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Station

Zebra Mussel Research Technical Notes

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Zebra Mussels at Lock and Dam 6, Upper Mississippi River, January 1994

Background and purpose

Zebra mussels have existed in the upper Mississippi River since 1991. In early December 1993, Lock and Dam 6, located at Trempealeau, WI, was dewatered for major maintenance and repair. The dewatering provided an opportunity to collect information on the density of zebra mussels on a fixed structure, specifically lock walls, gates, and other structures within the chamber.

Additional information

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Methods

Zebra mussels were sampled on two structures within the dewatered chamber. A 1-m^2 quadrat was randomly placed at various locations on the floor of the lock chamber, and the zebra mussels attached to the floor within the quadrat were counted. The insides of large intake and emptying ports, which provide internal drainage of the chamber (Figure 1), were also sampled. Zebra mussels were usually attached to the top of these ports; therefore, only the top dimensions were used to calculate densities. Ports had different top dimensions depending on location within the lock chamber. Ports located on the west side had top surface areas of approximately 2.6 m^2. Ports on the eastern side had top surface areas of approximately 1.5 m^2.

Results and discussion

Zebra mussels were sparsely attached to lock walls and hard surfaces throughout the lock chamber. A mean density of 7.9 mussels/m^2 was estimated for zebra mussels attached to the lock chamber floor (Table 1). A higher density (19 mussels/m^2) was estimated for zebra mussels attached to the inside tops of intake ports. In July 1993, a density of 5.2 mussels/m^2 was estimated from square-meter quadrat samples collected by Corps of Engineers divers during routine lock maintenance inspections (U.S. Army Engineer District (USAED), St. Paul 1993).

The lock chamber is approximately 183 m long, 33.5 m wide and 9.3 m high. Under normal conditions, water levels in the chamber inundate approximately 6.6 m of the 9.3-m wall. The floor of the chamber is continuously inundated.

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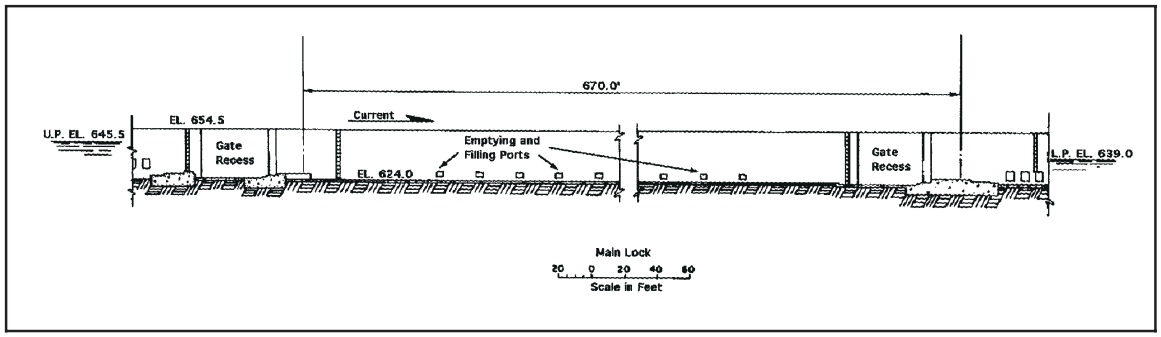

Figure 1. Cross sections of Lock and Dam 6 depicting the intake and emptying ports where zebra mussels were collected

Table 1. Summary Statistics for Zebra Mussels Collected at Lock and Dam 6 (Trempealeau, WI) and Lock and Dam 9 (Lynxville, WI), January 1994

Sampling Location: Floor of Lock and Dam No. 6												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**	**Standard Deviation**
Number	5	7	10	3	0	5	7	15	21	0	6.6	6.31
Number/ft^2	0.56	0.78	1.11	0.33	0	0.56	0.78	1.67	2.33	0	0.74	0.71
Number/m^2	5.98	8.37	11.96	3.55	0	5.98	8.37	17.94	25.12	0	7.94	7.55
Sampling Location: Intake Ports at Lock and Dam 9												
	East Side of the Chamber								**West Side**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**	**Standard Deviation**
Number	25	23	23	31	32	22	28	30	51	70	33.5	14.54
Number/ft^2	1.56	1.44	1.44	1.94	2	1.38	1.75	1.88	1.82	2.5	1.77	0.32
Number/m^2	16.8	15.5	15.5	20.9	21.5	14.8	18.8	20.2	19.6	26.9	19.05	3.48

Not considering the internal tunnels and canals in the lock structure, during normal operations approximately 8,500 m^2 of surface area is underwater and available for zebra mussel attachment. Multiplying this number by the calculated mean chamber floor density indicated that approximately 67,000 zebra mussels were on the lock chamber walls and floor prior to dewatering.

Forty intake ports (20 per side) are located in the lock chamber. A mean of 33.5 zebra mussels was observed per intake port. An estimated 1,340 zebra mussels could have attached to the top surface of intake ports prior to dewatering.

Many other surfaces in the lock chamber, including the lock gates and internal drainage canals and tunnels, had zebra mussels. No quantitative data were collected on these surfaces; however, zebra mussel densities on these surfaces appeared to be similar to those observed on the lock chamber floor, about 8 mussels/m^2.

Considering all surfaces available for attachment in the lock chamber, it can reasonably be estimated that 120,000 zebra mussels existed in the lock chamber prior to dewatering. For comparative purposes, one zebra mussel was collected from the dewatered lock chamber at Lock and Dam 8 in January 1992 (USAED, St. Paul 1992a). In December 1992, Lock and Dam 9 was dewatered. At that

time, it was estimated that between 2,000 and 5,000 zebra mussels existed in the chamber (USAED, St. Paul 1992b).

Assuming that conditions at Lock and Dam 6 were and are similar to those at Locks and Dams 8 and 9, zebra mussel numbers have geometrically increased on the order of 1 $\backslash 10^5$ in 2 years. If this trend continues, zebra mussel biofouling could begin to cause problems with lock and dam operations within 1 or 2 years. High densities of zebra mussels in intake ports and water supply conduits and on lock gates and submerged gate-operating machinery can be expected.

Zebra mussels observed on the lock chamber walls were dead as a result of freezing. Living zebra mussels were collected from seams in the lock floor where leaks of raw river water continued to enter the chamber. Between 1 and 6 in. of water remained standing on the chamber floor during collection. It is likely that water remaining in the lock would freeze solid with the onset of colder weather.

Zebra mussel shells collected from the floor of the chamber ranged in size from 1.25 to 4 cm total shell length, with the majority being approximately 2.5 cm long. One large individual, approximately 4.6 cm long, was collected. Two potential explanations exist for the presence of larger sized zebra mussels in the chamber: larger zebra mussels had been transported to the lock by barges and had fallen or been scraped off during lockage, or zebra mussels have existed in the chamber for a long time.

Zebra mussels observed attached to top areas of intake ports were usually much smaller, ranging in size from 0.1 to 0.5 cm. It is likely these smaller zebra mussels had settled on the intake ports as veligers, providing evidence of successful reproduction in the Mississippi River.

Conclusions

Reported densities of zebra mussels at Lock and Dam 6 are relatively low and currently are causing no operational problems. However, compared to the numbers of zebra mussels observed at locks and dams dewatered 2 years ago (Lock and Dam 8) and last year (Lock and Dam 9), zebra mussel numbers have increased dramatically. The size range of zebra mussels collected from the dewatered chamber indicates that a reproducing population of zebra mussels existed in the chamber prior to dewatering. It is likely that reproducing individuals still exist on guidewalls, auxiliary lock chamber surfaces, and other underwater surfaces at Lock and Dam 9.

Zebra mussel numbers have increased exponentially on lock and dam surfaces since their introduction into the upper Mississippi River. Increased problems with biofouling of lock and dams and associated machinery and native biota should be expected in the next few years. Dewatering during cold weather periods is an effective method of killing zebra mussels within lock chambers. (See also Technical Notes ZMR-2-09 and ZMR-2-10; Payne 1992a,b).

References

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