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Tiny Eurasian Mussel Now Threatening Mighty Hoover Dam

By SCOTT STREATER of Greenwire

Correction appended.

The Bureau of Reclamation wants to use an experimental biological pesticide to control invasive mussels that are interfering with dam and hydropower operations that supply electricity and drinking water to millions of people across the Southwest.

The problem is quagga mussels, natives of Europe and Asia discovered in the Colorado River watershed in early 2007. The organisms, which grow to about 1.5 inches, are clogging water lines that are used to cool the 17 massive hydropower turbines at Hoover Dam and have already forced dam operators to temporarily shut down turbines that supply electricity to 1.6 million people in southern Nevada, Arizona and California.

The mussels have caused similar problems at the downstream Davis Dam in Lake Mohave and Parker Dam in Lake Havasu, both of which provide electricity for thousands of people in Arizona and California. The mussels have also threatened to clog water intake lines in Lake Mead operated by the Southern Nevada Water System that supply water to more than 2 million people in the Las Vegas area.

"We're very concerned," said Fred Nibling, a Reclamation biologist in Denver who is helping lead agency efforts to combat the mussel invasion.

The Bureau of Reclamation, which operates the Hoover, Davis and Parker dams, has employed divers with high-pressure water hoses to blow mussels out of pipelines and filter gates, and the agency retains the option of using chlorine treatments on the mussels if necessary. But those treatments are expensive, temporary and, in the case of chlorine, can have negative environmental effects.

So the bureau has applied to U.S. EPA for an exemption waiver that would allow it to use an experimental pesticide that contains the freshwater bacteria *Pseudomonas fluorescens*, which in laboratory tests has shown great promise to kill quagga mussels, and their invasive cousins zebra mussels, without harming other organisms.

The waiver is needed because EPA has not approved commercial use of the pesticide. If approved, it would mark the first time the pesticide has been used to treat zebra and quagga mussel infestations in the United States, Nibling said.

"We have not faced any crisis levels yet," Nibling said. "But we want to have our operators equipped with the latest tools if a situation arrives where they need to aggressively attack the mussels."

EPA is reviewing the request to use the pesticide, manufactured by California-based Marrone Bio

Innovations, and has asked Reclamation officials to more narrowly define where they plan to apply the pesticide, according to Dale Kemery, an EPA spokesman.

Great Lakes pest moves West

The bacteriological pesticide, which Reclamation wants to begin using early next year, is the latest tool in an ongoing battle to curtail the rapid and devastating spread of quagga and zebra mussels.

The mussels were first discovered in the Great Lakes region in the late 1980s, where they were introduced by foreign ships emptying their ballast tanks. Since then, the mollusks have clogged industrial water pipes and caused widespread ecological problems. Today, they are estimated to cause more than $5 million a year in damages to the Great Lakes region.

While the mussel infestation in the Lower Colorado River has not reached the same level of severity as in the Great Lakes, federal regulators say aggressive action is needed to keep it from spreading further into the river basin.

A widespread infestation in the Colorado River watershed would be devastating, Reclamation officials say, because the survival of the arid region is tied to the elaborate system of hydroelectric dams, canals and reservoirs.

Yet the mussels are spreading rapidly in the Lower Colorado watershed. Young mussels float in the water column and get carried by the water currents downstream, while adults attach themselves to the bottoms of boats and can be transported miles away.

"We see major colonization on our equipment, and we don't see this becoming less and less of a problem, but rather more and more of a problem," said Leonard Willett, Reclamation's Lower Colorado River quagga mussel coordinator.

An expedited process

Registering a new pesticide or other chemical product normally requires an exhaustive regulatory review process, necessitating years of study before EPA approves it for commercial use.

But the Federal Insecticide, Fungicide, and Rodenticide Act allows for federal and state agencies to "be exempted from any provision" of the law if the EPA administrator "determines that emergency conditions exist which require the exemption."

Those conditions exist in the Lower Colorado River, according to the Nov. 12 *Federal Register* notice detailing Reclamation's request for a "quarantine exemption.

Numerous pipelines, filter screens and pumping stations "are becoming clogged" with mussels, and this "proliferation and dispersion of mussel populations threatens to seriously impact [Reclamation] operations, resulting in the interruption of hydropower and water delivery at significant economic costs," the federal notice said.

Of particular concern is the blockage of water lines designed to cool the hydropower turbines at dams like Hoover. This problem has already caused a "significant increase in the frequency of high temperature alarms in cooling systems, requiring shutdowns" so that the mussels could be removed, Reclamation said in its notice.

If approved, the bacteriological pesticide would represent a new chapter in mussel eradication because it would be the first time that officials pump a control substance into water entering pipelines, some of which are only a few inches in diameter and buried under feet of concrete.

"The next step is to treat a pipe," Nibling said.

That cannot happen unless EPA grants the exemption request. To date, Reclamation officials have only been able to test the biocide in a laboratory at the Davis Dam.

"Our hands are kind of tied," said Willett, the quagga mussel coordinator. "We really can't test or put it into the cooling water lines and see how effective it is. We can theorize from our lab tests that ... it is very effective, but until we can use it [in real-world applications], we don't know."

Keith Pitts, vice president of regulatory affairs for Marrone Bio Innovations, the pesticide manufacturer, said the company is confident the pesticide would be effective at killing mussels. "We've seen good, high mortality rates, in the 90 to 100 percent range," he said.

On questions of safety, Willett said Reclamation would only use dead bacteria in the pesticide. But even dead, the bacteria has been shown to release a toxin that attacks the cells in the mussels' digestive gland, causing massive hemorrhaging that kills individual mussels within hours, and entire colonies within days.

Still, some have raised concerns about whether *P. flourescens* has been thoroughly vetted by independent scientists.

Andrew Cohen, a marine biologist who directs the Center for Research on Aquatic Bioinvasions in Richmond, Calif., chaired a state science panel that devised a mussel action plan for the California Fish and Game Department.

Cohen said the panel reviewed the pesticide but was unimpressed by its kill ratio of between 70 and 100 percent. He also said he was struck by the fact that, at least at the time, the majority of testing had been done by those that were advocating its use.

But Cohen said Reclamation's plan to use dead bacteria "doesn't seem like an unreasonable thing to test out in the environment."

"If it were live, that might be different, because once you've got something live out in the environment, you can't issue a recall notice and get it back," he said.

A better alternative

One of the key arguments employed by those in favor of the biological pesticide is that it is better than the most commonly used chemical treatment, chlorine.

It is well known that chlorine interacts with the organic compounds in the water to produce "disinfection byproducts and carcinogenic substances" that can harm fish and other organisms, according to Reclamation documents. What's more, the quagga mussels can sense when chlorine has been added to the water and clam up for 14 days, thus requiring more chlorine applications.

The mussels cannot, however, detect *P. fluorescens*. They begin filtering it right through their systems within hours, Willett said.

"Compared to the alternatives of chemicals, it's a much better solution all the way around," he said.

The use of a pesticide could also spare Reclamation and other water management agencies from having to employ divers with water guns to manually clean intake valves and flow gates. Such treatments can be required every six months, and over time can become expensive officials say.

Thus, the Southern Nevada Water System is "following the development of that technology closely," said Ron Zegers, the water system's director.

The mussels clog the utility's two massive water intake pipelines, and if not routinely treated, they could disrupt the flow of 390 million gallons of water a day to the Las Vegas area, Zegers said. The water system spends about $1 million a year to manage the problem, he said.

"We have divers clean the inlet valves, and [the mussels] move back on after we clean them," Zegers said. "This probably will be a way of life for us for years to come unless we can come up with a method of providing chemical injections right before the inlet screens to help keep them clean."

Streater reports from Colorado Springs, Colo.

Correction: *An earlier version of this story erroneously reported that the Bureau of Reclamation had used chlorine treatments to remove mussels from hydrodam water pipelines and filter gates. While the agency has the option to use chlorine to remove mussels, it has not yet used such treatments.*

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