

G9 Science: Class 5 Homework

Read the following excerpt and answer the questions below. Adapted from <https://youngs-wiki.wikispaces.com>:

THE ZEBRA MUSSEL

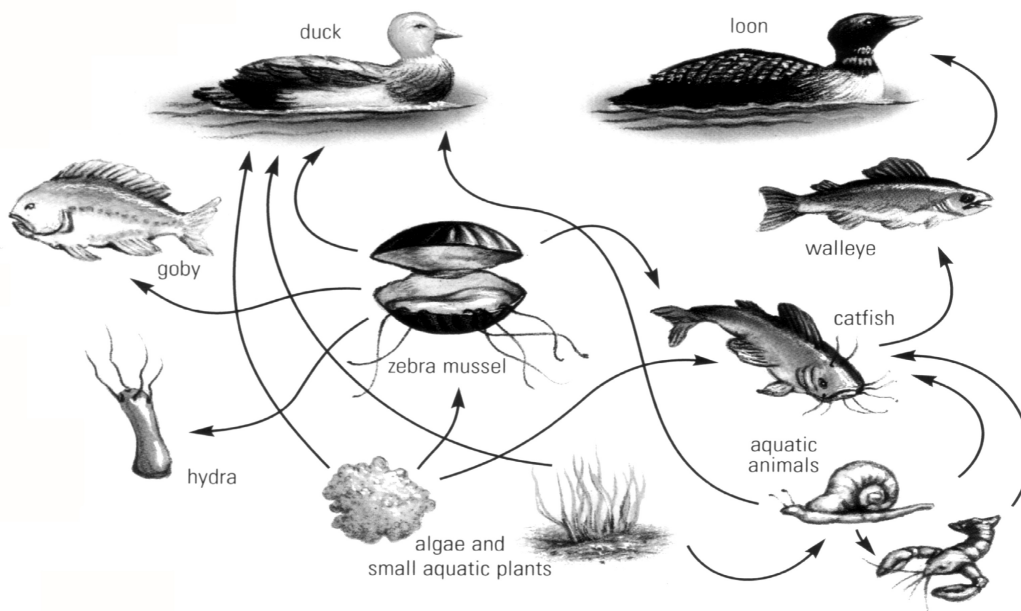


The identification of the zebra mussel in Lake Erie in the early 1990s set off a series of alarms that captured the attention of news media for nearly eight years. Biologists believe that this tiny bivalve (mollusk), a native of the Caspian Sea in western Asia, entered the Great Lakes from bilge water discharged from ships. In the Great Lakes, this exotic species found lots of food and spread quickly.

In 1991 there were extensive colonies of zebra mussels in Lake Ontario and small groups could be found in Georgian Bay on Lake Huron. By 1994, the zebra mussel was common in the Rideau Canal and throughout the Trent-Severn Waterway. By 1995, the invading mussels had moved through the Ohio River to the Mississippi, and could be found all the way to the Gulf of Mexico.

The mussel attaches to almost any hard object standing in water. The mussels blocked water intake pipes from the Great Lakes, choking hydroelectric plants and freshwater supplies for a number of industries. Ontario Hydro, municipalities, and the Ontario Ministry of the Environment all undertook massive campaigns to prevent the mussels from moving up intake pipes into generating stations, water treatment plants, and industrial plants. These efforts may also have diverted attention and resources away from pollution issues in the Great Lakes.

ECOLOGY & THE ZEBRA MUSSEL



Speculations about what this rapidly reproducing organism might do to the food webs of the lake ecosystems were even more alarming. For example, ecologists noted that the pearly mussel, a natural inhabitant of most of Ontario's freshwater lakes, had difficulty competing with the zebra mussel. In every place that zebra mussels invaded, a decline in the number of pearly mussels followed. Zebra mussels and pearly mussels should not compete for the same niche: pearly mussels burrow into mud along the shores of freshwater lakes, while zebra mussels attach themselves to hard surfaces. However, the shells of the pearly mussels are a hard surface – layers of zebra mussels form on top of pearly mussels.

Mussels are filter feeders. They put out small threads covered with a sticky mucous, and comb the water to remove small organisms for food. Bacteria, algae, and very tiny animals are taken into the mollusk for food. If many zebra mussels attach to the shells of the pearly mussels, little food filters down to the pearly mussels. Also, the zebra mussels attached to their shells prevent them from moving to a more favourable location.

However, the introduction of zebra mussels has not been detrimental to other species. Ducks, especially the Lessers Scaup, and other aquatic birds feed on the mussel. The discarded shells of the zebra mussel also provide underwater shelter for snails, aquatic insects, small crustaceans, and water mites. Hydra (a small freshwater relative of the jellyfish) also benefits: the larvae of the zebra mussel provide a ready source of food.

The invading mussels have indeed caused problems, but the Great Lakes ecosystem has not been devastated. Zebra mussels do not cover the shoreline, nor have they eliminated competing species. One study, of yellow perch in western Lake Erie, indicates that they do not interfere with the spawning of fish. In fact, they may even help yellow perch by creating a more favourable habitat for small crustaceans, such as crayfish, that feed on the mussel. Perch eat crustaceans.

Some studies even credit the zebra mussel with long-term benefits. The number of algae had been increasing greatly owing to fertilizers and other human pollutants that were carried into the Great Lakes with the spring runoff. The growth in algae was affecting aquatic plants, as the algae were blocking light from the Sun. Mussels eat algae, and now aquatic plants are thriving once again.

The mussels not only reduced the amount of algae in the Great Lakes, but they also removed pollutants from the water. Each adult mussel draws in as much as 1.5 L of water daily, retaining the pollutants and expelling the water. So much water is filtered that Lake Erie is now 60% clearer than it was before the arrival of the mussel. However, all of this filtering of pollutants does not come without a cost. The pollutants stored in the zebra mussels are passed on to predators, for whom they can be toxic.

Ecologists are also speculating about the negative effects of reducing the algae population, because algae are the most important producers in the lakes, and so are important in the food web. Even clearer water may pose a threat. More sunlight would penetrate the water, causing

greater warming. Because warm water holds less oxygen, fish such as trout, which require higher levels of oxygen, could suffer.

As you can see, assessing the impact of the zebra mussel is a complicated business, and it has recently become more complicated. Another exotic species, the goby, was found in the Welland Canal in 1996. The stowaway likely entered the Great Lakes from ballast water held in a freighter that had visited the Black Sea. Gobies eat zebra mussels, but they also have other effects – we cannot rely on them to restore the original ecosystem. The goby chases other fish away from their spawning grounds and feeds on the eggs of native fish such as walleye, perch, and small-mouth bass. Other invasive species, including the Eurasian ruffe, spiny water flea, and purple loosestrife, have also been introduced to the Great Lakes through ballast water.



ECONOMICS & THE ZEBRA MUSSEL

The predicted human disaster of clogged pipes, resulting in multi-billion-dollar clean-up bills, has proven to be slightly exaggerated. Evidence seems to indicate that chlorine has prevented the zebra mussel from choking off water intake systems. However, controlling the mussels has not come without financial cost. One estimate for Ontario Hydro has pegged the cost of the initial control efforts at \$20 million, with an annual cost of as much as \$1 million for maintenance. Commercial fishing has survived the influx of invading mussel, but only barely. The industry, which generated \$600 million before the zebra mussel, now generates only \$200 million.

QUESTIONS

1. List the positive and negative effects of the introduction of the zebra mussels to the Great Lakes. **[6 marks]**

Positive Effects	Negative Effects

2. Why do you think it is important that Canadian Customs ask visitors to Canada to declare any fruits, vegetables, plants, meat, animal products and live animals when they enter Canada? **[2 marks]**
3. The article states that Gobies eat Zebra Mussels. Do you think that this is an effective method to control the population levels of the Zebra Mussels? Why or why not? **[3 marks]**
4. Use the food web on Page 1 to answer the following questions:
- a) List all the organisms that the zebra mussel eats. **[1 mark]**
- b) List all the organisms that eat the zebra mussel. **[4 marks]**

- c) Which organisms are in direct competition with the zebra mussel? **[2 marks]**
- d) If there were a disease that decreases the duck population, how would this affect the population of zebra mussels? **[2 marks]**
5. Which human activities would you recommend to the Ministry of Natural Resources to prevent the introduction of non-native species to enter the Great Lakes? **[2 marks]**
6. Research an invasive species other than Zebra Mussels found in Canada. Provide a brief description for each of the questions below:
- a) Where did the invasive species originate and how did it come to Canada?
[2 marks]
- b) What are the ecological problems that this invasive species caused? **[2 marks]**
- c) What are the economical problems that this invasive species caused? **[2 marks]**
7. What type of symbiotic relationship does the zebra mussel have with the pearly mussel? Explain your thinking. **[2 marks]**

8. According to the article, the lack of algae in the water caused the water temperature to increase. Why do you think environmentalists are equally concerned about organisms in lakes and ponds that are located next to factories releasing clean warm water?

[3 marks]

9. Create a timeline to summarize the appearance of zebra mussels in North America.

[3 marks]

10. According to the article, “The pollutants stored in the zebra mussels are passed on to predators, for whom they can be toxic.” Using this idea, explain why people are discouraged to eat large fish such as swordfish and shark. **[3 marks]**