

A Report on Invading Species LEVEL 2

A

A Report for the Ministry of the Environment

Petromyzon marinus / Sea Lamprey

Range

Sea lampreys were first observed in Lake Ontario in the 1830's. They entered Lake Ontario via the St. Lawrence Seaway, and then gained access to the upper Great Lakes when the Welland Canal was constructed in 1919. By 1919, sea lampreys could be found in all of the Great Lakes.



Photo: NOAA, Great Lakes Environmental Research Laboratory

Identification

Sea lampreys belong to a family of fish that do not have jaws. This species has been around for a very long time, perhaps as far back as the dinosaurs! They are thin and look a lot like eels. An adult usually grows to be between 12 and 20 feet long. Unlike eels though, lampreys have a fin beginning about their middle and stretching right down and around their tails. It makes lampreys very distinguishable as their fins are very fine and sway as the lampreys swim. The lampreys are brown in colour with pale yellow under bellies and large red eyes. The lampreys probably came into the Great Lakes from the Atlantic Ocean, by way of the Erie Canal.

B

Spawning

They move stones to prepare the river bed for spawning. They take these stones from the river bottom and pile them in the shape of a horseshoe downstream of their nest. By doing this they create a depression in the river bottom of well aerated gravel, which is vital to the survival of their eggs. The sea lampreys dies after spawning and can lay over 100,000 eggs each spawning season.

Feeding

The Sea lampreys preys upon large deep-water salmonids, such as the lake trout, which is a very valuable fish for commercial fishing. After the lampreys preyed upon a species to the point of extreme depletion they began to prey on another type of fish. This pattern of feeding was very destructive to many fish in the Great Lakes. In the 1930s and 1940s, in some of the lakes the lamprey devastated the populations of large top predatory fish. In some instances several species of fish became extinct in certain lakes (Cox 150). Sea lamprey's are so devastating that only one in seven fish attacked will survive a sea lamprey attack, normally the larger fish can survive. The sea lamprey feeds on body fluids of other fish, clinging to its sides with it's sucker like mouth and sharp teeth which cut through the scales and skin of its prey with ease.

LEVEL 2

C

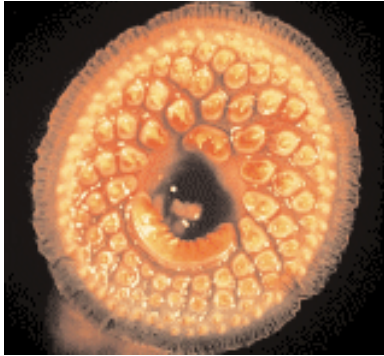


Photo: NOAA, Great Lakes Environmental Research Laboratory

The Atlantic Sea lamprey and the harm it causes to host species were first discovered in Lake Ontario in the 1860s (Cox 150). The sea lamprey came up the Hudson River and through the Erie Canal into Lake Ontario. The lamprey thrived in the warm waters of the streams leading to Lake Ontario. The lampreys spread to the other Great Lakes by going through the Welland Canal (Cox 150).

Control

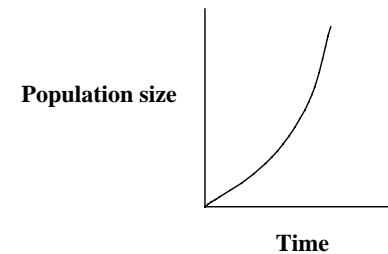
In the 1970s efforts were started to control the growing lamprey problem. Dams were built at the mouths of the streams where lampreys regularly spawned. Also a lampricide was discovered that was supposed to kill the lampreys larvae. At first the lamprey population dwindled and was thought to be under control. Many fisheries started reintroducing fish such as the lake trout back into the lakes in an attempt to restore their numbers and the ecosystem. With more fish no available to prey on, the lamprey population exploded again.

D

The St. Mary's River, which leads into Lake Huron, is the spawning ground for more than 40,000 lampreys each spring (Young 100). Since 1973, when sewage treatment plants were upgraded and industrial contaminants were decreased in the river, the water quality has improved. The combined total of sea lamprey larvae in St. Mary's River, Lake Michigan and Lake Ontario is estimated to be around 6.8 million. (Swink 385).

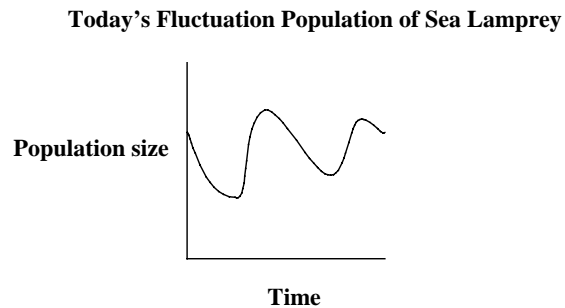
Other methods have been tried to kill the lampreys. Electrical barriers were placed at the mouths of spawning streams. The electrical barriers were designed to lower the number of adult lampreys that could reach spawning sites. A technique known as the Sterile-Male-Release that reduces the success of Sea lamprey spawning.

Exponential Growth of Unchecked Sea Lamprey Population



E

If left unchecked the population of sea lampreys would rise Exponentially as represented by the graph above, but due to human control methods the population of Sea lampreys is kept under control and fluctuates slightly as shown in the graph below.



The sea lamprey has had an immense impact on fish communities, fisheries, and fishery management in the St. Lawrence River and the Great Lakes of North America.

Direct Predation - Sea lampreys kill large numbers of predatory sport fish. Lampreys preyed on large fish with commercial value. The lamprey invasion made it hard on the people who fished the Great Lakes to make a living.

Ecological Impacts - Because of lower large fish populations, small fish were able to increase in numbers and cause the population of species lower down the food chain to decrease.

F

Predictions

If left unchecked the population of sea lamprey would become part of the natural ecosystem of the great lakes. At first the population of sea lamprey would rise to the point at which they had depleted vast amounts of all large fish populations on which they feed, to the point at which the population of sea lamprey could no longer be supported at it's high numbers, then the sea lamprey's population would drop and allow the larger fish populations to rise, much like how the larger fish keep the population of small fish in the great lakes under control. With the help of human innovation the great lakes ecosystem can remain much the same as they have in the past.

In order to keep the lamprey population in check, I recommend continued use of lampricide, as this works well at killing larvae. Sterile-male-release can reduce lamprey spawning, and has the smallest impact on the environment.

LEVEL 2

G

Bibliography

<http://www.on.ec.gc.ca/success-stories/co/lamprey-e.html>

Young, R.J; G.C Christie, R.B. McDonald, D.W. Cuddy, T.J. Morse and N.R. Payne. “Effects of habitat change in the St. Mary’s River and northern Lake Huron On sea lamprey populations”. Canadian journal of fisheries and aquatic sciences. 1996. P. 99-104.

Cox, George W. Conservation Biology. 2nd ed. Iowa; Wm. C. Brown Publishers. 1997.

Swink, William D. “Growth and Survival of Newly Parasitic Sea Lampreys at Representative Winter Temperatures”. American Fisheries Society. 1995. P 380-386.

<http://muweb.millersville.edu/~columbus/papers/poerstel.html>

<http://www.dnr.state.wi.us/org/caer/ce/eeek/critter/invert/lamprey.htm>

http://www.protectyourwaters.net/hitchhikers/fish_sea_lamprey.php

Teacher’s Notes**Knowledge/Understanding**

- The student demonstrates some understanding of how the invading species has adapted. He or she notes a breeding adaptation of sea lampreys (i.e., “They move stones to prepare the river bed for spawning”). However, no mention is made of some important adaptations (e.g., the sea lamprey’s ability to live in fresh water).

Inquiry

- The student analyses the actual or potential problem with some effectiveness. He or she makes general references to fish populations affected by the parasitic nature of the lamprey (e.g., “Because of lower large fish populations, small fish were able to increase in numbers and cause the population of species lower down the food chain to decrease”). However, only the lake trout is specifically identified. The student does not include numerical data to convey the magnitude of the problem.
- The student predicts the future impact of the invading species with some effectiveness. He or she makes general predictions that distinguish unchecked population growth from a controlled situation (e.g., “At first the population of sea lamprey would rise to the point at which they had depleted vast amounts of all large fish populations on which they feed”; “With the help of human innovation the great lakes ecosystem can remain much the same as they have in the past”). However, there is a lack of quantitative data to support the predictions scientifically.

Communication

- The student communicates information in a graph/chart/table format with some clarity. Both graphs represent trends described in the text. The titles and variables are clearly indicated on the graphs, and the curves have appropriate shapes. However, both graphs are schematic and do not show numerical data.

LEVEL 2

- The student communicates ideas and information with some clarity. He or she organizes the report into reasonably logical sections, but does not organize the material within them very effectively (e.g., the final sentence of the Identification section and the second paragraph of the Feeding section are not relevant to those sections). The student uses scientific terminology correctly, but there is a lack of explanation of specific terms (e.g., “lampricide”, “Sterile-Male-Release”). The report includes one example of a non-metric unit (i.e., in “12-20 inches long”).

Making Connections

- The student recommends and justifies a course of action of some effectiveness. He or she mentions four methods of controlling the lamprey population (i.e., using dams, “lampricide”, “electrical barriers”, and “Sterile-Male-Release”). The student recommends and briefly justifies the “continued use of lampricide” and the use of “Sterile-male-release”, but there are no details of the effectiveness of each method.

Comments

This work is representative of a solid level-2 performance. The student demonstrates some 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:

- include more examples of adaptations;
- use quantitative research data to describe the magnitude of the problem and to predict the future impact of the invading species;
- include graphs that represent numerical data;
- edit and proofread the report to improve the organization;
- explain unfamiliar scientific terms;
- use SI units throughout the report;
- use scientific data to justify the recommendation.