



US Army Corps  
of Engineers  
Waterways Experiment  
Station

# Zebra Mussel Research

## Technical Notes

Section 2 — Control Methods

Technical Note ZMR-2-10

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### Aerial Exposure and Mortality of Zebra Mussels

**Background and purpose** The U.S. Army Corps of Engineers is tasked with the development of environmentally sound control methods and strategies to deal with problem-causing infestations of zebra mussels at public facilities. Nonchemical means of control will be used to the maximum extent possible. Aerial exposure of zebra mussels at dewatered facilities offers a nonchemical means of control. The purpose of this note is to summarize information on mortality rates under different conditions of aerial exposure.

**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 of the 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.

**Approach** Laboratory experiments were conducted in which adult zebra mussels were exposed to air in one of five relative humidity and three temperature treatments (15 humidity-temperature combinations). Time required for 100 percent mortality was assessed.

**Results** Temperature was positively related and humidity was negatively related to mortality, and the interactive effects of these two variables were important. Survival time during aerial emersion was greatly increased by high humidity at low, but not at high temperature. A multiple regression model was developed to quantify the combined effects of temperature (T, in degrees Celsius) and relative humidity (RH, in percent) on the duration (D, in hours) of aerial exposure required for 100 percent mortality:

$$\ln D = 5.917 - 0.082 T + 0.010 RH$$

( $r = 0.93$ ;  $n = 15$ ;  $F = 47.2$ ;  $p < 0.00001$ )

Survival durations as predicted by this model for selected temperature and relative humidity conditions are tabulated below.

Relative Humidity, percent	Days to 100 Percent Mortality at Air Temperature, ° C		
	5	15	25
95	26.6	11.7	5.2
50	16.9	7.5	3.3
5	10.8	4.8	2.1

To ensure 100 percent mortality, aerial exposure must last nearly a month at moderately low temperature (5° C) and high humidity (95 percent) but only two days at moderately high temperature (25° C) and extremely low humidity (5 percent). However, even at high humidity (95 percent), 100 percent mortality is expected in approximately 5 days at 25° C.

**Recommendations** Although mortality due to aerial exposure in the field cannot be entirely simulated in the laboratory, the multiple regression model presented herein provides useful quantification of the effects of two environmental variables, temperature and humidity, known to affect mortality of aerially exposed bivalves. Dewatering to kill zebra mussels will be most effective if conducted in summer, although this is obviously not possible in all situations. Additional reduction of required exposure time for complete kill can be attained if relative humidity is low or can be reduced.