Least Wanted: The Invasive Sea Lamprey

Authors: Michigan Water Stewardship Program, Eaton Conservation District, borrowed from the Michigan Department of Natural Resources (Aquatic Invasive Species Education Project)

Lesson Overview: This activity will engage students in an active simulation of the relationship between native lake trout, the invasive sea lamprey, and the biological control of the introduced, non-native (non-harmful) Chinook salmon. This activity illustrates the importance of the early warning detection of invasive species as they attempt to establish themselves in an ecosystem. It is a demonstration of a professional biologist's management of an invasive species before and after its establishment, and conveys the understanding that once an invasive population is established it remains indefinitely.

Objectives: Students will be able:

1. Confirm sea lamprey are an invasive species.
2. Identify 1 or more ways to control invasive species.
3. Recognize that once an invasive population is established, it is difficult to control.
4. Identify ways biologist attempt to reduce the population of sea lamprey.

This lesson meets the following Michigan Department of Education standards:

Next Generation Science Standards (NGSS):

- ✓ MS-LS2-1 - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- ✓ MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- ✓ MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- ✓ MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- ✓ MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- ✓ HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- ✓ HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- ✓ HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Recommended Grade(s): 6th, 7th, 8th, 9th, 10th, 11th, 12th

Recommended Subject(s): Science **Duration:** Prep time: 10 min, Activity: 30 min

Materials Required: name tag print outs – 'invasive species' 1 per student, 'control' 1 per student, 'first invasive species' 1 total, 'habitat biologist' 3 or less; chart paper and markers; cones for marking playing field boundaries

Suggested Vocabulary for Students: sea lamprey, lake trout, invasive species, native species, non-native species, introduced species, biologist, biological control, chemical control, mechanical control

Background Information for Educator: Sea Lampreys (Petromyzon marinus) are primitive jawless fish native to the Atlantic Ocean. In the Great Lakes, there are several different types of native lampreys (including the silver lamprey, the American brook lamprey, and the northern brook lamprey) but the exotic sea lamprey is far larger and more predaceous than native lampreys. Lampreys have a large sucking disk for a mouth and a well-developed sense of smell. The mouth is filled with sharp teeth that surround a file-like tongue. A lamprey's body has smooth, scale less skin and two dorsal fins, but has no lateral line, no vertebrae, no swim bladder, and no paired fins. Sea lampreys are native to the Atlantic Ocean, not the Great Lakes. Sea lampreys entered the Great Lakes system in the 1800s through manmade locks and shipping canals. Prior to the opening of the Welland Canal in 1829, and prior to its modification in 1919, Niagara Falls served as a natural barrier to keep sea lampreys out of the upper Great Lakes. Sea lampreys were first observed in Lake Ontario in the 1830s. They did not invade Lake Erie prior to the improvements of the Welland Canal in 1919; sea lampreys were first observed in Lake Erie in 1921. After spreading into Lake Erie, sea lampreys moved rapidly to the other Great Lakes, appearing in Lake St. Clair in 1934, Lake Michigan in 1936, Lake Huron in 1937, and Lake Superior in 1938. By the late 1940s, sea lamprey populations had exploded in all of the upper Great Lakes causing severe damage to lake trout and other critical fish species. Sea lampreys have had an enormous negative impact on the Great Lakes fishery. Because sea lampreys did not evolve with naturally occurring Great Lakes fish species, their aggressive, predaceous behavior gave them a strong advantage over their native fish prey. Sea lampreys prey on all species of large Great Lakes fish such as lake trout, salmon, rainbow trout (steelhead), whitefish, chubs, burbot, walleye and catfish. Of the 5,747 streams and tributaries of the Great Lakes, 433 are known to produce sea lamprey and about 250 are treated on a regular cycle. The Great Lakes Fishery Commission treats approximately 60-70 streams a year for sea lampreys.

Lesson Procedure:

Set Up / Introduction:

- ~ Print and cut out name tag cards.
- ~ Outline playing field with cones. (Approximately 50 yard square)
- ~ Set up chart paper.
- ~ Ask students how they think the sea lamprey got into the Great Lakes and spread. Discuss.
- ~ Tell the students they are going to simulate a sea lamprey entering a local native ecosystem (represented by a 50 yard square playing field), and the impact it has over five years.

Activity:

- ~ Round 1
  - One student will be the “first invasive” sea lamprey (have them wear their card). The rest of the students represent lake trout. Ask all the students, both the first invasive and the native lake trout, to spread out on the playing field. (representing Lake Huron).
  - Chart “Year #1” using a bar graph, with one invasive and the total of the remaining participants as “X# of lake trout”.

- ~ Round 2
  - The goal of the “first invasive” student is to tag as many fish as possible. The fish try not to get tagged. If they are tagged, they must freeze with their arms out to their side.
  - Allow the game to play for approximately 2 minutes. (If necessary, stop the round *before* all the fish are tagged!) Ask those that are frozen to raise their hands. Give each frozen student an “invasives” tag to wear as they have been overtaken by lamprey. Chart these results on “year #2”.
- ~ Round 3
  - Repeat for another 2 minutes with all the new “invasive” sea lamprey able to tag the original lake trout. Chart as “year #3”.
  - Ask the class what they could do to stop or reverse the impact the invasive sea lamprey has had on the great lakes ecosystem. What can stop or slow the spread of invasives, including the sea lamprey?
  - (If not many trout were tagged during rounds 2 and 3, add one more round of the new invasive sea lamprey now tagging before moving on to the next step.)
- ~ Round 4
  - Introduce a “habitat biologist”: they tag “invasives” and hand them a “control” name tag. During this round, the “control” tag keeps the native lake trout safe from being frozen by that “invasive” species. Examples of biological control may be introducing a new species like Chinook to control invasive alewives, or a chemical control like lampricide (TFM), there are even mechanical controls—sea lamprey traps.
  - Run a 2 minute round and chart the results with the “invasives” and the “habitat biologist” both tagging species. Did adding a biologist slow the spread of the invasive species?

- ~ Round 5
  - Add a second/third “habitat biologist” for 2 minutes and chart “year #5” results.

Wrap up / Assessment Questions:

- ~ What did the students learn?
- ~ Lead student discussion about the chart results.
- ~ Lead student discussion about invasive, non-native, native (here in mid-1800s before European), and introduced species.
- ~ Discuss if the biologists with the control helped. Did this make it easier for the native trout to escape the invasives?

Adaptations/Extension/Enhancements:

- ~ After Round 4, invasives that were tagged with a control are not allowed to tag trout. Alternatively, those invasives tagged in Round 4 must crawl on their hands and knees to tag trout in Round 5. They can still be given a new control in Round 5, thus qualifying them unable to tag any trout.
- ~ Contact the fisheries division of the DNR. *Sometimes* they are able to bring a live sea lamprey to be used as educational outreach.
- ~ Repeat the game as necessary to build a set of data to study.

Additional Resources:

- ~ MWSP website: www.miwaterstewardship.org
- ~ US Fisheries and Wildlife Service - https://www.fws.gov/Midwest/fisheries/sea-lamprey.html
- ~ Michigan DNR sea lamprey identification - https://www.michigan.gov/invasives/0,5664,7-324-68002_73845-374989--,00.html
- ~ Minnesota DNR sea lamprey identification - https://www.dnr.state.mn.us/invasives/aquaticanimals/sealamprey/index.html
- ~ Great Lake Fisheries Commission - http://www.glfc.org/pubs/FACT_3.pdf
- ~ The link to this original DNR invasive species lesson plan series: https://www.michigan.gov/documents/dnr/Aquatic_Invasive_Species_Education_project_607805_7.pdf

Our MWSP logo represents the two hands of Michigan - both the upper and lower peninsulas - and caring for our water resources and water quality. The green hand symbolizes all vegetation and crops in our state and the tan hand symbolizes soils. The lighter blue water signifies the vast surface water throughout the state and the darker blue water denotes groundwater.

Habitat Biologist **(fisheries management)**	**Habitat Biologist** **(fisheries management)**
Habitat Biologist **(fisheries management)**	**FIRST Invasive Species Detected**
Invasive Species	**Invasive Species**

Invasive Species	**Invasive Species**
Invasive Species	**Invasive Species**
Invasive Species	**Invasive Species**

Invasive Species	**Invasive Species**
Invasive Species	**Invasive Species**
Invasive Species	**Invasive Species**

Invasive Species	**Invasive Species**
Invasive Species	**Invasive Species**
Invasive Species	**Invasive Species**

Native Lake Trout	Native Lake Trout
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Biological Control	Chemical Control
Biological Control	Chemical Control
Biological Control	Chemical Control
Biological Control	Chemical Control
Biological Control	Chemical Control
Biological Control	Chemical Control
Mechanical Control	Mechanical Control
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