Lesson 4: Beat the Barriers

Activity: This board game teaches students about the various methods used to limit the sea lamprey population in the Great Lakes. Students assume the identity of sea lampreys and attempt to migrate from Lake Ontario to Lake Superior.

Grade level: 4-8
Subjects: Science and Social Studies
Setting: Classroom
Duration: 15-20 minutes
Key terms: Barrier, Host, Invasive species, Parasite, Spawning

Objectives

After participating in this activity, students will be able to:

- Discuss the differences among the various types of technology used to control the sea lamprey population.
- Locate the lamprey-associated, **spawning** ground "hot spots" in the Great Lakes.
- Describe **parasite/host** relationships.
- Identify the placement of the Great Lakes and describe how the lakes are connected.

Summary

Sea lampreys have been one of the most devastating invader species to enter the Great Lakes. Over time, they've contributed to the decline of native fish populations and threaten a multi-billion dollar commercial fishing industry. By learning about sea lamprey, students begin to understand how harmful exotic species can become and how expensive and complex it is to control an **invasive species** once it's established.

From top to bottom: Sea lamprey barrier, detail of sea lamprey mouth, and sea lamprey feeding on a fish.

With the help of global positioning and mapping technology, larval "hot spots," such as the St. Mary's River, are recorded and targeted for control.

Background

Sea lampreys are eel-like fish that are native to the Atlantic Ocean. Since the 1830s, they have been migrating into the Great Lakes via Lake Ontario and the Erie Canal. Niagara Falls acted as a natural **barrier** for sea lampreys until the Welland Canal was improved in 1919. Once sea lampreys entered Lake Erie, they quickly spread to Lake Huron and Lake Michigan. In 1938, sea lampreys entered Lake Superior by attaching to ships passing through the Soo Locks on the St. Marys River. Because sea lampreys attach to and feed on native freshwater fish, they have posed a serious threat to whitefish, lake trout, and salmon during the past 50 years.

A single lamprey is capable of consuming 40 pounds of host fish in its lifetime. During an adult lamprey's 18-month life span, it will attach to a host fish with its suction-like toothed mouth, then suck nutrition out of the host fish, often killing it. The rapid decline in the number of native freshwater fish affects a Great Lakes sport and commercial fishing industry valued at almost $4.5 billion annually.

Biologists use a combination of methods to control the sea lamprey population in the Great Lakes. Several types of mechanical and electrical barriers have been constructed in strategic locations on Great Lakes tributaries. The barriers allow native freshwater fish to migrate upstream but block sea lampreys from reaching spawning habitat. Sterilization programs for male sea lampreys have also reduced the sea lamprey population. Finally, a special chemical that kills sea lamprey larvae, and an underwater high-power vacuum have both been used in the St. Marys River lamprey spawning grounds to eliminate thousands of lamprey larvae.

Materials and Preparation

- Dice
- Beat the Barriers game board
- Barrier Fact Sheet
- Barrier Cards
- Lamprey Cards

NOTE: *Beat the Barriers Game Board*, *Barrier Cards, Lamprey Cards*, and *Barrier Fact Sheet*, see the end of this lesson (supplemental materials).

Advance Preparation

1. Copy and assemble the game boards. Tape together two sections to make each game board. Copy enough game boards so that four students can play each game.
2. Copy game cards and fact sheet. Copy one or two sets of barrier cards and lamprey cards for each game. (Two sets for each game are advised since students go through one set quite rapidly.) Copy one barrier fact sheet for each game. Students will cut out the sea lamprey picture on the side of game board to use as moveable game pieces.

Procedure

1. Show pictures of sea lampreys attached to lake trout on the Barrier Fact Sheet. Explain a little bit about sea lampreys, parasite/host relationships, and the value of host fish.
2. Describe methods to control sea lamprey populations, including various barriers used in the game.
3. Explain that fisheries managers use barriers to prevent sea lampreys from migrating through all of the Great Lakes. If lampreys did not reach the spawning grounds, managers could discontinue the chemical control methods currently used to eliminate larvae.
4. Divide students into cooperative learning groups of up to four students. Distribute the barrier fact sheet to each group, and have students cut out and color the game pieces.
5. Four students can play the game at a time. Each player assumes the identity of a sea lamprey and attempts to move from the "Start" position, which is Lake Ontario, up through the Great Lakes to the "Finish" position, which is Lake Superior.

6. Players should read each space carefully as they proceed through the game. Players must do what is written on the game space or card. A player's turn continues until there are no more instructions to move the game piece.
7. When landing on a space marked "Take a Barrier Card" or "Take a Lamprey Card," a player must draw a card from the appropriate pile, read it aloud to the other players, and move his or her game piece as instructed. After a card has been read, it should be returned to the bottom of the pile of cards.
8. The winner is the first lamprey to migrate all the way from Lake Ontario to Lake Superior. Players must roll the exact amount to reach the "Finish" position.
9. After playing the game, have students list or discuss the types of methods being used to slow the increase of the lamprey population.
10. Have each student write a paragraph about the two methods that he or she believes to be the most effective, explaining why they have been chosen. Have them refer to the barrier fact sheet.

Source

Prepared by Rosemary Nowak, Eden Elementary School, Eden, New York, for the *ESCAPE Compendium*, developed by the Great Lakes Sea Grant Network.

Assessment & Standards

See separate document: FLOW_Assessment_GLCE.pdf

FLOW Feedback

Please take 10 minutes to provide us with your feedback.
Go to: http://www.miseagrant.umich.edu/flow/flow-feedback.html

Supplemental Materials, Unit 1

Lesson 4 - Beat the Barriers Documents:

- Beat the Barriers game board
- Barrier Fact Sheet
- Barrier Cards
- Lamprey Cards
- Additional details and photos about aquatic invasive species, see: www.miseagrant.umich.edu/ais
- Aquatic Invasive Species Poster Series, *Great Lakes Most Unwanted,* see: www.miseagrant.umich.edu/store

BARRIER FACT SHEET

These are the current types of barriers that are being used in the Great Lakes. They attempt to keep sea lampreys from migrating upstream to their spawning grounds.

FOR MORE INFORMATION ABOUT SEA LAMPREY CONTROL, SEE THE GREAT LAKES FISHERY COMMISSION WEB SITE: WWW.GLFC.ORG/SLFT.HTM

LOW HEAD BARRIER

Two to four feet high, this barrier is placed in a river and prevents lampreys from moving further upstream. A lip is used to keep lampreys from using their suction-cup mouths to climb over the barrier. A jumping pool near the barrier allows other fish to easily jump over the barrier.

ADJUSTABLE-CREST BARRIER

These barriers have adjustable, inflatable crests that are raised only during sea lamprey spawning season. The barrier is computer controlled and adjusts to the water level of the stream. It remains lowered on the river bottom except during lamprey spawning season. As a result, most fish can easily swim over the barrier.

VELOCITY BARRIER

Sea lampreys are poor swimmers that tire easily and need to attach to solid surfaces to rest. Velocity barriers create areas of rapidly moving water. Lampreys are not able to attach to surfaces next to these barriers. Fish can swim through these barriers.

ELECTRICAL BARRIER

DC current is run through these barriers at places where lampreys attempt to pass. The current stops the lamprey.

For more info see: www.glfc.org

BARRIER CARDS

Unit 1, Lesson 4

Sea Grant Michigan

BARRIER CARD

A lip on the **low-head barrier** is used to keep lampreys from using their suction-cup mouths to climb over the barrier.

LOSE A TURN.

BARRIER CARD

The **adjustable-crest barriers** have adjustable, inflatable crests that are raised only during sea lamprey season. You just made it.

MOVE AHEAD 1 SPACE.

BARRIER CARD

The **adjustable-crest barriers** remain lowered on the river bottom except during lamprey spawning season, and as a result most fish can easily swim over the barrier.

MOVE BACK 1 SPACE.

BARRIER CARD

Electrical barriers have DC current running through them at places where lampreys attempt to pass. The current stops the lamprey.

GO BACK TO "START."

BARRIER CARD

A jumping pool near the **low-head barrier** allows other fish to easily jump over the barrier.

MOVE BACK 3 SPACES.

BARRIER CARD

Velocity barriers create areas of rapidly moving water, with surfaces that make it impossible for lampreys to attach.

GO BACK TO "START."

BARRIER CARD

Velocity barriers don't prevent fish from swimming through them. Sea lampreys are poor swimmers that tire easily and cannot go through this barrier.

MOVE BACK 2 SPACES.

BARRIER CARD

The **adjustable-crest barriers** are computer controlled and adjust to the water level of the stream.

STAY WHERE YOU ARE.

FOLD

FOLD

LAMPREY CARDS

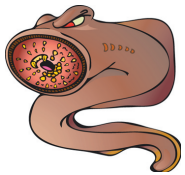
Unit 1, Lesson 4

Sea Grant Michigan

LAMPREY CARD

You reached the Great Lakes, which contain few natural predators for sea lampreys. Because there is limited danger of another species killing you, you are free to attach to as many fish as you like.

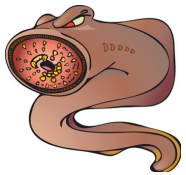
MOVE AHEAD 3 SPACES.



LAMPREY CARD

You found your way to Lake Huron where the sea lamprey population is estimated to be equal to that of the four other Great Lakes combined!

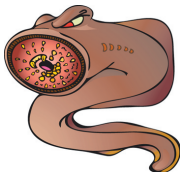
MOVE AHEAD 3 SPACES.



LAMPREY CARD

You successfully spawned with a female and beat out a sterilized male sea lamprey.

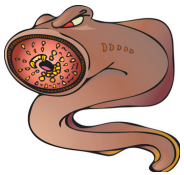
MOVE AHEAD 1 SPACE.



LAMPREY CARD

You have reached a barrier in a river that has not been well maintained due to high costs. You find a way through the barrier.

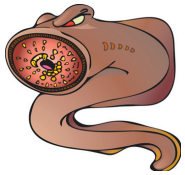
MOVE AHEAD 2 SPACES.



LAMPREY CARD

Scientists began treating Lake Erie with a chemical that kills sea lamprey larvae. However, you found the mouth of a small stream where these chemical methods cannot be used.

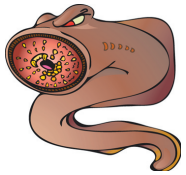
MOVE AHEAD 1 SPACE.



LAMPREY CARD

Because sea lampreys did not evolve with the native fish of the Great Lakes, your aggressive behavior gives you a strong advantage over your native fish prey.

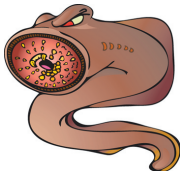
MOVE AHEAD 2 SPACES.



LAMPREY CARD

Local scientists have improved the water quality in a nearby lake. This has created a nice home for you and your sea lamprey family.

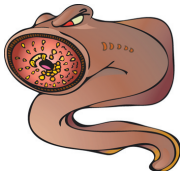
MOVE AHEAD 2 SPACES



LAMPREY CARD

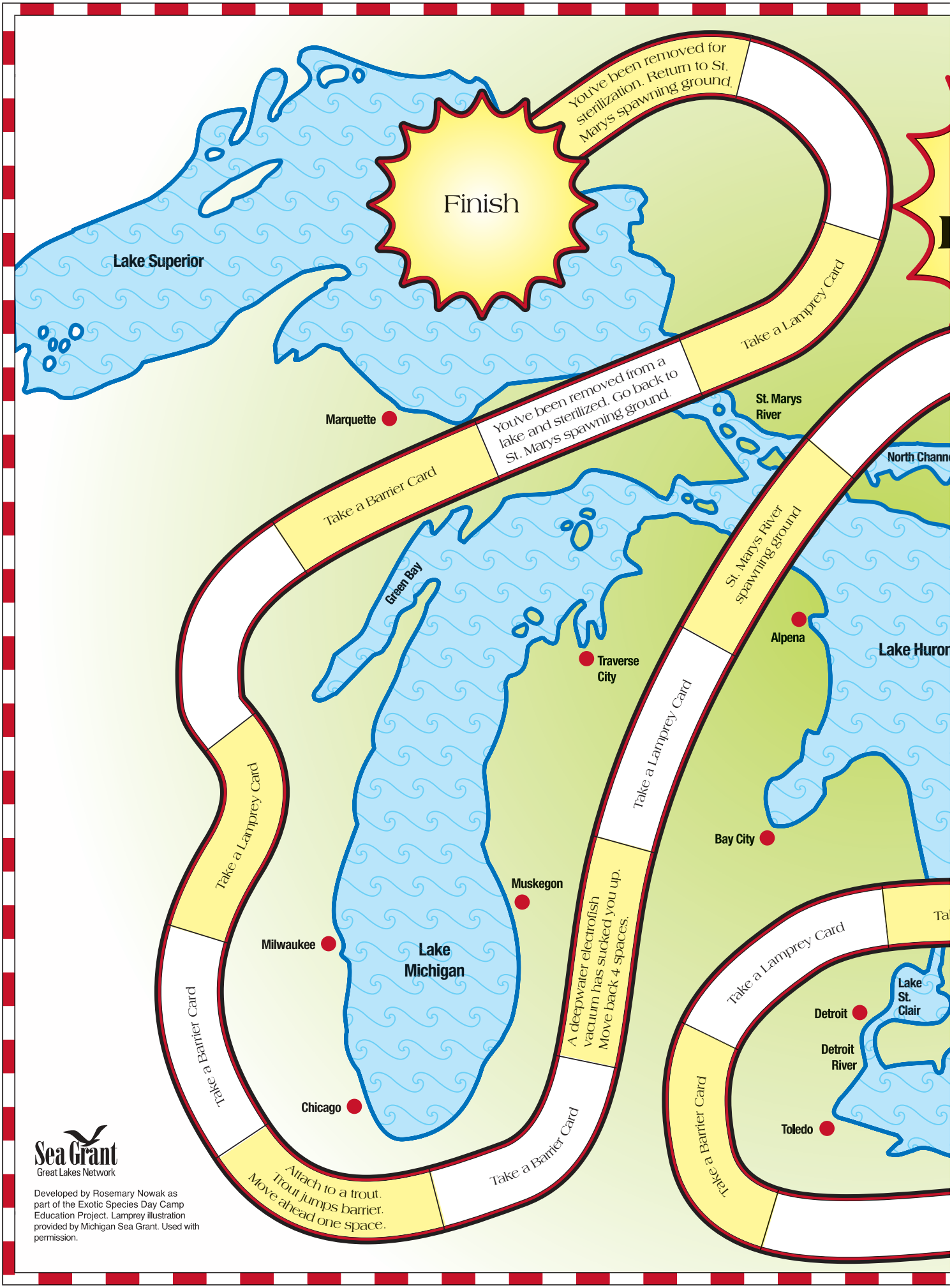
Whew! You just barely made it past the electrofish vacuum in your spawning ground.

MOVE AHEAD 1 SPACE.



FOLD

FOLD



Sea Grant
Great Lakes Network

Developed by Rosemary Nowak as part of the Exotic Species Day Camp Education Project. Lamprey illustration provided by Michigan Sea Grant. Used with permission.

CUT

Beat the BARRIERS

Take a Lamprey Card

Attach to a whitefish. Move ahead 4 squares.

North Channel

Lake Huron

St. Lawrence River

Grab a ride on a trout. Move ahead 3 spaces.

Toronto

Lake Ontario

Rochester

Niagara River

Welland Canal

Erie Canal

Buffalo

Take a Barrier Card

St. Clair River

Lake St. Clair

Lake Erie

Start

Grab a ride on a trout. Move ahead 3 spaces.

Cleveland

Pulled out of Lake Erie while attached to a whitefish. Go back to start.

N

W E

S

CUT

CUT

GAME PIECES

CUT

FOLD

CUT

FOLD

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FOLD

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