



US Army Corps
of Engineers
Waterways Experiment
Station

Zebra Mussel Research

Technical Notes

Section 4 — Miscellaneous

Technical Note ZMR-4-03

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Susceptibility of Navigation Locks to Zebra Mussel Infestations

Background The U.S. Army Corps of Engineers maintains and operates 195 locks (with a total of 236 chambers) in the United States. These locks differ with respect to age, type, and method of operation. Locks are used to maintain adequate water levels in large rivers to enable commercial vessels and recreational craft to navigate safely. Concern has been expressed that zebra mussel infestations at locks could slow operation and, in some cases, cause navigation hazards.

Purpose The purpose of this technical note is to summarize recent information on the presence of zebra mussels at navigation locks in the inland waterway system. In addition, strategies for controlling zebra mussels at locks are discussed.

Additional information This technical note was prepared by Drs. Andrew C. Miller and Frank Neilson, U.S. Army Engineer Waterways Experiment Station (WES), and Ms. Karen Gunnison, Kalamazoo College, Kalamazoo, MI. For more information, contact Dr. Miller, (601) 634-2141, or Dr. Neilson, (601) 634-2615. Dr. Ed Theriot, WES, (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Locks with zebra mussel infestations Zebra mussels were first noticed in the St. Lawrence Seaway in winter 1988-89, in a pool regulation culvert at Snell Lock. In fall 1989, zebra mussels were observed on mooring bits in the same lock. By winter 1990-91, Snell Lock had a major zebra mussel infestation, and a few zebra mussels were found at Eisenhower Lock, located 3 miles west on the St. Lawrence Seaway. In winter 1991-92, few zebra mussels were found in Snell Lock, but a major infestation was found at Eisenhower Lock. Here, mussels were found on the wall, floor, sill, miter gates, and cables, as well as on concrete, wood, and painted metal. Very few were found on a tainter gate covered with epoxy paint.

Mussels were found either singly or in clusters (2 or 3 in. in diameter) of 50 to 150 individuals. Zebra mussels were most common on partially eroding concrete that needed repair, or in joints between the monoliths. They were not found on trash racks or in culverts, presumably because of the high water velocities.

Operations personnel of the St. Lawrence Seaway reported no specific problems with zebra mussels in their locks. Zebra mussels did not affect operation of gates, water flow, pressure, or water-level sensing equipment. The mussels occasionally caused minor objectionable odor when the chamber was dewatered (Shafer 1992). This was particularly noticeable since the top of the chamber had been covered to provide more agreeable working conditions during winter maintenance.

Zebra mussels were found at Black Rock Lock in Buffalo, NY, in fall 1989. Since then, the lock walls have become infested with mussels. This lock was last dewatered before the infestation. As of fall 1992, operation of Black Rock Lock has not been negatively affected by zebra mussels. The chamber was dewatered in January 1993, and all equipment was inspected for damage. Lock personnel found evidence of corrosion on metallic surfaces, but no structural damage.

Zebra mussels were found in September 1991 on a vertical lift gate at the Melvin Price Locks and Dam, near Alton, IL. Less than 50 individuals were collected; all were approximately 1 cm long. Mussels could have settled as veligers in early 1991 or late 1990. Alternatively, they could have been scraped off a barge in 1991.

In January 1992, Lock 25, located north of St. Louis on the upper Mississippi River, was dewatered for maintenance and inspection. Approximately 100 adult zebra mussels, about 1 cm long, were found. Mussels had probably settled as veligers early in 1991 or could have been scraped off a barge. Zebra mussels were found along the lock wall and on the floor of the lock. Specimens were usually found singly or in groups of two or three.

A lock on the Welland Canal was examined for zebra mussels when it was dewatered in February 1992. Zebra mussels were found singly or in groups of 10 or 20 in monolith joints. Small clumps of individual mussels were found at the base of the monolith joints. No zebra mussels were found in culvert openings.

Most zebra mussels probably do not survive a dewatering, especially when conducted under freezing conditions. Since locks in the Welland Canal and St. Lawrence Seaway are dewatered each year, it is possible they will not have heavy zebra mussel infestations. Personnel at the Seaway have found extensive infestations on water intakes that are outside Snell Lock chamber and therefore unaffected by dewatering. Locks in the central United States that are not regularly dewatered could be more susceptible to heavy infestations. However, zebra mussels have been at Black Rock Lock since 1989, and personnel have reported no major problems. This lock is not regularly dewatered.

**River reaches
infested with
zebra mussels**

By May 1993, the following rivers had become infested with zebra mussels:

- Ohio River between river mile (RM) 981.0 (its mouth) and RM 161.7.
- Cumberland River between its mouth and RM 148.7 at Nashville, TN.
- Tennessee River between its mouth and RM 424.7.
- Upper Mississippi River between St. Louis, MO (RM 250.0), and St. Paul, MN (RM 853.3).

- Lower Mississippi River between New Orleans, LA (RM 98.0), and its confluence with the Ohio River (RM 953.5).
- Illinois River between its mouth and where it joins the Des Plaines and Kankakee Rivers, 45 miles southwest of Chicago, IL.

As of May 1993, over 30 Corps locks on major rivers were infested with zebra mussels.

- Kanawha River, West Virginia (3 locks).
- Ohio River (7 locks).
- Cumberland River (2 locks).
- Tennessee River (4 locks).
- Upper Mississippi River (12 locks).
- Illinois River (8 locks).

An estuarine mussel (*Mytilopsis leucophaeta*) has also been found in the inland waterway system. This species does not reproduce in fresh water (Marelli and Gray 1983), but is known to be carried from brackish water on hulls of commercial and recreational vessels. *Mytilopsis leucophaeta* was collected in Kentucky Lock in fall 1992, and has been regularly collected in Kentucky Lake (personal communication, Dr. Jim Sickle, Murray State University, Murray, KY). This species is not capable of reproducing in freshwater and should not affect structural components of public facilities along inland waterways.

Control strategies

A group of scientists and engineers with expertise in navigation lock design and operation identified two components particularly vulnerable to zebra mussels. These were gage wells and other small-ported devices used to house water-level sensing equipment, and raw water systems used for fire protection. The working group recommended that raw water systems be periodically drained and treated with hot water or steam. Also, chlorinated water should be used instead of untreated raw water, or screens with small mesh should be installed over water intakes. Ensuring that the water is not used regularly for other purposes (which reoxygenates standing water) could help to eliminate zebra mussels.

The group also recommended that gaging wells be inspected by deploying inexpensive monitoring devices, such as ceramic tile, concrete blocks, or polyvinyl chloride plates suspended from rope or cable. These devices can be easily removed for examination. The interior of gaging wells can be treated with small amounts of chlorine. The pipe that encloses pressure sensors, as well as other small piping leading to raw water, could be treated with an antifoulant coating.

References

- Marelli, D. C., and Gray, S. 1983. "Conchological Redescriptions of *Mytilopsis sallei* and *Mytilopsis leucophaeta* of the brackish western Atlantic," *The Veliger*, Vol 25, No. 3, pp 185-194.
- Shafer, D. 1992. "A Preliminary Examination of Odor Problems Caused by Zebra Mussels," Technical Note ZMR-4-04, Zebra Mussel Research Program, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.