

water users and suppliers throughout the lower Great Lakes and adjacent waterbodies.

In light of the severe problems encountered by water users in Lake Erie during 1989 and 1990, the Monroe County Water Authority (MCWA) viewed the possibility of zebra mussel infestation of its sole water intake as a critical planning issue. MCWA's concerns were heightened by peak summer water demands which routinely required production approaching the nominal capacity of the intake. Knowing that it had little capacity to spare and cognizant of the speed at which these mollusks were migrating, MCWA decided that the zebra mussel threat required a proactive and aggressive response.

ZEBRA MUSSEL CONTROL USING ACOUSTIC ENERGY. John Menezes, Sonalysts, Inc., 215 Parkway North, Waterford, CT 06385.

The spread of the zebra mussel *Dreissena polymorpha* (Pallas) into the Great Lakes and adjoining waters is a great concern to utility, municipal, industrial, and environmental interests because of the propensity of the species to rapidly cover the area it colonizes. A practical and economical device or method that reduces zebra mussel colonization without detrimental side effects is highly desirable.

The research and technical programs in which Sonalysts has participated focused on affecting veliger and immediate post-veliger developmental stages using acoustic energy. In 1990, small-scale studies were performed under contract to Empire State Electric Energy Research Corporation (ESEERCO) by Sonalysts to survey the effect of underwater sound on the viability of larval, post-veliger, juvenile, and adult zebra mussels.

The acoustic energy was generated by several devices designed for underwater and laboratory applications using narrow frequency bands between 155 Hz and 1 MHz. The initial screening was conducted by evaluating gross morphological and behavioral effects in very small-scale (<1 liter) systems using short-term exposures at or near the maximum operating amplitude of each device. When an initial survey test showed promising results (e.g., veligers destroyed, mussels gaping, shells fractured or detached) the test was conducted on a larger scale with replicate and reference samples at different amplitudes, ranges, or durations.

Based on the 1990 results, ESEERCO sponsored Sonalysts to conduct additional research during the summer of 1991 (currently ongoing) which provided an opportunity to extend this work towards the optimization of acoustic parameters and an increase in scale (range, volume). A pilot-scale system will be developed and deployed in 1992 based on the information and results collected during the summer of '91 testing. The pilot-scale system is being designed to prevent the attachment of viable juveniles to intake walls and induce mortality as veligers pass through moving volumes of water.

From the surveys, we learned that high intensity acoustic sources can lethally disintegrate veligers and shatter the shells of

juvenile zebra mussels. The effect on juveniles is size and time dependent. *In situ* tests also indicated that juveniles and adults longer than 10 mm could also be killed, even at lower amplitudes, with less than 18 hours of treatment. Sonalysts will discuss this acoustic research on zebra mussel control and their plan to demonstrate a full-scale installation of acoustic control devices at an operating intake.

BIOLOGICAL CONTROL OF ZEBRA MUSSELS: SCREENING FOR LETHAL MICROORGANISMS. Daniel P. Molloy and Barbara Griffin, New York State Museum Biological Survey, State Education Department, Albany, NY 12816.

Initiated in April 1991, this research project focuses on the development of a biological method for controlling zebra mussels. Microorganisms are being tested in the laboratory to identify those which are lethal to attached zebra mussel life stages. Over 260 different microorganisms are being screened over a two year period. These candidate control microorganisms will not be "natural" parasites of zebra mussels, but rather naturally occurring soil and water microbes, which just by chance happen to be lethal to zebra mussels when the mussels are exposed to artificially high densities of the microbe. A microorganism which at artificially high densities is poisonous to zebra mussels undoubtedly exists in nature, and the proposed research is designed to identify it. This type of research approach has a track record of success, since it has already produced a commercially available, environmentally safe, microbial control agent for another aquatic, filter-feeding, invertebrate pest—the black fly. Preliminary results of those microorganisms screened to date will be presented.

THERMAL BACKFLUSHING TO CONTROL ZEBRA MUSSELS AT STEAM STATION. E. F. Neuhauser,¹ M. A. Rhode,¹ J. J. Knowlton,² R. J. Wahanik,² M. Borden,² D. P. Lewis,³ and G. Mackle,⁴ ¹Niagara Mohawk Power Corporation, Syracuse, NY, ²Gilbert/Commonwealth, Inc., Reading, PA, ³Aquatic Sciences Inc., St. Catharines, Ontario, ⁴Mackie and Associates Water Systems Analyst, Guelph, Ontario.

Other than thermal treatment, the use of various chemical treatments to control zebra mussels (*Dreissena polymorpha*) in both the U.S. and Canada is well documented and appears to be effective under a number of different protocols. However, concerns over the potential impact of these treatments to receiving water bodies has motivated industry to investigate alternative or complementary control approaches. The control of zebra mussels by thermal treatment is an alternative approach to chemical treatment which may be effective while producing minimal harm to the environment.

To remove the zebra mussel infestation in the circulating water system at Niagara Mohawk Power Corporation Dunkirk Steam Station, it is proposed to increase the temperature of the intake water used for steam condenser cooling from 55–65°F (13–18°C) to at least 95°F (35°C). The construction of the circulating water