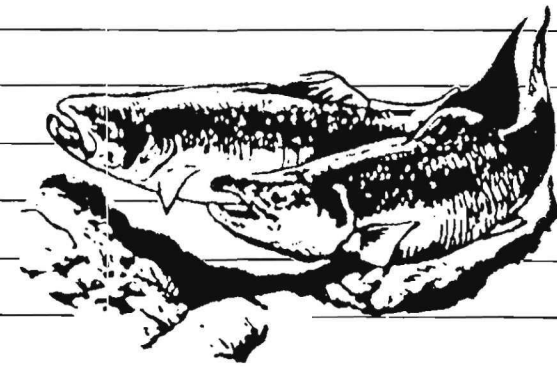
Research



Information bulletin

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Culture of Zebra Mussels in Five Water Sources

The life cycle of the zebra mussel (*Dreissena polymorpha*) has been extensively studied to control and lessen the harm of this nuisance species to the environment and aquatic organisms. Research in the laboratory requires methods that maintain the organism in a healthy state. Because mussels are confined to water, the quality of the water, nutrients, and food organisms determine the mussels' condition. The characteristics of the water source determine the availability of metabolic elements that are essential for growth and survival of mussels. We evaluated five different water sources as potential culture waters for zebra mussels by monitoring crucial water characteristics and mussel survival.

Culture Methods and Water Quality Characteristics

Culture water was obtained from one site on the Mississippi River, two sites on the Black River (Black River-A and Black River-B), the well-water supply of the National Fisheries Research Center–LaCrosse laboratory, and a standardized reconstituted test water supply. Water of the Black River was sampled at two locations because of differences in water characteristics from the mixing of Mississippi River water with Black River water at the Black River-B site. Twenty zebra mussels (4–8 mm shell length) were placed in each of five 38-L aquariums with 20 L of aerated culture water at room temperature (20° C ± 1° C) and were fed equal portions of a daily diet of live multi-species algae (*Chlorella* and *Ankistrodesmus*) and dried chlorella. The water sources were tested in triplicate. Dissolved oxygen, pH, and temperature were monitored daily. Twice weekly a half volume of water was siphoned from each aquarium and replaced with fresh culture water to maintain water quality. Before replacement, culture waters were poured through a 5-µm bag filter to remove microorganisms and particulate matter. Before and after each replacement, water quality characteristics of pH, dissolved oxygen, hardness, alkalinity, conductivity, and ammonia were monitored. Mussels were assessed for survival and growth after 68 days of culture. Each live mussel was measured with a computer-assisted Optical Pattern Recognition System.

Water Sources Had Distinctive Characteristics

Personnel of the National Fisheries Research Center—LaCrosse had monitored the water sources for this study since the early 1970's. A substantial historical data base revealed that the water sources have distinctive characteristics. In our study, the Mississippi River water had a higher mean hardness value (226 ppm; mg/L $CaCO_3$) than the Black River-B (172 ppm), well water (146 ppm), Black River-A (80 ppm), and reconstituted water (51 ppm). Alkalinity and conductivity evidenced the same trends. Dawson (U.S. Fish and Wildlife, personal communication) reported that calcium levels were highest in the Mississippi River (22.5 ppm) and in

the Black River-B (14.9 ppm) and lowest in the reconstituted water and in the Black River-A (< 8 ppm).

Mussel Growth and Survival Rates Varied

The survival rate of the mussels in the various water sources was higher in the Mississippi River (95%) than in well water (88%), Black River-B (85%), Black River-A (85%), and reconstituted water (73%). The growth rates of the mussels during the culture period were greater in the Mississippi River (4.12 mm) than in the Black River-A (2.83 mm), Black River-B (2.64 mm), reconstituted water (1.39 mm), and well water (0.85 mm). The mussels in the river water sources had significantly higher ($P \leq 0.05$) growth rates than the mussels in laboratory waters. The mussels in the Black River-A and reconstituted water had visibly eroded shell umbos. Growth and survival of mussels in this study seem to be related to water characteristics. The Mississippi River and Black River-B had the highest hardness and calcium concentrations, and researchers have reported that these characteristics are essential for mussel growth, survival, and distribution. The reconstituted water had the lowest hardness (40–48 ppm) and calcium concentration (5.8 ppm), which may have resulted in slower growth, erosion of shells, and the lowest survival.

Management Implications

Our investigation revealed that dissolved oxygen, ammonia (NH_3), water hardness, and calcium concentrations of culture water influence the survival and growth rates of zebra mussels. The densities of mussels in rearing tanks directly affect the apportioning of food and the accumulation of waste products. The Mississippi River water provided the best environment for mussel culture. These data support the premise that zebra mussels will thrive and increase in number in the Mississippi River and other waters with high calcium and hardness concentrations and adequate nutrient levels.

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