

A Report on Invading Species LEVEL 1

A

A report for the Ministry of the Environment

Zebra Mussel

Origin of Zebra Mussels

Zebra mussels originated in Balkans, Poland, and the former Soviet Union. The first large populations of zebra mussels were discovered in 1769 in the Caspian Sea and the Ural River. They were brought over to North America in the hulls of ships from Europe and were dispersed into the waters of the St. Lawrence Seaway and the Great Lakes. The first sighting of zebra mussels in North America was in 1988 in Lake St. Clair. Since 1988 zebra mussels have spread all across North America, as far as Texas.

Characteristics of Zebra Mussels

- 1) Life span is 3-5 years.
- 2) Shells are 25-35mm in length.
- 3) They are filter feeders and they can filter large amounts of water. They can filter a whole lake or reservoir in a few months.
- 4) Adults spread from area to area by attaching themselves to boats and being transported around.
- 5) Adults grow in large concentrations on top of one another.
- 6) They reach sexual maturity within second year of life.
- 7) Females can release more than one million eggs during spawning, these eggs are released 2-5 per year.

B

- 8) Fertilization occurs in water that is 12 degrees C. water. There eggs can be fertilized 2.5-5 hrs after release and the males sperm can last up to 22 hrs.
- 9) They can live in fresh and brackish water. They do not withstand low PH or low oxygen.

Problem with Zebra Mussels

Zebra mussels invade environments that contain phytoplankton. These zebra mussels compete for the plankton in the environment with other invertebrates and young fish. The phytoplankton that the zebra mussels eat can cause a decline in surviving small fish. Environmentalists are worried about ending up with more older fish then younger fish. The zebra mussels have affected the migration of birds that normally move south but, now instead stay and feed on the mussels in the rivers. The zebra mussels also cause problems to many industries as they must spend millions of dollars per year on cleaning their drainage pipes from the factories. The drainage pipes have been seen to be clogged by up to 50% by the zebra mussels attaching themselves to the pipe hindering the drainage of waste into the river. This is causing a major problem because the zebra mussels have begun to spread throughout North America. The first sighting of zebra mussels was in Lake St. Clair in 1988 and the zebra mussels have now been sighted as far away as Texas. The problem has become more widespread and more difficult to deal with.

LEVEL 1

C

Populations

Most zebra mussels are located in the areas around the Great Lakes, settling mostly at the Detroit side of Lake Erie. Figure A illustrates the population distribution of zebra mussels spread from their point of origin in the Great Lakes.



Figure A: Information provided by ODNR Division of Wildlife (Twine Line – Jan/Feb 2002)

D

Impacts

Zebra mussels are notorious for their colonizing on water supply pipes of hydroelectric and nuclear power plants, public water supply plants, and industrial facilities. They colonize pipes thus, restricting the flow of water in the pipes. This can lead to a lack of water supply for; condensers, fire fighting equipment, and air conditioning and cooling systems. One case had zebra mussels colonize 700 000 m² at a power plant in Michigan, and the diameters of the pipe subsequently reduced by two-thirds. Boaters can have access drag due to zebra mussels attaching themselves to the boats. Zebra mussels can also lodge themselves into engine cooling systems causing the engines to overheat. If left in water for long periods of time fishing gear could be harmed by the zebra mussels. Most biological impacts have not been noticed in North America yet but results from Europe show that zebra mussels have affected the life of native mussels as they disrupt their feeding, growth, locomotion, respiration, and reproduction. Scientists believe that zebra mussels will eventually remove native mussels from an ecosystem due to the zebra mussels ability to attach to the native mussels and sometimes triple or quadruple the weight of the native mussel. The zebra mussels have had little to no affect on the fish populations in the Great Lakes, but it could still take more time for affects to develop in the Great Lakes as not all affects have been seen by scientists yet.

E

Solution

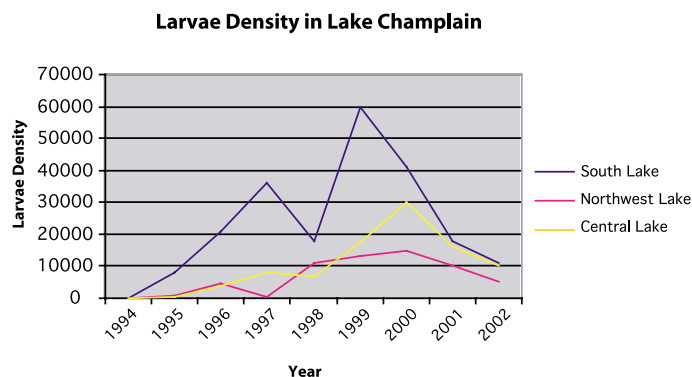
Many different solutions have been tried to try and eliminate zebra mussels from the ecosystem. The most effective has been the use of chemicals. Some methods of removal works better then others. The methods are listed below:

- Chemical Molluscides
- Dewatering / Desiccation (freezing, heated air)
- Thermal (steam injection, hot water greater then 32 degrees C.)
- CO² injection
- Ultraviolet light
- Flushing

The Future of Zebra Mussels

Scientists believe that they have the reproduction of zebra mussels minimized. They have found ways that have eliminated the larvae that the zebra mussels produce. Figure B illustrates the control of the larvae. The reduction of the larvae can help eliminate the reproduction of zebra mussel and help eliminate the amount of adult zebra mussels in the ecosystems.

Figure B



F

Bibliography

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LEVEL 1

Teacher’s Notes**Knowledge/Understanding**

- The student demonstrates limited understanding of how the invading species has adapted. The student lists several characteristics of zebra mussels (e.g., “Females can release more than one million eggs during spawning”), but he or she does not indicate how they may be regarded as adaptations for colonization and population growth.

Inquiry

- The student analyses the actual or potential problem with limited effectiveness. He or she gives some examples of the effects of zebra mussels (e.g., “restricting the flow of water in the pipes”; “ending up with more older fish than younger fish”; “have affected the migration of birds”). However, for the biotic factors, the student does not explain how the effects of mussel colonization can be considered problems.
- The student predicts the future impact of the invading species with limited effectiveness. He or she does not make a clear prediction about the future impact of zebra mussels on the Great Lakes (e.g., “Scientists believe that zebra mussels will eventually remove native mussels from an ecosystem”; “Scientists believe that they have the reproduction of zebra mussels minimized”). The report includes no projections of future populations.

Communication

- The student communicates information in graph/chart/table format with limited clarity. The graph is clearly titled, has a legend, and is partially labelled, but no units of larvae density are shown. The significance of the graph is unclear. It is described as illustrating “the control of the larvae”, but there is no explanation of what causes the changes in larvae density or of the significance of the three broken-line graphs on the same axes.

- The student communicates ideas and information with limited clarity. He or she organizes the report into logical sections, but does not organize the material within them very effectively (e.g., the “first sighting of zebra mussels” and the zebra mussel’s ability to clog pipes are each described in two different sections). Some statements in the report require explanation (e.g., “Some methods of removal works better than others”). The report contains some careless errors (e.g., “these eggs are released 2-5 per year”; “Boaters can have access drag”).

Making Connections

- The student recommends and justifies a course of action of limited effectiveness. He or she provides a list of control methods, but there is no description of how they are applied or of their advantages and disadvantages. The student states that “The most effective has been the use of chemicals”, but he or she supplies no evidence to support this statement.

Comments

This work is representative of a solid level-1 performance. The student demonstrates a limited degree of achievement of the expectations in all four categories of knowledge and skills.

Next Steps

In order to improve his or her performance, the student needs to:

- link characteristics more clearly to adaptations;
- describe in more detail the problems created by the invading species;
- provide detailed predictions on the future impact of the species;
- label the graph fully and explain the information shown on it;
- edit and proofread the report to eliminate repetition, unclear statements, and careless errors;
- provide a clearer recommendation and a detailed justification.