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Station

Zebra Mussel Research Technical Notes

Section 1 — Environmental Testing Technical Note ZMR-1-06

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Mussel Filtration Rates Using Natural versus Artificial Particles in Suspension

Background and purpose

Rapid reduction of suspended particulate matter is a major concern in the invasion of North American rivers and lakes by the filter-feeding zebra mussel, *Dreissena polymorpha*. Measurements of water clearance and particle filtration rates are obviously important in evaluations of this ecological concern. In addition, these rate measurements can indicate the physiological condition of both natural and laboratory mussel populations, providing information that can be used to develop environmentally sound control methods.

Most clearance and filtration studies involve feeding mussels a known concentration of particles for a given time period. Reduction in concentration is then measured and used to compute filtration and clearance rates. Particle type affects filtration rate. Neutrally buoyant, inert, latex and polystyrene microspheres (beads) are relatively simple to use and have often been used in filtration studies. The purpose of this note is to compare particle filtration rates using polystyrene microspheres (beads) to rates based on filtration using natural particles in suspension.

Additional information

This technical note was written by Dr. Barry S. Payne and Mr. Jin Lei based on laboratory studies conducted at the U.S. Army Engineer Waterways Experiment Station (WES). For additional information, call Dr. Payne, (601) 634-3837. Dr. Ed Theriot, WES, (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Approach

Mussels were collected from the Black Rock Lock in the Niagara River, New York, in late fall and shipped on ice to WES. They were acclimated at a temperature of 8° C for 4 weeks before filtration studies at the same temperature. In filtration tests, mussels (approximately 25 mm in length) were fed suspensions of either naturally occurring particles (concentrated from water samples of an inlet canal to Brown's Lake at WES) or 2-μm plastic beads at one of two concentrations: 14 mg/L or 27 mg/L. Measurements were made of initial filtration rates (0-60 minutes in feeding suspension) and filtration rates after two hours. The latter allowed an assessment of filtration response after initially filtered material, either natural particles or beads, had passed through the digestive system.

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Results Striking differences were noted in the initial versus post-two hour filtration rates of plastic beads (Figure 1). For natural particles there were minimal differences between initial and post-two hour filtration rates. Mussels that were fed beads exhibited initial filtration rates that were approximately an order of magnitude higher than rates measured two hours later. Those mussels that were fed natural particles exhibited initial rates that were only slightly higher than rates measured two hours later. In all experiments, after 30 to 60 minutes, mussels began to produce feces containing particles filtered during the initial phase of feeding. The large reduction in filtration rate noted after two hours of bead filtration probably reflected a physiological response to the lack of nutritional value of ingested beads.

Recommendations If studies rely on suspensions of artificial, nonnutritive particles such as plastic beads, clearance and filtration rates should be measured during the initial phase of feeding before there is time for reduction of water clearance rates. Clearly, the type of particle used in filter-feeding studies can greatly affect rate measurements. Caution must be taken both in field extrapolation of results and in comparisons among studies relying on different types of suspended particles.

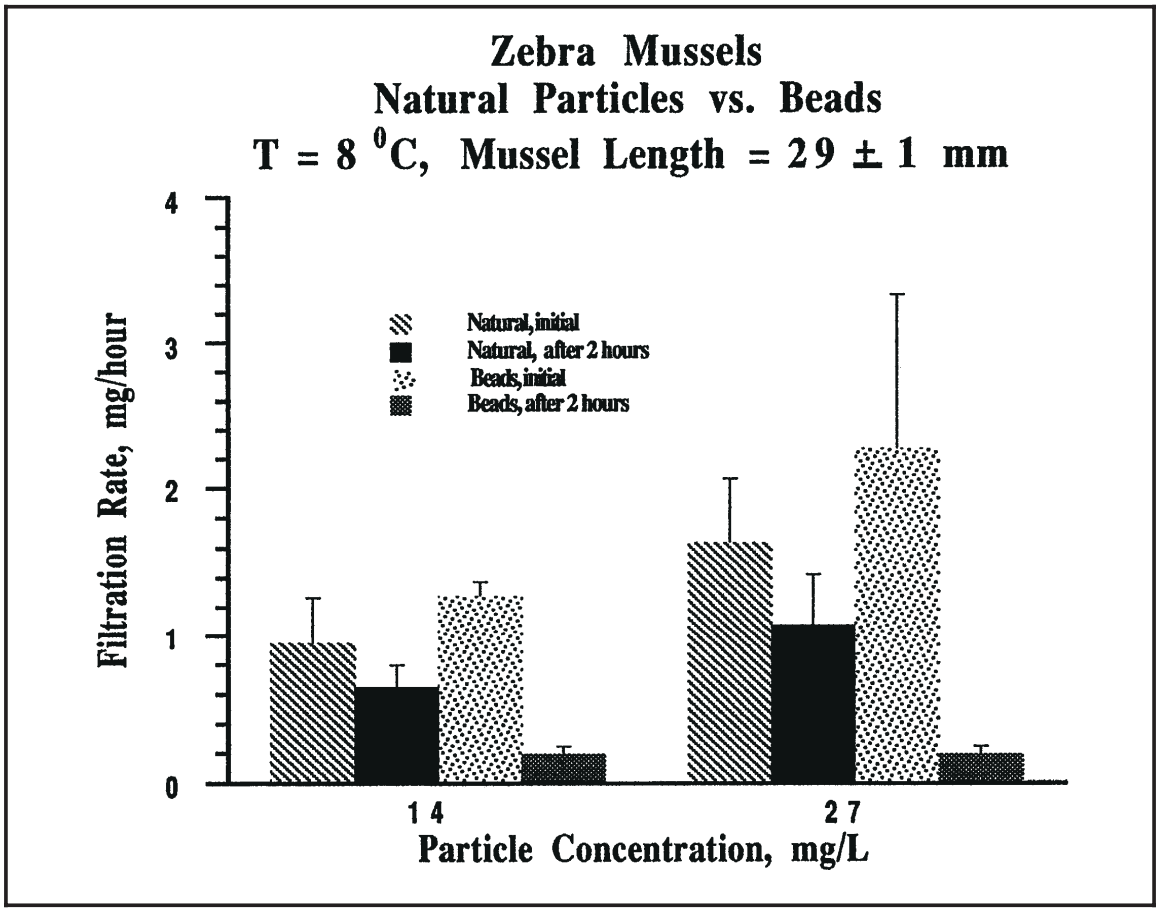

Figure 1. Filtration rates of plastic beads for zebra mussels