



US Army Corps
of Engineers
Waterways Experiment
Station

Zebra Mussel Research Technical Notes

Section 2 — Control Methods

Technical Note ZMR-2-09

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Freeze Survival of Aerially Exposed Zebra Mussels

Background Intertidal marine molluscs related to the zebra mussel, *Dreissena polymorpha*, are often naturally exposed to very cold air and are able to withstand freezing at temperatures as low as -10° to -20° C (Prosser 1973). In contrast, fish do not withstand freezing at temperatures of less than -2.0° C (Prosser 1973). Water freezes at 0° C and surface ice is less dense than the water underneath that ranges from 1° to 4° C. Supercooled water, especially in lotic systems, occasionally exposes truly aquatic species to slightly subfreezing water temperatures. Zebra mussels, a fully aquatic invertebrate that can occupy lentic and lotic habitats, can be effectively controlled by winter dewatering and exposure to subfreezing air temperatures.

Additional information This technical note was written by Dr. Barry S. Payne, U.S. Army Engineer Waterways Experiment Station (WES), based on studies conducted by Dr. Robert F. McMahon and Mr. Thomas A. Ussery, Center for Biological Macrofouling Research, University of Texas at Arlington. Contact Dr. Payne, (601) 634-3837, for additional information. Dr. Ed Theriot, WES, (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Experimental approach A series of laboratory experiments were conducted to test the survival of aerially exposed zebra mussels, both separate and clustered, to air temperatures ranging from 0° to -10° C. Because zebra mussels can form a thick layer of byssally attached individuals, it is important to differentiate freeze survival of separate mussels from that of clustered mussels. A thermostated, refrigerated water bath with antifreeze was used to control experimental exposure temperatures to within 0.1° C.

Results Time required for 100 percent mortality ranged from approximately 0.5 hour (at -10.0° C) to greater than 48 hours (at 0.0° C) for separate mussels (Figure 1). Mussels in clusters were more tolerant of reduced air temperatures. The time required for 100 percent mortality of clustered mussels ranged from slightly less than 2 hours at -10.0° C to over 48 hours at both -1.5° and 0.0° C. Increased survival time of clustered versus separate mussels was substantially greater at -1.5° C than at -3.0° C or less.

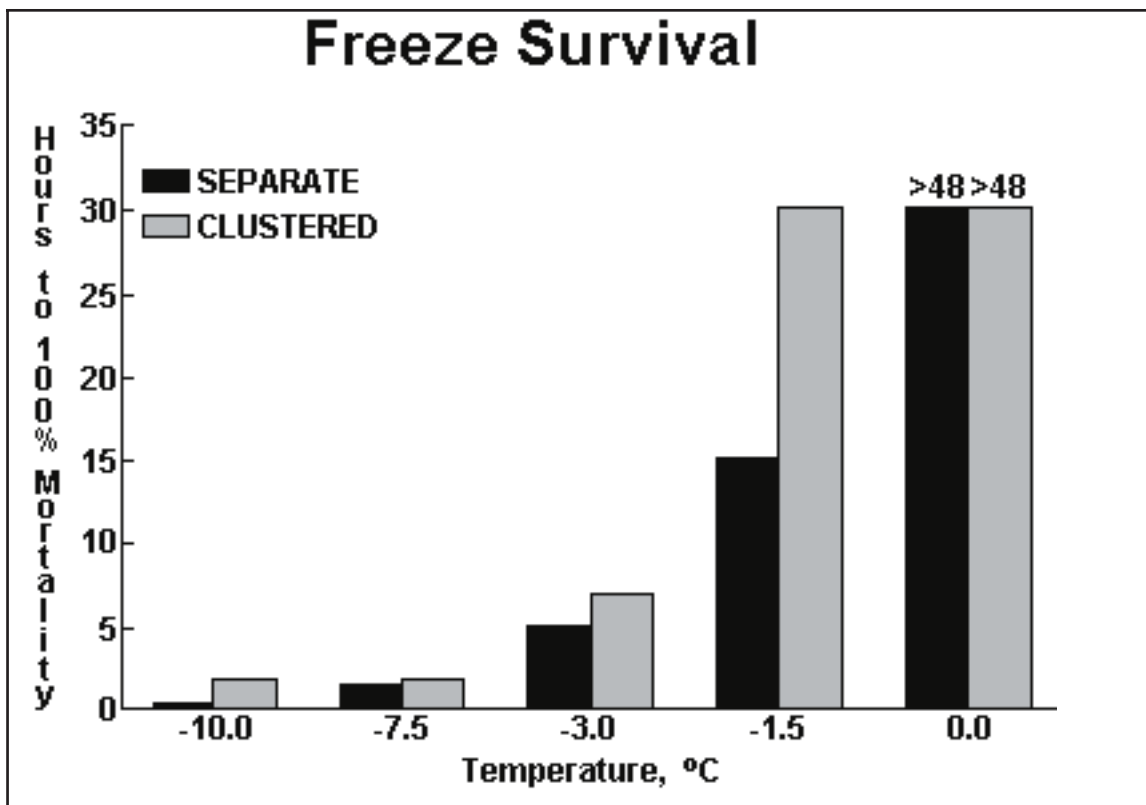


Figure 1. Time to 100 percent mortality

Implications for control

In situations where zebra mussel are tightly packed together and layered on each other (that is, locks, dams, or other public facilities where low winter temperatures are common), aerial exposure in winter at temperatures of less than -3.0° C for several hours will likely be an effective control method. However, exposure for several days will be required if temperatures are at or just below freezing. Where feasible, winter drawdown offers an environmentally sound control method for killing zebra mussels.

Reference

Prosser, C. L. 1973. "Temperature," chapter 9, in: C. L. Prosser, ed., *Comparative Animal Physiology*, 3d ed., W. B. Saunders, Philadelphia, PA, pp 362-428.