single strand of human hair is approximately 70 to 75 microns in diameter.

This stage in their lives is the time at which the mussels are most vulnerable.

In all, 1,000 liters of water are filtered through the plankton net at each site to obtain 500 milliliter samples. The collected water samples are then shipped to the Denver Office for analysis. Between sample collections, all monitoring equipment is bathed and cleansed in simple household vinegar since the veligers cannot live in acidic conditions.



A 12-inch long steel monitoring plate retrieved from near Parker Dam is encrusted with quagga mussels.



A Davis Dam gate is literally coated with quagga mussels.
LCR photos courtesy of Leonard Willett.

How Do They Exist?

Existing research results indicate mussels eat by filtering tiny organisms out of the water and reproduce by sending clouds of eggs and sperm into the water which, when fertilized, settle nearby, latch on, and start growing. A single female can lay a million eggs a year, resulting in massive colonies.

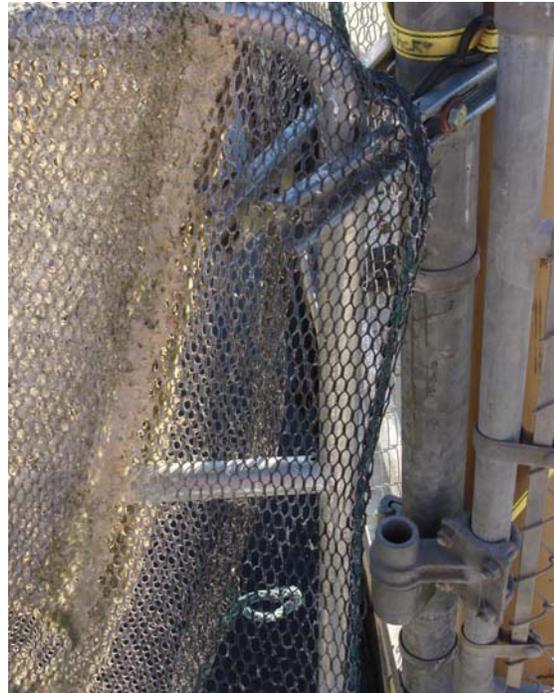
Researchers say quagga mussels pose no health risk to the drinking water supply, but they can alter the food chain of a body of water, which can lead to algae growth and poor-tasting drinking water. And, since they multiply quickly, they are capable of clogging pipes and screens at power stations; water treatment plants; and agricultural irrigation lines, pumps, and other equipment exposed to water by attaching themselves and multiplying out of control.

Additionally, they are considered impossible to eradicate after they become established in a reservoir, lake, or other body of water. In the East, it is common for water managers to have to drain pipes and use jackhammers to remove quagga or zebra mussels.

Control

“It is illegal to move noxious invasive plants and animals in waters of the United States,” said Jerry Hickman, director of the Endangered Species Programs for Lower Colorado River. And adding to the problem of quagga mussels are threats from other noxious invasive species, which include: zebra mussels; nonnative fishes such as sunfish, Tilapia, and others; and plants such as Giant Salvinia and European Milfoil.

“All southwestern states agree that boat owners are responsible if they transport any ‘aquatic hitchhikers,’” said Hickman. “The cooperative education program, designed to help the public and called ‘Stop Aquatic Hitchhikers,’ is currently being used by State and Federal agencies in Utah, Nevada, California, Arizona and New Mexico.”



A fish breeding net from the Willow Beach fish hatchery is rendered useless after colonization by quagga mussels. LCR photo by Steve León.



Near Cottonwood Cove, one of the four quagga mussel monitoring sites downstream of Hoover Dam and Willow Beach, Jim Stolberg prepares to drop a water quality probe to determine current water quality parameters (temperature, conductivity, pH, dissolved oxygen, and turbidity). The unit is lowered to the lake bottom at each site and measurements are taken at specified intervals. Depths depend on the monitoring site, and range from 10-45 meters or about 30-130 feet (all measurements are recorded in metric units). LCR photo by Steve León.

“Reclamation is one of the partners with the Bureau of Land Management and the U.S. Fish and Wildlife Service and about 29 entities in the area of Lake Havasu, which are working to limit the spread of invasive species from this popular fishing and boating destination,” he added.

Consequently, boaters and anglers in the Western States have been urged to take precautions at all waterways where quagga mussels can possibly spread. Before leaving a waterway, boaters should clean the hull and remove all plant and animal materials. In addition, water should be drained from the boat to prevent the mussels from hitching a ride to another lake or river.

At many other locations boat owners were being asked to drain vessels before leaving the reservoir parking lot and to make sure they are dry inside and out before going from one freshwater body of water to another.

Regional Response

To address the quagga mussel issue, several steps were taken in the region. Among them was the creation of a Lower Colorado Quagga Mussel Task Force chaired by Bill Bruninga and whose members include Tim Dewey, Bob Walsh, Tom Burke, and Jerry Hickman.

Additionally, a Lower Colorado Dam Office (LCDO) action plan was developed, and following the guides outlined in the plan, regional staff members, under the direction of Leonard Willett, Hoover Dam's Water Treatment manager, are "Currently setting up monitoring programs at all three dams – Hoover, Davis and Parker," he said. As part of LCD Monitoring, plates have been installed in the dams' forebays and tail races. "Bio-Boxes" (side-stream samplers, which are aquarium-like devices to monitor the settlement of mussels in the powerplant) have also been installed.

The plan is based on a recently completed comprehensive review of all three dams with a quagga mussel consultant – RNT Consulting, Inc. – and addresses methods for dealing with and controlling quagga mussels.

"At individual dams, the mitigation strategy chosen will be based on engineering assessment of the individual mitigation strategies available," it said.

"Duplex strainer screens will be replaced with self-cleaning, 1/8-inch screens to collect and block adult shells from entering the system," Willet added, "as we move forward in the fight against quaggas."

He also said the plan was presented recently to the power customers as well as Reclamation personnel.

Highlights of the Lower Colorado Dams Office Quagga Mussel Action Plan

- Installation of monitoring equipment and replacement strainers
- Installation of smooth metal or stainless steel plates at 10 foot intervals in the fore bay of each dam near the intakes and tail bay areas. Smooth plates are preferred because half of the plate will be scraped on a monthly basis to determine new mussel settlement. The remaining un-scraped half of the plate will be observed for colonization over time.
- During the first week of each month, findings from each plate will be recorded.
- Bio-boxes will be installed on internal piping in an area closest to the beginning of the cooling water intake lines, and if possible, at the end of the process.
- Visual inspections of all trash racks will be done every 3 to 4 months beginning in April and continuing through November. All pipeline intakes and strainers will be inspected also to observe or remove colonization.
- Immediately replace all duplex strainers with 1/8" screens. Self cleaning strainers may be required with smaller screen.
- Accumulation of mussels in large numbers on the sampling plates and trash racks will require more frequent cleaning. As exterior pipe lines start to become colonized and cooling water strainers begin to plug additional cleaning will also be required.
- If mussel colonization creates on-going operations and maintenance problems, control measures will be needed such as, flushing with 104F water (rapid response), installation of filter systems (40 micron absolute) or focusing ultra violet light on the affected areas of pipelines (UV light can provide effective prevention of mussel settlement), and possibly contracting with a vendor for permit acquisition and chemical (chlorine) applications for any necessary immediate control.



Jon Nelson lowers a 12-inch in diameter Secchi disk painted with two black and two white alternating quadrants to measure and record the turbidity of water quality at survey sites in the Colorado River. Clear water is one indicator of mussel presence. LCR photo by Steve León.

Concurrently, an ongoing monitoring program will determine what type of control system to set up or if any system is needed, Willett said.

The consultant’s findings and recommendations were divided into two reports. One focuses on Davis and Parker Dams – “Assessment of the Potential Impact of Quagga Mussels on Davis and Parker Dam and Recommendations for Monitoring and Control.” The second report, which focuses on Hoover Dam, will appear later this month.

“Hoover and Davis Dams appear to have time to evaluate monitoring data and determine what path forward we want to choose,” said Willett.

Communication with all the utilities will continue as alternatives are determined, and then the associated costs will be presented for their consideration.

Recent Update

Since the time this article was originally published, quagga mussels have been found in the piping systems of Davis and Hoover Dams. Additionally, mussel colonies have been found in the powerhouses of both dams.

“Control measures at this time is reactive and being completed using a rapid response plan by flushing with hot water or dismantling equipment so the mussels can be removed,” said Willett.



A water intake at Davis Dam outside Unit 1. LCR photo courtesy of Leonard Willett.

“Long-term, pro-active measures are being evaluated at Hoover Dam, such as replacing forebay water supply with tailbay water for all cooling water systems.”

Tailbay water has a much lower population of mussels than forebay water. The proposed replacement system will be designed with mussel barrier control incorporated into the design (i.e., installing strainers followed by ultraviolet or self-cleaning filter prior to using the water in the powerhouse).

Davis Dam staff members are replacing the 3/8-inch basket screens with a 1/8-inch screen of the existing strainer to evaluate the effectiveness of adult or debris mussel removal.

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“Additionally, the domestic water supply line is being colonized and staff members are evaluating the better option between hot water flushes or mechanical cleaning,” Willett said. “On the exterior in the forebay the inlet is becoming colonized and mussels will need to be removed by divers or by the use of high-pressure water in the near future.”

For additional information contact:

Leonard Willett
Lower Colorado River Dam’s Office - Hoover Dam
LCD-2300 - PO Box 60400
Boulder City, NV 89006-0400

(702) 494-2216
(702) 494-2297 (FAX)
E-mail: LWillett@lc.usbr.gov

Mission

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The purpose of this bulletin is to serve as a medium of exchanging operation and maintenance information. Its success depends upon your help in obtaining and submitting new and useful operation and maintenance ideas.

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Jerry Fischer, Bureau of Reclamation, ATTN: 86-68360, PO Box 25007,
Denver, CO 80225-0007; (303) 445-2748, FAX (303) 445-6381;
email: jfischer@do.usbr.gov

Vicki Hoffman, Pacific Northwest Region, ATTN: PN-3234, 1150 North Curtis
Road, Boise, ID 83706-1234; (208) 378-5335, FAX (208) 378-5305

Steve Herbst, Mid-Pacific Region, ATTN: MP-430, 2800 Cottage Way,
Sacramento, CA 95825-1898; (916) 978-5228, FAX (916) 978-5290

Albert Graves, Lower Colorado Region, ATTN: BCOO-4846, PO Box 61470,
Boulder City, NV 89006-1470; (702) 293-8163, FAX (702) 293-8042

Don Wintch, Upper Colorado Region, ATTN: UC-258, PO Box 11568,
Salt Lake City, UT 84147-0568; (801) 524-3307, FAX (801) 524-5499

Dave Nelson, Great Plains Region, ATTN: GP-2400, PO Box 36900,
Billings, MT 59107-6900; (406) 247-7630, FAX (406) 247-7898