A Report on Invading Species LOW LEVEL 2

A

A Report for the Ministry of the Environment

Sea Lamprey Problem:

The Sea Lamprey is an invading species to the Great Lakes in Ontario. The lamprey is a jaw-less fish that attaches itself to native species like, the Splake, Carp, Sucker, Bullhead, Rainbow trout and Bass. However the fish to suffer the most in the upper Great Lakes is the Lake trout. The Lampreys attach to a host by sucking (using the disc in its mouth), they sink their many rows of teeth into the flesh, and start sucking all the bodily fluids out of their host. This often leaves the host dead or extremely close to dying.

Entrance Into Ontario:

The Sea Lamprey is a fish native to the Atlantic Ocean, it invaded Lake Ontario, in approximately 1890, and Lake Erie in approximately 1921. Water falls and other natural barriers prevented the Sea Lampreys from entering earlier, but when manmade locks and canals were created to connect the Atlantic Ocean to the lower Great Lakes the lampreys now had an entrance.

Characteristics of the Sea Lamprey:

An adult Sea Lamprey can reach lengths of 1m but are generally around 46cm long. The Lamprey is a very primitive fish in that it has not evolved much since the original jaw-less fishes. The lamprey has seven gill openings on each side of the head and a nasal opening on top of the head between the eyes. There are also two dorsal fins, and when breeding a ridge of skin appears along the back of the males. The mouth of the Lamprey is a round sucking disc containing rows of extremely sharp teeth and a grasping tongue that has three large teeth on it. Lampreys can weigh up to 2.2 kg in females and 1.2kg in males.

B

As larvae Sea Lampreys live as filter feeders for several years until they transform into free swimming juveniles. The transformation includes the development of eyes, teeth on the tongue, the sucking disk and the loss of the hood overhanging the mouth. The Sea Lampreys life as an adult is a short lived 12-20 months. The lamprey dies directly after mating season whether it has mated or not. The taxonomy of the lamprey can be viewed in ***figure1***

Taxonomy	
Phylum:	Chordata
Subphylum:	Vertebrata
Superclass:	Agnatha
Class:	Cephalaspidomorphi
Order:	Petromyzontiformes
Family:	Petromyzonidae
Genus:	*Petromyzon*
Species:	*marinus*

(Figure 1 http://ourworld.compuserve.com)

C

Common names: Sea Lamprey

Rock Licker

Lambere = to lick

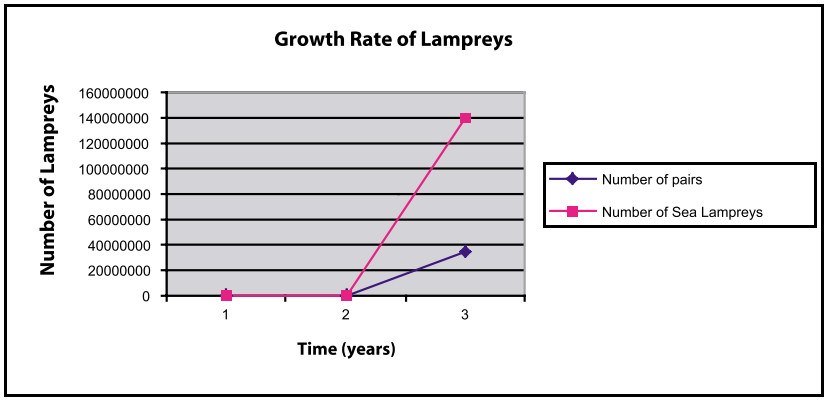
Petra = a stone

Factors That Affect the Sea Lamprey:

Barriers that are more than two feet above surface level of the water will often stop the lampreys in their path as they cannot generally jump over two feet. This can be a problem for them during mating season. Another factor that affects the Lamprey is its ability to adapt, or not adapt, to the changing conditions of the water it inhabits. The Lamprey is unable to adapt to new toxins in the water that have minimal or no effect on other wildlife. Also migration generally begins in April, but the temperature of the water plays a big role in this. Water temperatures required for spawning is 15C to 21C, if the water is too warm or too cold spawning will not occur.

The rate at which the Sea Lamprey spawning is discouraging. Figure 2 shows that for every one mating pair there is a possible 3780 new pairs the next year, which means that the following generations could be as large as 14288400 pairs after only three years.

D



(Figure 2)

The Impact of the Lamprey on Humans:

The average person may not notice the impact that the Lamprey has on humans, but it is certainly noticed by the average fishermen. An adult Lamprey can eat up to 18.5 kg of fish in its adult life. In Lake Superior although productions dropped 90% from 1930 to 1952 the number of Sea Lampreys caught rose from 1000 to 70000. The Lamprey leaves visible signs of its presence in any lake it enters and it leaves behind wounded fish that fishermen do not want to eat, or catch, so they do not return, meaning a loss of business for the local area surrounding the lake. They also hurt the large-scale fisheries, because there are less fish to catch and many of the ones that are left are scarred and wounded. The lamprey is only bad news for fisheries in Ontario. The long term effects of the lamprey could be that it wipes out entire species of fish, such as lake trout. Then there could be a big economic effect on people who fish in Ontario. The province could lose billions of dollars in taxes, license fees and tourism.

LOW LEVEL 2

E

Possible Solutions to problem:

Since Lampreys are most vulnerable in their migratory group's one solution that has been implemented, is to install devices, which stop the migration of spawning adults. The problem however is that this method will take many years due to the fact that every generation must pass through the device, and although a Lamprey is only an adult for a short while their lives can span as long as 17 years.

Another solution was to send Electric current through the water to kill all the newly transformed lampreys at one point during a downstream migration. This however fails to work if there is a storm causing power outage.

The best and most effective method of control seems to be the use of TMF. TMF is a lampricide made of the chemical compounds, 3-trifluoromethyl, 4-nitrophenol. TMF is selective to only Sea Lampreys. At low concentrations TMF kills Lampreys, but most other fish are unaffected. Other fish species have the ability to metabolize TMF and discharge it from their bodies. The TFM causes circulatory and respiratory collapse. To use this lampricide most effectively, it should be used during spawning killing the new and old generations of lampreys.

F

Works Cited

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Teacher's Notes

Knowledge/Understanding

– The student demonstrates limited understanding of how the invading species has adapted. He or she makes the general statement: "Another factor that affects the Lamprey is its ability to adapt, or not adapt, to the changing conditions of the water it inhabits." However, in presenting information about the sea lamprey, including that it "is unable to adapt to new toxins in the water", he or she does not include specific examples of adaptations for this species.

Inquiry

– The student analyses the actual or potential problem with some effectiveness. The student acknowledges the effect on fish species in general terms (e.g., "the fish to suffer the most in the upper Great Lakes is the Lake trout"), but he or she focuses on the impact of sea lampreys on humans (e.g., "The lamprey is only bad news for fisheries in Ontario"; "In Lake Superior … productions dropped 90% from 1930 to 1952"). The student devotes little attention to more general effects on the ecology.
– The student predicts the future impact of the invading species with some effectiveness. He or she states that "The long term effects of the lamprey could be that it wipes out entire species of fish" and that "The province could lose billions of dollars". However, the projections of population growth appear to assume survivorship of all offspring and do not acknowledge the history or current practice of controlling lamprey populations in the Great Lakes.

Communication

– The student communicates information in a graph/chart/table format with limited clarity. He or she titles the graph, identifies the variables, and provides a key. However, the relationship between the "Number of Sea Lampreys" and the "Number of pairs" in year 3 is unclear, and the plotted number of pairs does not agree with the "14288400" figure in the text. There is no curve to represent exponential growth, and no indication of what happens after the exponential growth phase.
– The student communicates ideas and information with some clarity. The report is organized into reasonable sections, and some ideas are expressed fairly clearly (e.g., "The Lamprey leaves visible signs of its presence in any lake it enters and it leaves behind wounded fish that fishermen do not want to eat, or catch, so they do not return, meaning a loss of business for the local area surrounding the lake"). However, some information is irrelevant to the problem (e.g., Figure 1) or is carelessly expressed (e.g., the use of the non-metric "two feet", the repeated use of "TMF" for TFM).

Making Connections

– The student recommends and justifies a course of action of some effectiveness. He or she briefly describes three control methods (i.e., the use of "a lampricide", "Electric current", and "devices, which stop the migration of spawning adults"). The student recommends the lampricide as "The best and most effective method of control", but he or she does not support the recommendation with scientific data and does not explain the drawbacks of the other two methods effectively (e.g., "The problem however is that this method will take many years due to the fact that every generation must pass through the device").

Comments

This work is representative of a low level-2 performance. The student demonstrates some degree of achievement of the expectations in the Inquiry and Making Connections categories of knowledge and skills. The student also demonstrates some degree of achievement with respect to one criterion in the Communication category. However, with respect to the Knowledge/Understanding category and one criterion in the Communication category, the student demonstrates a limited degree of achievement – i.e., achievement that is more characteristic of level 1.

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Next Steps

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

- include specific examples of adaptations;
- describe the general effects of sea lampreys on the ecology;
- use broader scientific evidence to predict the future impact of the invading species;
- include a graph that uses scientific evidence to project future population changes;
- use SI units throughout the report;
- edit and proofread the report to eliminate careless errors and irrelevant information;
- use scientific data to justify the recommendation more effectively.