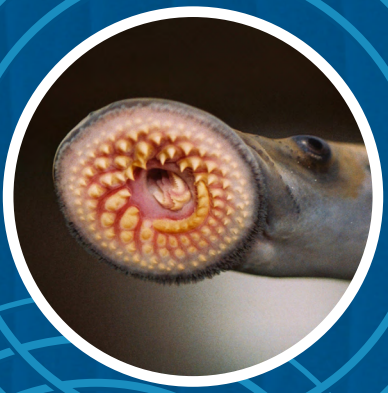
Ripple Effects

The Impact of Aquatic Invasive Species in the Great Lakes



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The Impact of Aquatic Invasive Species in the Great Lakes

Funding is provided by Great Lakes Restoration Initiative via an interagency agreement between the U.S. EPA Great Lakes National Program Office and the National Oceanic and Atmospheric Administration (Grant NA23OAR4170128).

IISG25-HCE-EDU-031

Illinois Extension
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Sea Grant
ILLINOIS-INDIANA

PURDUE UNIVERSITY | Extension - Forestry and Natural Resources

Ripple Effects

Lesson 01: Invader Species of the Great Lakes

Grade Level

6th

Subject

Science, Social Studies, Language Arts

Class Time

3 CLASS PERIODS

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Students engage in a card-matching activity to learn about aquatic invasive species (AIS). In groups students select an aquatic invasive species, create a poster or factsheet and develop a charade-like game to demonstrate ways to prevent invasive species from spreading.

Objectives

Students will be able to:

- Name and recognize some AIS in the Great Lakes.
- Understand and analyze the positive and negative impacts of AIS in the Great Lakes ecosystem.
- Explain the ways in which AIS are introduced into the Great Lakes.
- Describe and act out ways to avoid the spread of AIS.

Materials

- ☐ Invader Species picture cards
- ☐ Introduction cards
- ☐ Ecosystem Impact cards
- ☐ 8 ½” x 11” colored paper
- ☐ Scissors

Vocabulary

- Alewife
- Ballast water
- Invasive species
- Great Lakes
- Non-native species
- Pacific salmon
- Plankton
- Purple loosestrife
- Sea lamprey
- Spiny waterflea
- Zebra mussel

Last Updated: 01/09/2026.

Background

An invasive plant or animal is one that has moved and established outside of its native range and causes harm to the environment, economy, or human health. Invasive species arrive through intentional or accidental human actions. Biologists usually judge the consequences of these impacts based on how much they add to, or detract from, some important human endeavors. They also attempt to examine the effects upon other plant or animal species. Invasive species sometimes have no natural predators in their new locations, and this may allow them to overpopulate an area and reduce native species.

Since the early 1800s, over 180 species of aquatic plants, algae, fish, worms, mollusks, other organisms, and diseases have been introduced into the Great Lakes. It is estimated that about 20% of the 170 or so species of Great Lakes fish are non-native species that were introduced accidentally or intentionally.

A few aquatic invasive species have had very substantial impacts. One such invader to the Great Lakes is the sea lamprey. Common to the ocean waters from Florida to Labrador, sea lamprey swim inland into fresh waters to spawn. Natural barriers, like Niagara Falls, previously prevented them from reaching the rest of the Great Lakes. However, once shipping routes like the Erie and Welland canals were opened up, sea lamprey easily found their way to the Great Lakes, where it decimated populations of native and stocked fish species.

Many AIS hitched a ride to the Great Lakes region in the ballast of ships. When ships are not loaded with cargo, they take on ballast for better balance, stability, and safety. The use of water as a ballast has replaced the use of sand and stones over the past 100 years or so. Scientists think many of today's invasive species, such as quagga mussels, round goby, Eurasian ruffe, and spiny waterflea, were sucked up from foreign harbors by powerful water pumps. Ballast tanks are filled with water from the harbors wherever ships are loaded, and then the water is dumped, along with any aquatic organisms present, when ships reach their destination. It is estimated that in the history of the Great Lakes, over 30% of the invader species entered in solid ballast and over 50% through ballast water.

The United States and Canada now require that all ships entering the Great Lakes to discharge their freshwater ballast while still in the ocean, replacing it with saltwater ballast to reduce the introduction of new aquatic invasive species.

There are always trade-offs involved with the accidental or intentional introduction of a species into an ecosystem. Sometimes the impacts are difficult to judge ahead of time. Laws and regulations are intended to force a careful review of pros and cons before the intentional introduction of a new species is allowed. The introduction of a species that will have mostly detrimental impacts is not allowed.

People can help to avoid the spread of AIS by taking precautions. For example, boaters should be careful to rinse the bottoms of boats, bilge pumps, and live wells with clean, heated tap water before leaving lake or river areas. And they should remove aquatic plants that cling to boats and hulls. Ships should always release foreign ballast before entering their destination.

Helpful Hints

- This activity involves a wide range of skills including citizenship, classification, comparison, description, discussion, listening, media construction, problem solving, public speaking, reading, reporting, responsibility, role-playing, small-group dynamics and writing.

Last Updated: 01/09/2026.

Procedure

1. Decide how many students you would like to have working together. Prepare a complete set of cards for each group. Copy each of the three types of cards (Ecosystem Impact, Introduction, and Invader picture cards) on different colored paper. Have students cut them apart, or have cards precut before doing the activity. One complete set contains 18 cards.

2. Introduce the topic of AIS to the class. Explain key points made in the background section and define difficult vocabulary words such as invasive, non-native, invader, ballast, and plankton.

3. Divide students into cooperative learning groups and distribute the cards.

4. Have students match each AIS to its corresponding cards.

5. When group members agree that they have matched the cards to the best of their ability, have them check their answers using the answer sheet.

6. Each group selects an invader to present to the class. Have students construct a poster or develop a factsheet. They should include the impact of the invader on humans or the ecosystem. Then have them prepare a charade-like presentation that demonstrates how to prevent the spread of their invasive species.

7. Each group presents its AIS using the poster or factsheet that was developed. The group acts out a way to prevent the spread of AIS and the rest of the class guesses the action they are performing.

After all groups have presented and acted, review the importance of informed decision-making with regard to AIS. Remind them that there are some positive changes as a result of AIS; however, there are often many negative impacts to the Great Lakes ecosystem, and we are all responsible for making good decisions. Help guide students to the conclusion that invading species can harm the ecosystem in sometimes unpredictable ways that may have short-term benefits, but long-term detrimental impacts.

Discussion questions include:

- Why should people be concerned about AIS?
- What are some negative impacts of AIS?
- What are some positive changes that result from AIS introductions?
- What actions can you take to prevent the spread of AIS?
- What are some examples of good and bad decisions people can make with regard to AIS?
- How do AIS affect ecosystems?

Wrap-Up

- Observe groups as they discuss and organize their cards.
- Observe group presentations of invasive species.
- Collect the groups' invader posters or factsheets to evaluate according to teacher criteria.

Last Updated: 01/09/2026.

Extension

- Do research on control methods that have been tried on various invader species and report on their successes or failures. Brainstorm a creative way to control one of the invaders.
- Investigate other Great Lakes invaders, such as the Eurasian watermilfoil, to determine ecological impacts. Add your species to this game.
- Draw a humorous cartoon depicting the problem or benefit of an invader species. Some examples are a quagga mussel looking for a place to attach on an already overcrowded lake bottom, a white perch nudging out a yellow perch or purple loosestrife choking out other plants.
- Look for AIS the next time you visit Great Lakes waters.

Resources

Websites:

A Field Identification Guide to Invasive Plants in Michigan's Natural Communities: https://mnfi.anr.msu.edu/invasive-species/InvasivePlantsFieldGuide.pdf
U.S. Geological Survey, Nonindigenous Aquatic Species: https://nas.er.usgs.gov/about/default.aspx
Great Lakes Aquatic Nonindigenous Species Information System: https:/www.glerl.noaa.gov/glansis/

Kits:

Aquatic Invaders Attack Pack, a backpack filled with resources that help students learn about AIS found in the Great Lakes: https://iiseagrant.org/education/loanable-kits/

Credits

Created by: Jim Alvaro, Anchor Bay School District, Clinton Township, MI
Modified by: Terri Hallesy, Illinois-Indiana Sea Grant
Invader Picture cards, Introduction cards, and Ecosystem Impact cards were included in the student activity of this lesson with permission from Ohio Sea Grant.

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

Student Activity: Aquatic Invasive Species Card Matching - Species 01

Student Activity: Aquatic Invasive Species Card Matching - Species 02

Photo Credit: Alison Fox, University of Florida, Bugwood.org

Student Activity: Aquatic Invasive Species Card Matching - Introduction 01

INTRODUCTION

Originally, this species came from the Caspian Sea region of eastern Europe and western Asia. Canals built during the early 1800s allowed it to spread throughout Europe. It was introduced into the Great Lakes about 1989, when one or more transoceanic ships discharged ballast water into Lake St. Clair. Freshwater ballast from a European port likely contained larvae and possible yearlings. Being a temperate, freshwater species, it found the plankton-rich Lake St. Clair and Lake Erie to its liking.

B

INTRODUCTION

Originally, this species came from the Atlantic Ocean, the St. Lawrence and Hudson rivers, and their tributaries for spawning. It swam from Lake Ontario into Lake Erie through the Erie and Welland canals, gaining entry into the upper Great Lakes by attaching to boat hulls.

H

INTRODUCTION

A native of northern Europe, it made its way into the Great Lakes watershed in 1990. This species is believed to have been brought over in freshwater or mud in ballast water of European freighters from eastern Baltic ports. It is currently spreading inland via rivers and canals.

C

INTRODUCTION

This species was originally brought to the United States in the 1970s for aquaculture and wastewater treatment, these fish escaped from fish farms into the Mississippi River System and spread through connected waterways. It is now approaching the Great Lakes through channels that link the Mississippi River Basin to Lake Michigan.

A

Student Activity: Aquatic Invasive Species Card Matching - Introduction 02

INTRODUCTION

From saltwater areas of the Atlantic coast, this invader moved up the Hudson River and, via various canal systems, into Lake Ontario and Lake Erie. Because of intentional stocking, it can now be found in all five Great Lakes.

D

INTRODUCTION

This invasive species came from Europe, Asia, and North Africa and was introduced into North America as an aquarium plant. It also spreads when it gets entwined on boats, fishing equipment, or waterfowl. It is now found in 37 states and three Canadian provinces.

E

INTRODUCTION

This species was intentionally imported from northern Europe over 100 years ago, because its hardiness and beautiful flowers were popular with landscapers, florists, and gardeners.

F

INTRODUCTION

Coming from the salty Atlantic Coast, this species migrated through water routes, including canals in New York state and the St. Lawrence River. It swam into the upper Great Lakes through the Welland and Erie barge canals before 1931.

G

Student Activity: Aquatic Invasive Species Card Matching - Ecosystem Impact 01

ECOSYSTEM IMPACT

This mussel filters plankton from the water; this allows sunlight to reach greater depths, resulting in an overgrowth of aquatic plants. It accumulates on objects such as boat hulls and underwater pipes, clogging valves of both industrial and municipal water intake sources.

U

ECOSYSTEM IMPACT

This lamprey destroys valuable fish, especially lake trout, by attaching with its sucker-like mouth to drain blood and body tissues. It upsets the ecological balance by removing top predators, allowing for population explosions of smaller fish such as alewives. It had great economic impact on the commercial fishing industry of the Great Lakes during the 1950s. Current control measures are able to keep populations in check, but it still impacts fish species in the Great Lakes today.

W

ECOSYSTEM IMPACT

This aquatic invasive species spawns from April to September, longer than many other fish, and produces a large number of offspring quickly. Males ferociously defend the nests, reducing the reproductive success of native species by denying them access to spawning habitat. This fish feeds on the eggs and young of native species, including many important sport fish like yellow perch, damaging an important industry for many Great Lakes states.

S

ECOSYSTEM IMPACT

This species loves to eat plankton, mussels, and snails, and can consume 5–20% of its body weight each day, easily outcompeting native species in the search for food. Because it is less valued by anglers, its spread could also harm the region's multi-billion-dollar fishing industry.

Z

Student Activity: Aquatic Invasive Species Card Matching - Ecosystem Impact 02

ECOSYSTEM IMPACT

Feeding primarily on zooplankton, this vertebrate competes for food with juveniles of almost all fish species. Large numbers die off in spring and summer because of electrolyte imbalance from living in freshwater. These die-offs clog municipal and industrial intake pipes and foul beaches. In 1967, bulldozers had to remove 50,000 tons of rotting fish from the southern shores of Lake Michigan.

Y

ECOSYSTEM IMPACT

This aquatic invasive species is suspected to be partially responsible for the decline of Lake Erie's yellow perch because it competed for food resources. It is also detrimental to walleye and white bass populations because these species' eggs can be a primary food source.

V

ECOSYSTEM IMPACT

This plant is called "the beautiful killer" because its dense roots choke waterways as it competes with other vegetation. It spreads quickly, crowding out valuable plants that provide food for migrating waterfowl, and destroys habitat for almost all other forms of wetland life.

X

ECOSYSTEM IMPACT

This invasive plant forms thick mats on the water's surface that choke out native aquatic vegetation. The mats alter the nutrient composition and flow of water, which in turn affects the amount of oxygen available to fish. It also disrupts all forms of water recreation–boating, swimming and fishing–because plants get caught in boat rotors, and swimmers and anglers are blocked from access to the water.

T

Invader Species: Card Matching Activity Answer Key

1. Quagga Mussel: B, U
2. Sea Lamprey: H, W
3. Round Goby: C, S
4. Bighead Carp: A, Z
5. Alewife: G, Y
6. White Perch: D, V
7. Purple Loosestrife: F, X
8. Eurasian Watermilfoil: E, T

Last Updated: 01/09/2026.

Ripple Effects

Lesson 02: Find 7 Ways Aquatic Invaders Are Spread

Grade Level

6th

Subject

Science

Class Time

1 CLASS PERIOD

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Aquatic invasive species (AIS) can be introduced into new bodies of water through various human pathways. Being aware of these pathways is one step that people can take in preventing future infestations.

Objectives

Students will be able to:

- Name and recognize seven ways that AIS can be introduced into new bodies of water by people.
- Describe how to avoid the spread of AIS.

Materials

- ☐ Find 7 Ways Aquatic Invasives are Spread student activity
- ☐ Computers or tablets with internet access for student use

Vocabulary

- Angler
- Bait well
- Boat trailer
- Great Lakes
- Hunting decoy
- Hydroplane
- Invasive species
- Pontoon
- Predator
- Propeller
- Recreationist
- Watercraft
- Scuba gear

Last Updated: 01/09/2026.

Background

Aquatic invasive species are organisms that have been introduced, either intentionally or unintentionally, into an ecosystem that is not their own. For example, if an angler releases bait after fishing, or if someone dumps aquarium plants in a local waterway, they could be unintentionally introducing AIS into the environment. These non-native organisms create additional competition for food and shelter, burdening species that were already present in the ecosystem. Because AIS lack natural predators their populations increase rapidly, and they begin to take over an area. It is almost impossible to eliminate them once they dominate a habitat. It costs tens of millions of dollars each year to control AIS. Students need to become aware of how native species in an ecosystem depend on each other to survive and the steps we can take to make a difference in keeping our waterways clean and healthy.

Helpful Hints

- Prior to completing this activity, students should have a general understanding about issues associated with aquatic invasive species.

Procedure

1. Students can work on this activity independently, or in small groups of 2–3.

2. Provide each student with a copy of Find 7 Ways Aquatic Invaders are Spread activity to complete.

3. Provide a brief introduction to AIS. In their groups, have students work cooperatively to find seven ways that AIS are spread. Students should visit https://www.transportzero.org/ and http://stopaquatichitchhikers.org/ to gather tips and clues on ways to control their spread.

4. Facilitate a brief class discussion about the 7 ways AIS are spread and ways to prevent it.

Wrap-Up

- Evaluation is based on the written responses to questions assigned in the Find 7 Ways Aquatic Invaders are Spread activity. The answers should indicate that students have gained understanding in finding the information requested.

Extension

1. One of the most important lessons students can learn in a unit about AIS is how to stop the spread of invaders. Working in groups, students could generate hypothetical solutions to a local environmental imbalance or destructive invasion.

2. A community stewardship project could include writing to congressional representatives about improving laws to prevent further AIS spread, creating a video to share on YouTube, or partnering with a community organization to raise awareness about AIS issues.

3. Students could research and report on current problems involving AIS and discuss successful control measures used to reduce spread.

Last Updated: 01/09/2026.

4. Visit https://iiseagrant.org/education/students-ask-scientists/ to learn about the Illinois-Indiana Sea Grant Students Ask Scientists program, where you can invite a scientist to be a guest speaker to talk with your students about AIS research and management.

5. Students could research and report on the importance of the Great Lakes regarding industry, recreation and tourism, agriculture, commercial and sports fisheries, forestry, and mining.

Resources

Websites:

Transport Zero: https://www.transportzero.org/
Great Lakes Information Network: https://www.glc.org/work/ais
U.S. Geological Survey, Nonindigenous Aquatic Species: https://nas.er.usgs.gov/about/default.aspx
Great Lakes Aquatic Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/

Illinois-Indiana Sea Grant Websites:

Aquatic Invasive Species: https://iiseagrant.org/work/aquatic-invasive-species/
Sea Grant takes AIM at AIS: http://www.iiseagrant.org/newsroom/sea-grant-takes-aim-at-ais
What's in your water garden? Learn more about AIS: http://www.iiseagrant.org/newsroom/whats-in-your-water-garden-learn-more-about-ais
Biologists can be heroes too: http://www.iiseagrant.org/newsroom/biologists-can-be-heroes-too

Credits

Originally created for ESCAPE Compendium, Great Lakes Sea Grant Network

Created by: Kristin TePas and Pat Charlebois and designed by Jerry Barrett and Susan White, Illinois-Indiana Sea Grant

Modified by: Terri Hallesy, Illinois-Indiana Sea Grant

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

What's wrong with this picture?
Find 7 Ways Aquatic Invaders Are Spread

What's wrong with this picture?
Find 7 Ways Aquatic Invaders Are Spread

Last Updated: 01/09/2026.

Ripple Effects | Find 7 Ways Aquatic Invaders Are Spread

Student Activity: Picture Puzzle

Name _____ **Date** _____ **Class Period** _____

Directions: Answer the questions below based on the Find 7 Ways Aquatic Invasives are Spread picture. Explore https://www.transportzero.org/ or https://stopaquatichitchhikers.org/ for additional information.

1. What vehicle can transport zebra mussels on its pontoons? How can this be prevented?

2. Which watercraft can act as an effective carrier of aquatic invaders? How can the owner of this watercraft prevent the unintentional spread of aquatic invaders?

3. What enjoyable indoor hobby creates problems in local ponds and rivers? How can this be prevented?

4. What does this recreationist wear that can move species to other water bodies? How do you think this could be prevented?

5. How do hunting decoys spread AIS? How do you think this could be prevented?

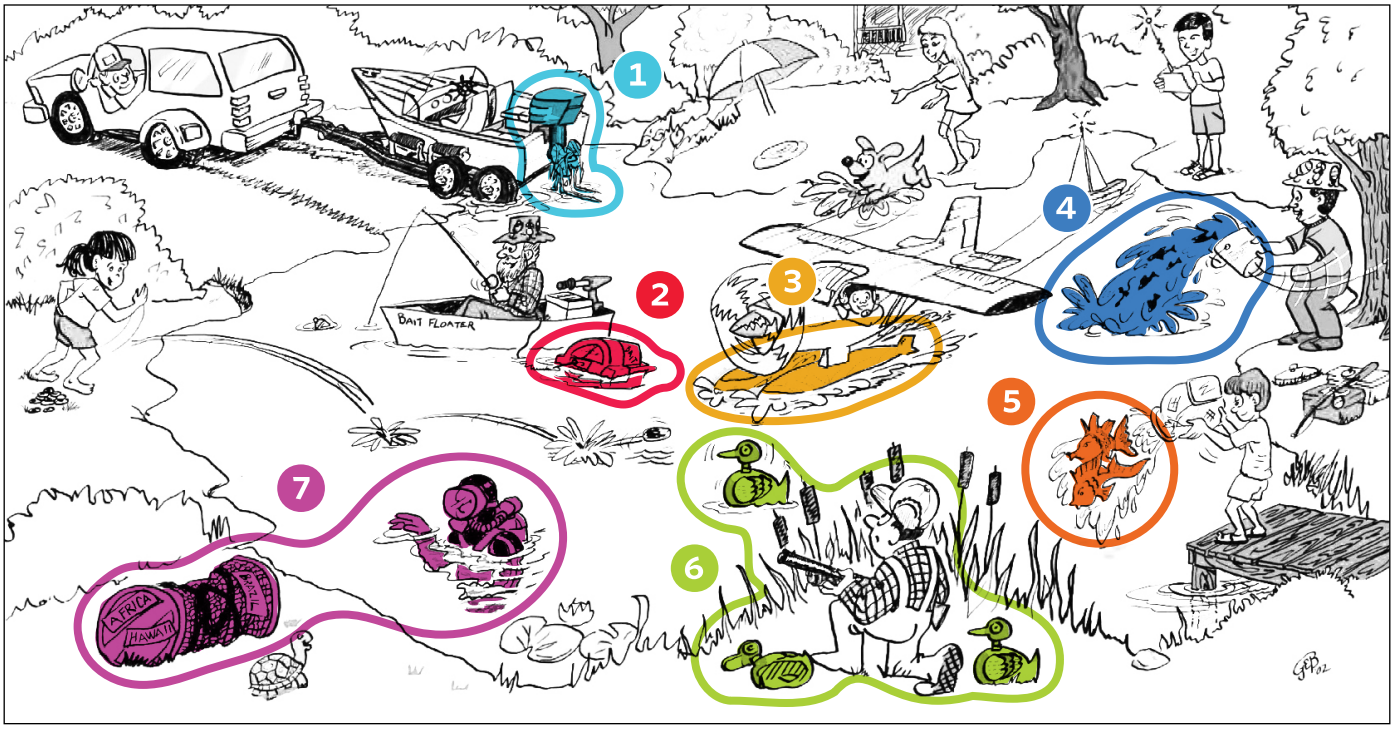
6. Where should anglers (fishermen) dispose of bait that is no longer needed? Why is it important to dispose of live bait properly?

7. If you catch more fish than you want, what's wrong with throwing them into a different lake or river?

Last Updated: 01/09/2026.

Student Activity: Picture Puzzle

What's wrong with this picture?
Find 7 Ways Aquatic Invaders Are Spread



1. Boat, 2. Fishing Bait, 3. Seaplane, 4. Releasing Fish, 5. Releasing Pets, 6. Hunting Decoys, 7. Scuba Gear

Last Updated: 01/09/2026.

Ripple Effects | Find 7 Ways Aquatic Invaders Are Spread

Find 7 Ways Aquatic Invasives are Spread Picture Puzzle

Directions: Answer the questions below based off the Find 7 Ways Aquatic Invasives are Spread picture. Explore https://www.transportzero.org/ or https://stopaquatichitchhikers.org/ for additional information.

Accept all reasonable responses.

1. What vehicle can transport zebra mussels on its pontoons? How can this be prevented?

   Seaplane is the correct answer. However, if students answered "boat" thinking of a pontoon boat, this response would also be correct. Pilots should be aware of the status of AIS in waterbodies they travel in, to avoid the possible infestations and the pontoons should be cleaned and dried before moving to a new water body.

2. Which watercraft can act as an effective carrier of aquatic invaders? How can the owner of this watercraft prevent the unintentional spread of aquatic invaders?

   The correct answer is boat. Boat trailer and seaplane are also appropriate answers. Invasive species can cling to the boat motor/propeller, and the trailer. Some steps to prevent the spread of AIS are: 1) clean vegetation from boat, trailer, and equipment, 2) flush the motor, bait wells, and live wells, and 3) let the boat air-dry for 5 days.

3. What enjoyable indoor hobby creates problems in local ponds and rivers? How can this be prevented?

   Aquarium plants and animals typically are not from lakes and ponds within the United States. If they are dumped into a waterbody, these fish could possibly breed and reproduce. If released, aquarium plants and animals can outcompete native species, causing them to suffer and die. Never dump aquarium pets or plants into a water body. Seek out rehoming pets or humane disposal.

4. What does this recreationist wear that can move species to other water bodies? How do you think this could be prevented?

   Scuba gear. All scuba equipment should be properly cleaned and dried after each use. Even clothing and scuba tanks can be a mode of transportation for aquatic invaders.

5. How do hunting decoys spread AIS? How do you think this could be prevented?

   Invasive plants and animals, like Hydrilla and zebra mussels, can attach to hunting decoys and be carried to another lake, river, or pond. As with all equipment used in water, decoys should be properly rinsed off and dried after each use.

6. Where should anglers (fishermen) dispose of bait that is no longer needed? Why is it important to dispose of live bait properly?

   "In the trash" is the best answer. Like aquarium fish, bait fish should never be released into a body of water. The proper way to dispose of unwanted minnows, worms and fish parts is in the trash. Some types of bait fish can reproduce rapidly and cause havoc for native fish.

7. If you catch more fish than you want, what's wrong with throwing them into a different lake or river?

   All fish that will not be eaten should only be released back into the waterbody from which they were taken. Non-natives introduced into a new ecosystem can disrupt the food web.

Last Updated: 01/09/2026.

Ripple Effects

Lesson 03: Characteristics of Great Lakes Invasive Species

Grade Level

6–8th

Subject

Science

Class Time

1–2 CLASS PERIODS

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Students use puzzle pieces to match Great Lakes aquatic invasive species (AIS) with their characteristics, classification, origin, and introduction to the ecosystem.

Objectives

Students will be able to:

- Name and recognize some AIS of the Great Lakes.
- Identify the characteristics of AIS in the Great Lakes ecosystem.
- Match the ways in which AIS are introduced into the Great Lakes.

Materials

- ☐ *AIS Puzzle*
- ☐ Blank puzzle template
- ☐ Envelope with colored pencils for each group
- ☐ 8½" × 11" colored paper (8 sheets per group, one color per group)
- ☐ Scissors

Vocabulary

- Alewife
- Characteristics
- Classification
- Common name
- Eurasian watermilfoil
- Origin
- Purple loosestrife
- Eurasian ruffe
- Scientific name
- Sea lamprey
- Spiny waterflea
- White perch
- Zebra mussel

Last Updated: 01/09/2026.

Background

Knowledge of Great Lakes aquatic invasive species is important if students are going to make educated decisions about them and the environment in the future. For example, the quagga mussel (*Dreissena bugensis*) originally came from areas near the Caspian Sea and were discovered in Lake Erie around 1989. Quagga mussels are bivalve mollusks that were carried in the ballast tanks of ocean-going ships. They filter water by feeding on plankton, reducing food for other animals and fish that feed on plankton. The following are more Great Lakes invasive species:

Sea lamprey (*Petromyzon marinus*) swam up the St. Lawrence River and the Erie Canal from the Atlantic Ocean and entered the Great Lakes. They are classified as primitive fish. They spawn in freshwater tributaries and are a parasite on native and stocked freshwater fish.

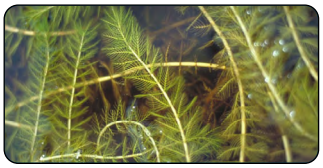
Spiny waterflea (*Bythotrephes longimanus*) is native to Northern Europe and parts of Asia. They entered Lake Ontario in 1982 and can now be found throughout the Great Lakes. They were introduced into the Great Lakes by ballast water discharged from ocean-going ships. Spiny waterfleas feed on smaller zooplankton, such as Daphnia, which are important food for fish.

Ruffe (*Gymnocephalus cernuus*) came from freshwater of Eurasia. They were discovered in Lake Superior in 1987, (based on 1986 samples) and had “hitchhiked” in ballast water. They have a dark spot on their dorsal fins and are a perch-like fish.

Alewife (*Alosa pseudoharengus*) came from the Atlantic Ocean. It entered the Great Lakes through the Welland and Erie canals. They are a herring-like fish with one dorsal fin, and they compete with other fish that feed on plankton.

White perch (*Morone americana*) came from the Atlantic Ocean through the Erie and Welland canals. White perch compete with native fish species and have the potential to decrease fish populations because they eat the eggs of walleye and other fish species.

Purple loosestrife (*Lythrum salicaria*) is native to Northern Europe and was intentionally imported for its hardiness and beautiful flowers. Purple loosestrife invades marshes and wetlands, replacing cattails and other aquatic plants. The plants form dense, impenetrable stands and are unsuitable as cover, food, or nesting sites for many native wetland animals.



Eurasian watermilfoil (*Myriophyllum spicatum*) is native to Europe, Asia, and Africa. This aquatic plant was introduced as an aquarium plant and by boats. It forms thick mats that choke out native aquatic plants. It has the ability to reproduce through stem fragments and runners, so a single segment of stem and leaves can actually form a new colony.

Last Updated: 01/09/2026.

Helpful Hints

- Students should have studied or researched specific AIS of the Great Lakes. If research did not cover all of the categories used for the puzzle, have students do the necessary research before doing all the puzzles.
- You may want to limit the number of AIS you put into each envelope. Four or six AIS may be a good way to start, depending on the group's ability level. This activity may take longer than one class period if you use all eight puzzles.
- Make sure that the puzzles are all the same color and are shuffled in each envelope. Have the students take turns choosing puzzle pieces, but have them work together as a team deciding on the proper placement of the puzzle pieces.
- The teacher should move between groups questioning the students on their progress. It may be helpful to ask:
  - What is the number of puzzle pieces?
  - What category does the number represent?

Procedure

Preparing for the activity

1. Copy the included puzzles on colored paper. Each group of students should have a different color, and all the puzzle pieces for a group should be the same color.

2. Using scissors, cut out the puzzles. Each AIS has six pieces, and there should be 48 pieces when complete, if all the species are used.

3. Shuffle puzzle pieces in each group's envelope. Copy the puzzle template with category name for each group.

4. Have students use resources to locate any information that is represented in the puzzle and has not been previously researched, origin, introduction to the Great Lakes, characteristics, or classification.

Conducting the activity

1. Divide students into cooperative learning groups of two or three students. Give each group an envelope with the shuffled puzzle pieces.

2. Provide each group with the puzzle template that contains the category names so they know what each of the numbered puzzle pieces represents.

3. Have students sort the puzzle pieces by number and then try to separate and match the pieces, in order by number. For example, have students first lay out all the pieces numbered as "1," which is the common and scientific name. Then have them match each of the pieces numbered "2," the pictures, with each of the corresponding names. Then go to the pieces numbered "3," to match the species origin to the correct puzzle, and so on.

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4. Let students use their notes the first time through the puzzle. Check to see that they have made the right choices, then scramble the pieces and let them try the puzzle without their notes. Switch group members, if time allows, and try the puzzle again.

Wrap-Up

The information from the puzzles can be used to design an objective test if a formal method of evaluation is desired. For an informal evaluation, teachers can determine grades for each group based on their success with completing the puzzles and doing the activity.

Extension

Students can create their own puzzles for other invasive species using the blank puzzle template.

Resources

Websites:

Great Lakes Commission: https://www.glc.org/work/ais
U.S. Geological Survey, Nonindigenous Aquatic Species: https://nas.er.usgs.gov/about/default.aspx
Great Lakes Aquatic Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/

Kits:

Aquatic Invaders Attack Pack, an interactive education kit containing preserved and facsimiles of aquatic invasive species available from Illinois-Indiana Sea Grant. Contact Janice Milanovich, 217-300-0211; janicem@illinois.edu or visit: https://iiseagrant.org/education/loanable-kits/

Credits

Originally created for ESCAPE Compendium, Great Lakes Sea Grant Network

Created by: Thomas E. Cooper (Retired) Gowanda Central School, Gowanda, NY

Modified by: Helen Domske, New York Sea Grant

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 01

1

INVASIVE SPECIES #1

Quagga Mussel
(Dreissena bugensis)

2

3

Came from the Ponto-Caspian Sea

4

Discovered in Lake Erie in 1989 where it "hitchhiked" in ballast water

5

Mollusks (bivalve)

6

Filter feeds on plankton

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 02

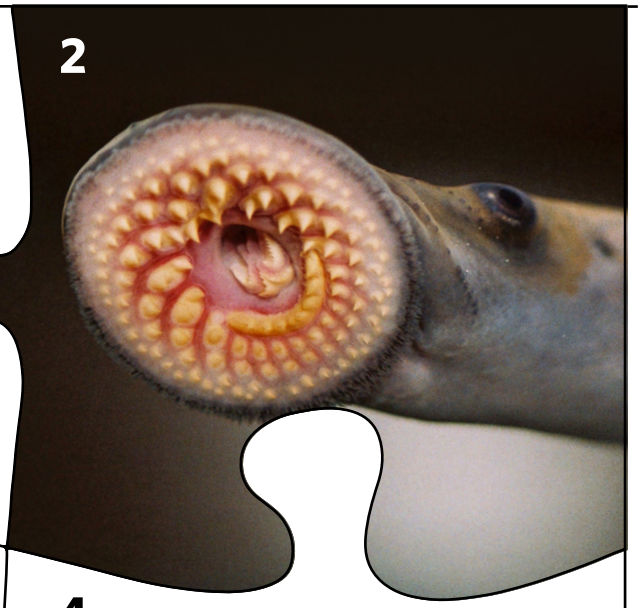
1

INVASIVE SPECIES #2

Sea Lamprey

(Petromyzon marinus)

2



3

Came from Atlantic Ocean

4

Attached to hulls of boats; spawn up freshwater tributaries.

5

Sucker-like mouth and parasitic on fish, especially Lake Trout.

6

Primitive fish

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 03

1

INVASIVE SPECIES #3

Spiny Water Flea

(Bythotrephes cederstroemi)

2

3

Native to Northern Europe

4

Entered Lake Huron in 1984, and in all Great Lakes by 1987. Found in ballast water and mud of boats.

5

This form of lake plankton feeds on smaller plankton.

6

Invertebrate

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 04

1

INVASIVE SPECIES #4

Eurasian Ruffe

(Gymnocephalus cernua)

2

3

Freshwater and brackish water of Northern Europe

4

Discovered in Lake Superior in 1986, where it "hitchhiked" in ballast water.

5

This bottom feeder has a dark spot on its dorsal fin.

6

Perch-like fish

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 05

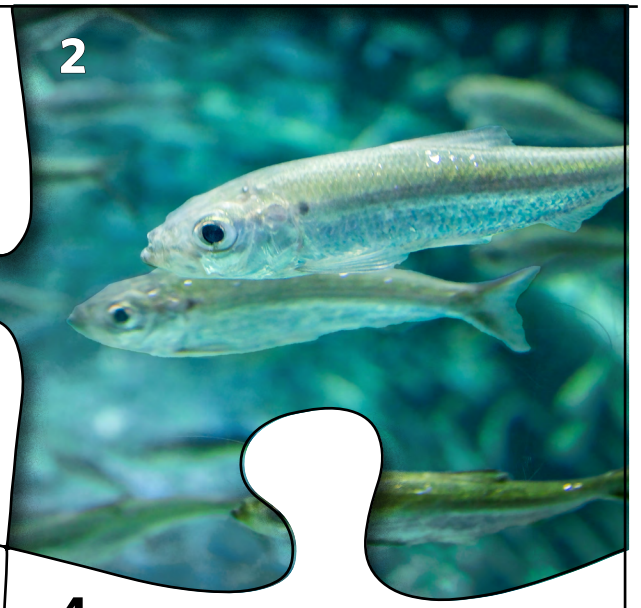
1

INVASIVE SPECIES #3

Alewife

(Alosa pseudoharengus)

2



3

Atlantic Ocean

4

It swam to the upper Great Lakes prior to 1932, through the Welland and Erie Canals.

5

Grows to approximately 5 inches and has one dorsal fin.

6

Herring-like fish

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 06

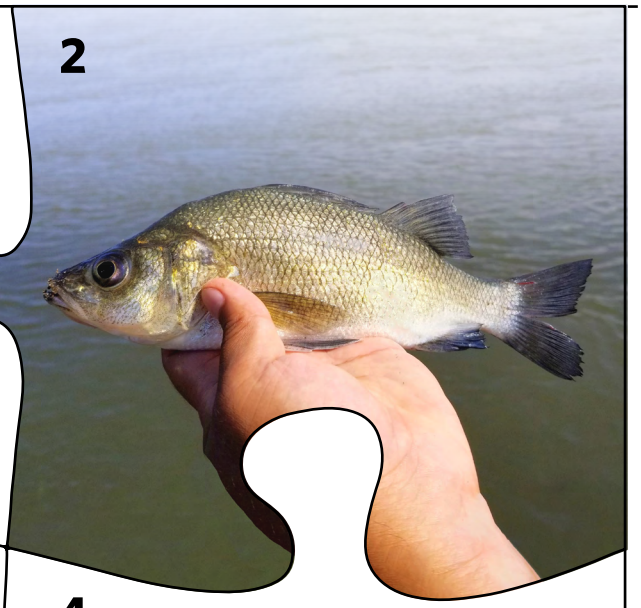
1

INVASIVE SPECIES #6

White Perch

(Morone americana)

2



3

Atlantic Ocean

4

Swam through various canal systems.

5

Grows to 8–12 inches and has no dark spots on the dorsal fin.

6

Fish

Aquatic Invasive Species Puzzle 07

1

INVASIVE SPECIES #7

Purple Loosestrife

(Lythrum salicaria)

2

3

Northern Europe

4

Imported for its hardiness and beautiful flowers.

5

The "beautiful killer" crowds out other plants and grows to 6 feet tall.

6

Flowering plant

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle 08

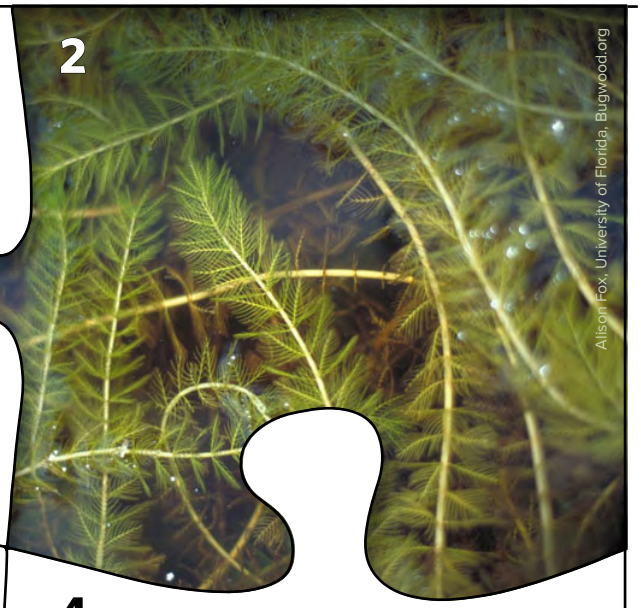
1

INVASIVE SPECIES #8

Eurasian Watermilfoil

(Myriophyllum spicatum)

2



Alison Fox, University of Florida, Bugwood.org

3

Europe, Asia, and Africa

4

Introduced as an aquarium plant.

5

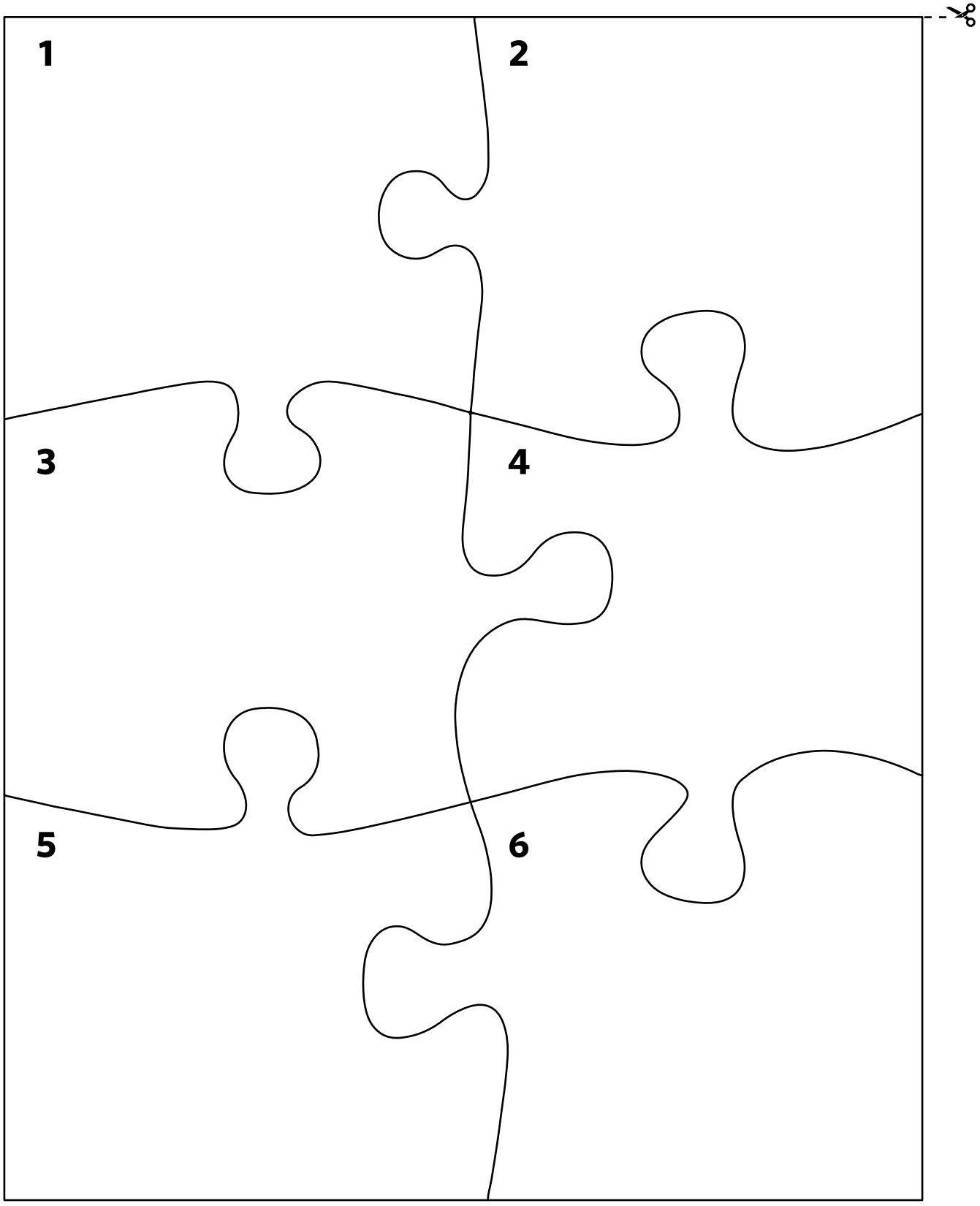
Forms thick mats that choke out native aquatic plants.

6

Aquatic plant

Last Updated: 01/09/2026.

Aquatic Invasive Species Puzzle Template



Last Updated: 01/09/2026.

Ripple Effects

Lesson 04: Seeing Purple - A Population Explosion

Grade Level

6–8th

Subject

Science

Class Time

3 CLASS PERIODS

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Through a simulation, sampling, and estimation activity, students learn about the impact of purple loosestrife on a wetland due to its exponential growth. They learn about the life cycle of purple loosestrife and appreciate how scientists determine the population size in an ecosystem.

Objectives

Students will be able to:

- Recognize purple loosestrife and tell how the seeds are dispersed.
- Describe that purple loosestrife produces over 2 million seeds and have a concept of how much that really is.
- Determine the population of purple loosestrife seeds in their wetland ecosystem through sampling.

Materials

- ☐ Purple loosestrife (*Lythrum salicaria*) factsheet
- ☐ Dot worksheet
- ☐ How Much is Two Million Seeds? worksheet
- ☐ One bag of purple paper confetti (or hole-punches from purple construction paper)
- ☐ Fan or blow dryer
- ☐ Meter sticks
- ☐ String (optional)

Vocabulary

- Population
- Purple loosestrife
- Sampling

Last Updated: 01/09/2026.

Background

Through its competitive advantage, purple loosestrife is an aggressive nonindigenous plant that rapidly disperses throughout wetland areas. It interferes with the growth of native species and fills in the spaces where the natives would normally grow. Purple loosestrife creates many problems that cause an imbalance in the wetland ecosystem.

Helpful Hints

- Students should already have an introduction to invasive species and their impact on ecosystems and native populations.
- Students should know how to multiply and use a calculator. It would be helpful for students to be able to use linear measurements to construct a grid.

Procedure

1. Distribute the informational factsheet on purple loosestrife. Have the students read it independently or read it aloud as a class.

2. Distribute the Dot Worksheet and have students complete the worksheet How Much Is Two Million Seeds? to realize the enormity of this number. If possible, bring in two reams of paper (500 sheets). Two reams of paper with 50 dots on each page would make 2 million dots!

3. Groups of students should be given large sheets of paper or poster board and asked to draw a wetland ecosystem. The teacher can show pictures of wetlands to help them understand.

4. Students make a grid on their wetland by drawing lines to make equal-sized sections. For example, poster board that is 22 x 28 inches (56 x 70 centimeters) could be divided into sections of 14 square centimeters. Students could mark off every 14 centimeters down (4 marks) and every 14 centimeters across (5 marks). The total number of sections would be 20. Then have students draw lines in at these marks. Finally, have students number the poster board sections.

5. Each group lines up their wetland ecosystem side-by-side leaving no spaces. The teacher spreads out a bag of purple confetti (or purple hole-punches) on cardboard. With a fan or hair dryer, the teacher simulates the wind and spreads the “seeds” to every ecosystem.

6. Students should take their ecosystem back to their desks. Have students estimate how many purple loosestrife seeds are in one section. Then they should estimate how many seeds are dispersed throughout the whole ecosystem. Students should look at their wetland and choose what section should be used to count the purple loosestrife seeds. All the seeds in this section are to be counted. To find the estimate, students should know that the size of the population equals the number in the section that was counted multiplied by the number of sections: population estimate = number in one section x number of sections.

7. If there is time, have students estimate and then count another section. Compare the results.

8. Compile the data from each of the groups. The ecosystem closer to the parent plant (fan) will receive more seeds (confetti or hole-punches). Notice how the seeds can be spread by the wind.

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9. Discuss the following questions (with sample answers):

   Purple loosestrife seeds can also travel by water and on things that move from place to place. The plant can also reproduce from its roots and parts of the stem. How would this affect our findings?

   The different ways they are transported would affect how far and fast the seeds could be dispersed.

   Did each section of your wetland ecosystem have the same number of seeds? Which wetland ecosystems had the most seeds? The least seeds? What factors determined which wetland ecosystem got the most?

   Each section counted should yield a different number of seeds. Students need to realize that typically a scientist cannot possibly count every organism in the environment.

Wrap-Up

- Have students describe how to count the number of insects in a square meter area of the playground, using the sampling method.
- By making calculations, have students compute how many sheets of paper with dots are needed to make 3 million.

Extension

1. Have students research the difficulty of getting rid of purple loosestrife and its impact on a wetland—how it can upset the balance of a wetland ecosystem.

Resources

Factsheets and Publications:

Why Are Wetlands Important? US EPA: https://www.epa.gov/wetlands/why-are-wetlands-important
Purple Loosestrife. Minnesota Department of Natural Resources: https://www.dnr.state.mn.us/invasives/aquaticplants/purpleloosestrife/index.html
Purple Loosestrife, Wisconsin Sea Grant: https://www.seagrant.wisc.edu/our-work/focus-areas/ais/invasive-species/invasive-species-fact-sheets/plants/purple-loosestrife/

Websites:

Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/

Kits:

Aquatic Invaders Attack Pack: https://iiseagrant.org/education/loanable-kits/

Credits

Originally created for ESCAPE Compendium, Great Lakes Sea Grant Network
Created by: Peter L. Edwards, Jay Cooke State Park, Carlton, MN
Modified by: Terri Hallesy, Illinois-Indiana Sea Grant

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

Ripple Effects | Seeing Purple: A Population Explosion

Purple Loosestrife (Lythrum salicaria) Factsheet

Purple loosestrife is a harmful invasive plant that grows in wetlands. It originally was native to Europe and Asia, but people brought it to North America in the 1800s as a garden flower. Many people thought it would be a great addition to their gardens because of its bright purple flowers. Also, some seeds may have arrived accidentally on ships with imported sheep. However, this plant spreads quickly from gardens to swamps, marshes, and ditches. It takes over these areas by growing fast and pushing out native plants.

Wetlands have many important plants like cattails, bulrushes, and grasses. These plants provide food, shelter, and places for animals to nest and breed. Cattails are especially useful because they create homes and nesting spaces for wetland animals. But purple loosestrife grows so thick that animals cannot use it for shelter or nesting. Very few animals eat it, and deer are one of the only ones that do—but they don't eat enough to stop it from spreading.

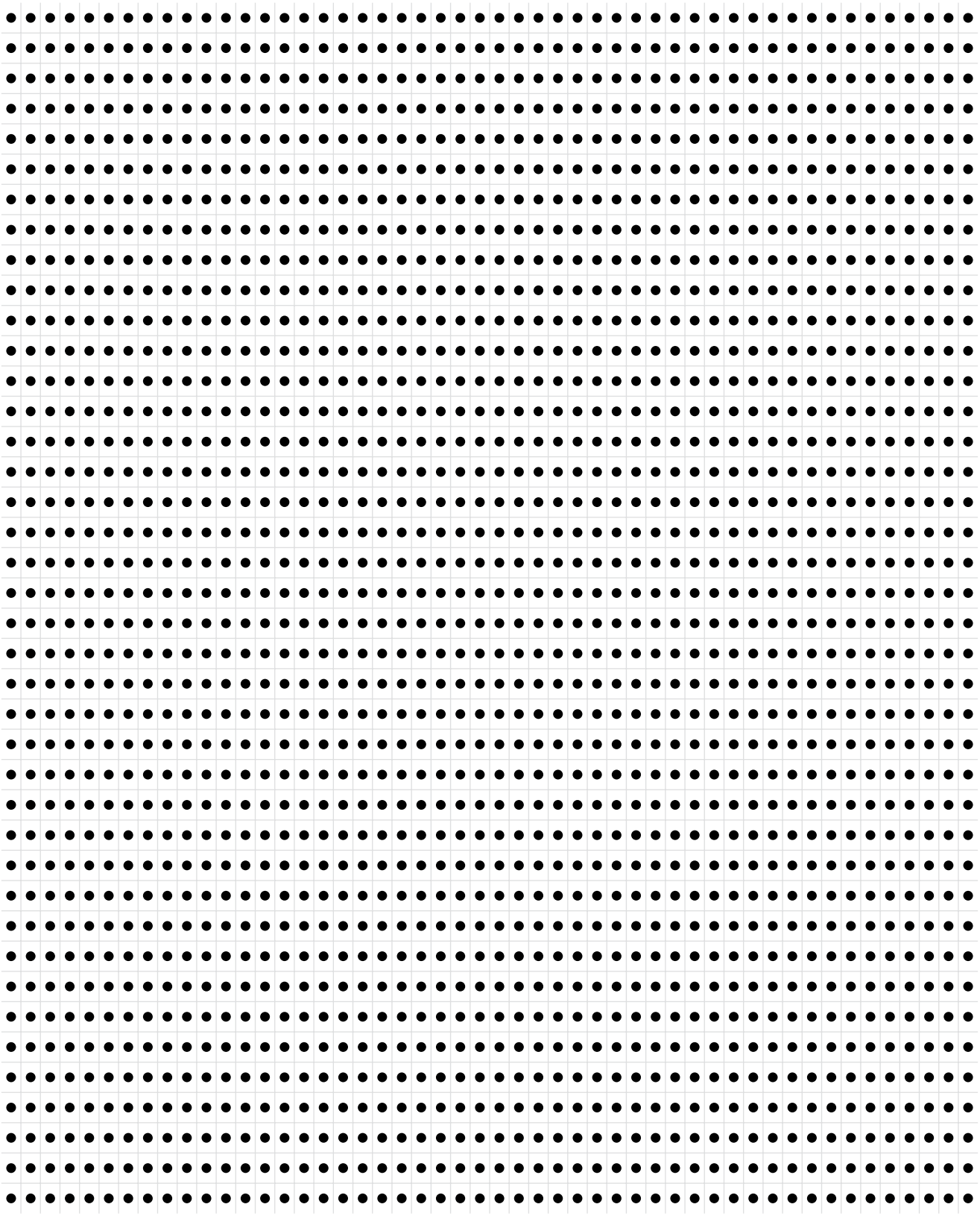
Purple loosestrife blooms from July to September. It grows between 2 and 7 feet tall and has long spikes of purple flowers, with each flower having 5–6 petals. Its leaves are long and narrow. This plant is a perennial, meaning it lives for many years. It has strong roots that spread out and form a thick mat underground. One of the biggest problems is how quickly it spreads. Each flower on the stalk eventually releases seeds, and each stalk can produce up to 300,000 seeds. A single mature plant can create more than 2 million seeds! Water carries these seeds to new places, spreading the plant even farther. Seeds can remain dormant for many years and sprout when conditions are just right. Seeds can also travel by wind, rain, vehicles, and animals—including humans. People who are working to stop the spread of the plant must be careful not to carry seeds on their shoes or clothes.

Not only does purple loosestrife grow from seeds, but it can also spread from broken stems and roots. The roots of a mature plant can send out 30–50 new shoots, creating dense clusters that take over wetlands. Controlling purple loosestrife is extremely difficult because of its fast growth and ability to spread seeds. It is nearly impossible to remove completely.

When purple loosestrife takes over a wetland, it reduces the number of native plants available for animals to eat. This causes animal populations to decrease and disrupts the balance of the ecosystem. For example, insect populations that rely on native plants for food can decline if they don't have enough to eat. This, in turn, impacts the birds that eat those insects. Purple loosestrife covers wetlands in a sea of beautiful purple flowers, but it harms native plant and animal life. The thick mats also make wetlands harder to use for recreation like boating and fishing. It can also increase the risk of flooding because it prevents drainage ditches from working properly.

Last Updated: 01/09/2026.

Student Activity: Dot Worksheet



Last Updated: 01/09/2026.

How Much Is Two Million Seeds?

Name _____ **Date** _____ **Class Period** _____

Directions: Please read all questions and show any work necessary to calculate your answers. All questions refer to the number of dots on the worksheet.

1. How many dots are on the worksheet? _____
2. How many total dots would there be on 5 sheets of paper? _____
3. How many total dots would there be on 50 sheets of paper? _____
4. How many sheets of paper would it take to make 1 million (1,000,000)? _____
5. How many sheets of paper would it take to make 2 million (2,000,000)? _____
6. Imagine each dot represents a seed. Each purple loosestrife plant can produce up to 2 million seeds. Explain how this characteristic allows purple loosestrife to take over wetland ecosystems it is introduced to.

_____

_____

How Much Is Two Million Seeds?

Name _____ **Date** _____ **Class Period** _____

Directions: Please read all questions and show any work necessary to calculate your answers. All questions refer to the number of dots on the worksheet.

1. How many dots are on the worksheet? _____
2. How many total dots would there be on 5 sheets of paper? _____
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4. How many sheets of paper would it take to make 1 million (1,000,000)? _____
5. How many sheets of paper would it take to make 2 million (2,000,000)? _____
6. Imagine each dot represents a seed. Each purple loosestrife plant can produce up to 2 million seeds. Explain how this characteristic allows purple loosestrife to take over wetland ecosystems it is introduced to.

_____

_____

ANSWER SHEET

Ripple Effects | Seeing Purple: A Population Explosion

How Much Is Two Million Seeds?

Name _____ **Date** _____ **Class Period** _____

Directions: Please read all questions and show any work necessary to calculate your answers. All questions refer to the number of dots on the worksheet.

1. How many dots are on the worksheet? 40 x 50 = **2,000 dots**

2. How many total dots would there be on 5 sheets of paper? 2,000 x 5 = **10,000 dots**

3. How many total dots would there be on 50 sheets of paper? 2,000 x 50 = **100,000 dots**

4. How many sheets of paper would it take to make 1 million (1,000,000)?

   1 million dots would be 10 x the bold number above. So, 10 x 50 sheets = **500 sheets of paper**

5. How many sheets of paper would it take to make 2 million (2,000,000)?

   2 million would require 2 x the bold number of sheets above. So, 2 x 500 sheets = **1,000 sheets of paper**

6. Imagine each dot represents a seed. Each purple loosestrife plant can produce up to 2 million seeds. Explain how this characteristic allows purple loosestrife to take over wetland ecosystems it is introduced to.

   With so many seeds that can be disbursed great distances in multiple ways, purple loosestrife can reproduce rapidly and steal space and resources from native plants. Seeds that lie dormant can sprout when there is room for them to grow.

Last Updated: 01/09/2026.

Last Updated: 01/09/2026.

Ripple Effects

Lesson 05: Interview with a Vampire

Grade Level

6–12th

Subject

Science, Language Arts

Class Time

3–5 CLASS PERIODS

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Students will act as reporters to research the effects of sea lamprey on the ecosystem. They write investigative reports, prepare posters, and/or give presentations to the class.

Objectives

Students will be able to:

- Use research skills and analyze scientific information about sea lamprey.
- Identify the impacts made by aquatic invasive species (AIS) and explain that these impacts do not occur from malicious intent, but rather through natural exploitation of resources.
- Create a poster and presentation.

Materials

- ☐ Poster board
- ☐ Glue or paste
- ☐ Computer with internet access for PowerPoint presentations

Vocabulary

- Invasive species
- Habitat utilization
- Homeostasis
- Predator-prey relationship
- Resources
- Sea lamprey

Last Updated: 01/09/2026.

Background

The sea lamprey (*Petromyzon marinus*) is a fish that is invasive in the Great Lakes system. They are characterized by their suction cup mouths with rows of sharp teeth and rasping tongue. They are jawless and their bodies lack bony structures.

Sea lampreys are native to the Atlantic Ocean and are found along the East Coast of North America. Sea lamprey came to the Great Lakes by swimming through man-made shipping canals. The Erie Canal (in the U.S.) and Welland Canal (in Canada) were constructed in the early 1800s to help ships bypass natural barriers like Niagara Falls, however, these man-made canal systems also opened a pathway for sea lamprey to invade the upper Great Lakes.

They were first discovered in Lake Ontario in 1835. Niagara Falls served as a natural barrier to the other Great Lakes, containing invasive sea lampreys to Lake Ontario, but improvements to the Welland Canal connected Lake Ontario to Lake Erie, and allowed the lamprey to circumvent the waterfall. Once the lamprey was established, the population exploded, aided by their reproductive ability (one female sea lamprey can produce up to 100,000 eggs) paired with the availability of spawning habitat (gravel substrate) and larval habitat (sedimentary substrate) found in the many freshwater streams across the Great Lakes watershed.

After several years of filtering organic matter in rivers and streams, sea lamprey juveniles begin a transformation into parasitic adult. These newly-formed adults then migrate to the Great Lakes where they feed on host fish for 12–18 months. Once in the Great Lakes, adult sea lamprey find access to an abundance of host fish like lake trout and whitefish to feed upon. While sea lampreys are parasites on larger fishes found in their native Atlantic Ocean, they became a devastating invasive predator when introduced to the Great Lakes due to a lack of natural predators and prey that hadn't evolved defenses against them.

Sea lampreys have had a profound effect on native fish populations, such as lake trout and whitefish. A single sea lamprey can kill about 40 pounds of fish during its parasitic life cycle in the Great Lakes. They use their sucker-like mouth to attach to fish, rasp through scales and skin with their teeth, and feed on blood and body fluids, eventually killing a large proportion of their host fish. As a result, this has earned them the nickname the “Vampires of the Great Lakes.” This parasitic predation has historically reduced and even collapsed fish populations, negatively impacting recreational, sport charter, and commercial fishing industries in the Great Lakes.

Today, sea lamprey are actively managed in the Great Lakes thanks to a sustained, binational program coordinated through the Great Lakes Fishery Commission. The sea lamprey control program uses lampricides to kill larval sea lampreys in Great Lakes tributaries. These lampricides are pesticides that are selective to sea lampreys. Physical barriers and traps are also used as control tactics to prevent upstream migration and spawning. The future of sea lamprey control innovations even includes the study of pheromones, which involves using specific chemical cues—both attractants and repellents—to manipulate sea lamprey behavior for management purposes. The population has been suppressed by about 90% since the mid-20th century, preventing the collapse of the ecosystem and the region’s fishery, valued at more than $4 billion dollars annually.

Reference:

Great Lakes Fishery Commission. (2024). Sea lamprey. https://www.glfc.org/sea-lamprey.php

Helpful Hints

- This activity should follow an introductory lesson on AIS. It would be helpful to have taught investigative reporting skills using the five W's (Who, What, Where, When, Why?) and research skills.

Procedure

1. Provide a brief introduction to AIS and show pictures and actual specimens (if available). Please note: preserved sea lamprey are available from science supply companies and it may be possible to borrow them from local college biology departments, US Fish & Wildlife Service offices, state environmental conservation departments, or Sea Grant offices, where permitted.

2. Explain that students will be researching the sea lamprey to present information in the form of a poster or PowerPoint presentation, in conjunction with a written investigative news report. Explain that they will be creating an "Interview with a Vampire" due to the sea lamprey's need to suck the blood and body fluids out of fishes.

3. Assign the following questions to direct the students' research (sample responses are provided) and have them include the information into their final poster, PowerPoint presentation, or report:

    a. **Where does the sea lamprey naturally occur?** They are native to the coastal Atlantic Ocean.

    b. **How did the sea lamprey enter the Great Lakes and inland waterways?** They migrated through the St. Lawrence River and Welland and Erie Canals.

c. **When did the sea lamprey arrive?** It is believed that they entered Lake Ontario before scientists began studying the environment and were first reported in the 1830s. They were found in Lake Erie in the 1920s and recorded in all the Great Lakes by 1938.

d. **What is their reproductive strategy?** They enter freshwater to spawn by building crescent-shaped nests, where they lay as many as 60,000 eggs. Of these, less than 1,000 survive long enough to hatch, which takes place in 10–20 days.

e. **What are other important life history factors? Migration? Life cycles?** Normally, sea lamprey live in the ocean, but migrate into freshwater to spawn, although they can live their entire life in freshwater, as they do in the Great Lakes basin. The sea lamprey larvae burrow into mud or soft sediment where they can spend 3–17 years, depending on environmental conditions. The larval sea lamprey feed on plankton, detritus, and small organisms, until they reach "transformer" size (about the size of a pencil). In the Great Lakes, the transformers begin their journey out to the open water and spend approximately 12–20 months as parasitic adults.

f. **Do they have any natural predators in inland waters?** In the Great Lakes, adult sea lamprey have very few predators, although bald eagles have been known to prey upon them.

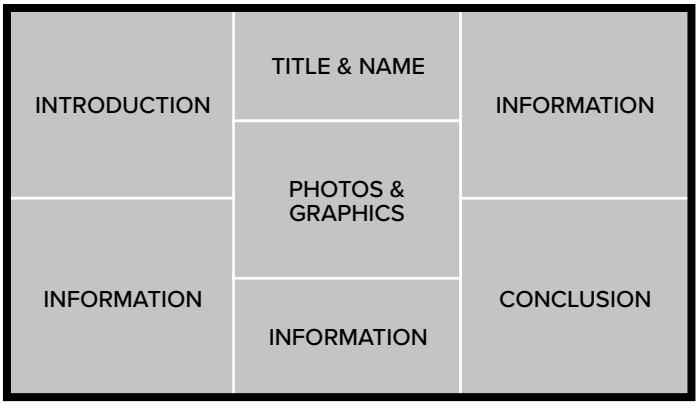
g. **How do they disrupt the ecosystem?** There has been a noticeable decline in native fishes such as lake trout and whitefish, which has resulted in a disruption of the predator-prey balance. Sea lamprey feed on all the large species of fish in the Great Lakes including Chinook and coho salmon, brown and rainbow trout, walleye, burbot, and even sturgeon.

h. **Can sea lamprey be removed or controlled?** The Great Lakes Fishery Commission is responsible for controlling sea lamprey and they routinely treat spawning streams and creeks with a chemical lampricide, which is a pesticide that is selective to lampreys. Other control methods include various barriers: low-head dams, adjustable-crest barriers, as well as velocity and electrical barriers. Anglers can help by checking their minnow traps to make sure they are not moving larval sea lamprey from Great Lakes tributaries.

4. Assign due dates for outlines of the poster or PowerPoints and their reports. Schedule 5–10 minute presentation times, including a question-and-answer period and discussion.

5. Make sure the class knows about the available resources, including the internet, school library, environmental agencies, and the Great Lakes Fishery Commission.

6. After two days of research, provide guidelines for the poster or PowerPoint slides. The key to the poster or slides is to make them concise. Encourage students to use a minimum amount of text and make type size large enough to be easily read. You may wish to suggest a poster or PowerPoint slide format like the following:



Wrap-Up

- Evaluation is based on the written responses to questions assigned in number 3 in the procedure above.

Resources

Great Lakes Fish Commission About Sea Lamprey: https://www.glfc.org/sea-lamprey.php
Great Lakes Fishery Commission Sea Lamprey Control: https://www.glfc.org/control.php
Great Lakes Aquatic Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/
U.S. Geological Survey, Biological Resources Division, Nonindigenous Aquatic Species: http://nas.er.usgs.gov
NOAA: What is a sea lamprey?: https://oceanservice.noaa.gov/facts/sea-lamprey.html
Great Lakes Fish Commission Lampricide video: https://www.youtube.com/watch?v=xJ80mh2cYWY
Sea Lamprey: GLANSIS video: https://www.youtube.com/watch?v=hSeSmDUppSY

Credits

Originally created for ESCAPE Compendium, Great Lakes Sea Grant Network
Created by: Cara Ewell, Silver Creek High School, Irving, NY
Modified by: Helen Domske, New York Sea Grant

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

Ripple Effects

Lesson 06: Fishing for Invader Clues

Grade Level

6–8th

Subject

Science

Class Time

3-4 CLASS PERIODS

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

This activity offers an engaging way for students to conduct research on a specific aquatic invasive species (AIS) based on a research source "caught" during a fishing game. Sources of research include websites, Sea Grant factsheets, pamphlets, journal articles, and other library resources.

Objectives

Students will be able to:

- Identify and explain the characteristics of one AIS, including physical description, habitat, mode of introduction, ecological impact, and potential solutions.
- Interact in cooperative learning groups to share research information about an AIS with other students, create a poster and give an oral presentation to classmates.

Materials

- ☐ Invasive Species Factsheet
- ☐ Invader Clue Cards
- ☐ 3" x 5" index cards (1 per student)
- ☐ Four fishing poles (or wooden dowels)
- ☐ Magnets (attached to back of each clue card or to use on the poles)
- ☐ Paper clips or doughnut-shaped magnets (one attached to each line of the pole)
- ☐ Poster paper (one sheet for each group of four)
  Markers and/or colored pencils
- ☐ Articles, factsheets, or pamphlets

Vocabulary

- Ballast water
- Biodiversity
- Common name
- Competition
- Ecosystem
- Invasive species
- Habitat
- Indigenous species
- Mode of introduction
- Native species
- Nonindigenous species
- Nuisance species
- Scientific name

Last Updated: 01/09/2026.

Background

The introduction of aquatic invasive species into the Great Lakes ecosystem threatens plant and animal biodiversity. Often AIS have adaptations or behaviors that may offer them a competitive advantage over other species. This can sometimes negatively impact populations of native species, either directly such as predation or competition for habitat resources or indirectly such as altering the environment or food webs. Awareness and education about AIS may be the best way to prevent the spread of these invaders.

Helpful Hints

- Prepare clue cards in advance (the teacher can fill in sources or have students find their own).
- Collaborate with the school librarian to locate additional resources.
- Bookmark websites prior to activity.
- Arrange and set up tables in advance.
- Use labels to indicate which article/pamphlet/factsheet should be at each location.
- Encourage students to reach beyond the required questions.
- Display posters on a bulletin board or in the hallway to share with all students in the school.

Procedure

Preparation

1. Prepare clue cards for the fishing expedition so that each source is represented on an index card. Use the clue card master as well as your own sources: article, pamphlet, website, or other resource.

2. Attach magnets to the bottom of each card with the blank side facing up. Attach paper clips to the fishing pole (or attach paper clips to the edge of each card and magnets to the poles).

3. Spread out materials onto different tables and label them to avoid confusion.

Individual research (50 minutes)

1. Introduce the topic of AIS and provide a working definition for the term. Locate relevant places on a map: the five Great Lakes, St. Lawrence River, Lake Champlain, Atlantic Ocean, Black Sea, and Caspian Sea.

2. Distribute the blank factsheet to each student. Briefly explain that they will obtain the following information: common name, scientific name, physical characteristics, native habitat or location, current habitat or location, mode of introduction, ecological impacts, potential solutions, and a drawing or picture.

3. Have each student use a fishing pole with a paper clip or magnet hook to “fish” for a research clue on an AIS. The card provides a source for the student to investigate first and assigns an AIS to the student.

4. Students continue to investigate resource(s) of his or her choices and complete the information on the factsheet.

Sharing information in groups (50–100 minutes)

1. Students investigating the same species come together at the same table to form a cooperative learning group. They share information from various resources and discuss ideas. This can include having students list possible solutions for the problem and ways to increase the public's awareness. If a written test is desired, you could also have the groups synthesize questions for use on a written test.

2. Students design and create an educational poster that includes a picture and information about the AIS. Encourage students to present information in an original, imaginative, and unique manner.

Group presentations (50 minutes)

1. Student groups present information to classmates using their poster as a visual aid. Classmates may ask questions about their AIS (about 5–10 minutes per group).

2. Show prepared slides about AIS (optional). Provide additional information and answer student questions. Summarize by discussing questions such as:

   a. Why do the Great Lakes have such a problem with AIS?

   b. What procedures now exist that may prevent further introduction of AIS into the Great Lakes?

Wrap-Up

- Possible assignment rubric (100 points):
  - 30 points: Poster (creativity, originality, neatness)
  - 30 points: Presentation (eye contact, clarity, poise, information)
  - 20 points: Factsheet
  - 20 points: Student evaluation (15 points = evaluation by 3 other groups members; 5 points = self-evaluation)

- A written test based on the questions generated in step 1 in the Sharing Information in Groups section could be used for formal evaluation.

Extension

- Additional assignments, extra-credit work, or interdisciplinary activities:
  - Find 10 additional facts on each AIS.
  - Create a webpage for each AIS.
  - Create and label a map that shows where an AIS originated and where it has spread.
  - Explain the effect of the unintentional consequences of ballast water discharges on the spread of AIS in the Great Lakes.
  - Find out why the sport-fishing industry is so important to the Great Lakes region and what the economic impact of this industry is in the basin or the Great Lake nearest your school.

- For a creative language arts activity, write a short story about an aquatic invasive species' journey to the Great Lakes.

- Invite a scientist, biologist or researcher to your school to share the latest information on AIS.

Resources

Websites:

EPA, Invasive Species in the Great Lakes: https://www.epa.gov/greatlakes/invasive-species-great-lakes-0
U.S. Geological Survey, Biological Resources Division, Nonindigenous Aquatic Species: https://nas.er.usgs.gov/
Great Lakes Aquatic Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/

US Geological Survey Factsheets:

Round goby: http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=713
Rusty Crayfish: https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=214
Dreissenid mussel: https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5
Eurasian Ruffe: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=7
Sea Lamprey: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=836
Purple loosestrife: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=239
Spiny water flea: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=162

Articles:

Invasive Crayfish Collaborative, Invasive Crayfish 101: https://invasivecrayfish.org/invasive-crayfish-101/
Great Lakes Now, Mussel Invasion Legacy Reaches Far Beyond Great Lakes:
https://www.greatlakesnow.org/2021/02/invasive-mussels-legacy-beyond-great-lakes/

Credits

Created by: Jim Alvaro, Anchor Bay School District, Clinton Township, MI. Modified by: Terri Hallesy, Illinois-Indiana Sea Grant. Invader Picture cards, Introduction cards, and Ecosystem Impact cards were included with permission from Ohio Sea Grant.

Great Lakes RESTORATION

CENTER FOR GREAT LAKES LITERACY CGLL

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This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Student Activity: Invasive Species Factsheet

Name _____ **Date** _____ **Class Period** _____

Directions: Fill in the facts about your chosen invasive species.

1. Species common name: _____
2. Species scientific name: _____
3. Physical characteristics: _____

   _____

   _____
4. Native habitat or location: _____
5. Current habitat or location: _____
6. Mode(s) of introduction: _____
7. How does this AIS impact the ecosystem? Explain. _____

   _____

   _____
8. What are potential solutions to the impacts on the ecosystem, or what are ways to prevent the spread?

   _____

   _____

   _____
9. Draw a picture of this species in the space below:

Last Updated: 01/09/2026.

Invader Clue Cards

Alewife

Circle One:
Website, Pamphlet, Article, Other:_____

Title:_____

Web Address:_____

Rusty Crayfish

Circle One:
Website, Pamphlet, Article, Other:_____

Title:_____

Web Address:_____

Eurasian Ruffe

Circle One:
Website, Phamphlet, Article, Other:_____

Title:_____

Web Address:_____

Quagga Mussel

Circle One:
Website, Pamphlet, Article, Other:_____

Title:_____

Web Address:_____

Sea Lamprey

Circle One:
Website, Phamphlet, Article, Other:_____

Title:_____

Web Address:_____

Purple Loosestrife

Circle One:
Website, Phamphlet, Article, Other:_____

Title:_____

Web Address:_____

Spiny Waterflea

Circle One:
Website, Pamphlet, Article, Other:_____

Title:_____

Web Address:_____

Round Goby

Circle One:
Website, Pamphlet, Article, Other:_____

Title:_____

Web Address:_____

Last Updated: 01/09/2026.

Last Updated: 01/09/2026.

Ripple Effects

Lesson 07: Don't Stop For Hitchhikers

Grade Level

6-8th

Subject

Science

Class Time

1 CLASS PERIOD

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Students role-play the part of lake inhabitants and the aquatic invasive species (AIS) that displace the native species. Props are used to help demonstrate how AIS enter a lake or river system, the negative effect they have on the native species, and what people can do to stop the spread of AIS.

Objectives

Students will be able to:

- Identify AIS and ways they are transported.
- Learn about several invasives that affect water habitat.
- Identify the positive or negative effects of AIS on native animals.
- Know how these invasives are transported and ways people can help to stop further spread.
- Describe and act out ways to avoid the spread of AIS.

Materials

- ☐ Role-playing script and directions
- ☐ Picture/drawing of aquatic invasives (Eurasian ruffe, zebra mussel, round goby, purple loosestrife, sea lamprey, Eurasian watermilfoil)
- ☐ Bait bucket (from bait stores)
- ☐ Bucket
- ☐ Seed package
- ☐ Two 6-foot ropes
- ☐ Toy boat/trailer (or picture)
- ☐ Paper fish
- ☐ 12 paper plates, six marked with "X" on both sides

Vocabulary

- Ballast water
- Round goby
- Eurasian watermilfoil
- Eurasian ruffe
- Invasive species
- Sea lamprey
- Purple loosestrife

Last Updated: 01/09/2026.

Background

Today there are several aquatic invasive species that pose a severe threat to lakes and river systems of many states. They are non-native, worldwide agents of habitat alteration and degradation. While natural boundaries help limit the spread of AIS, human activities such as recreation, and shipping have facilitated their movement to new lakes and rivers. The global shipping industry, particularly through the discharge of ballast water, plays a significant role in transporting these invaders across vast distances, introducing non-native species into the Great Lakes and other waterways. There are, however, simple actions that we can do to stop the spread of harmful species.

As stated in the suggested script to read to students, “AIS are invading lakes and rivers by hitching a ride with humans, and there is no stopping them, unless you take actions to prevent it.”

Helpful Hints

- Conduct the lesson in a large area (e.g., classroom, gym, outdoors) so students can spread out.
- Adjust the number of AIS volunteers based on class size; involve all students.
- Any fish species can replace the walleye.
- This activity includes biology, wildlife management, and botany.
- Adapt the script for younger students.

Procedure

1. Begin the program with the students forming a circle in a large open space, and tell them that the circle represents a lake. Explain that they will hear the story of the mighty walleye (or select a different fish) that lives in a big lake. Explain the definition of AIS.

2. Tell them that you need volunteers to play the parts of the lake inhabitants. The first volunteer is given a picture or drawing of the fish and taken to the “middle of the lake.” Explain that he or she is the biggest walleye in the lake.

3. Drop the paper plates on the ground around the inside of the circle, telling the group that this is the favorite food (the plain plates) and the favorite sleeping spots (plates with an “X”) of the walleye.

4. Now the story begins. Explain that the walleye swims and eats all over the lake. Have the volunteer walleye “swim” up to one of the paper plates and pretend to eat or sleep.

5. Next, introduce one of the AIS by first showing the students the picture and explaining how to identify it and the harmful effects it has on the habitat. The introduction of AIS can be in any order, but the sea lamprey should be last. See the activity script for information about each invasive species, which props to use with each, and what to tell students about the meaning of each prop. AIS include Eurasian watermilfoil, purple loosestrife, zebra mussel, Eurasian ruffe, round goby, and sea lamprey.

6. Explain how the invader is spread. Demonstrate this by using the appropriate prop. Give the picture to a group of students (about four or five students depending on the number present) and tell them that they are now AIS and must remember how it is spread.

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7. Next, have the group move one or two steps closer to the center of the circle to represent the loss of habitat for the walleye. After the students move in, say, “But the walleye doesn’t care, it has other places to sleep or eat.”

8. Each time a new species is introduced, and the volunteers take a step forward, the prior groups must take a step forward as well, ultimately covering up all the paper plates and surrounding the walleye. Have students think about how the habitat for the native animals is reduced to the point of being a threat for the native species’ survival each time a new AIS is added. Have students notice that the amount of living space is being reduced and is getting smaller.

9. The final invader introduced should be the sea lamprey. Set the rope pieces down parallel to each other about three feet apart, “entering” the edge of the lake. Introduce the ropes as a canal that was built to connect the lake to a river. Have a volunteer swim through the “canal” and simulate the attack of the sea lamprey. The student can simply touch the walleye on the arm or wrap their arms around the walleye.

10. At this point, the demonstration and role-playing are finished. Students can take their seats in the classroom or sit down at their current location for follow-up and review. Ask each group to remind the class how its invasive species is spread. Explain what is being done by the government, industry, academia and others to stop the spread of AIS. This information is found at the end of the role-playing script.

11. If desired, ask questions on the material covered in this lesson, to be answered either orally or in written form. This can be used as an evaluation tool. You could also have students match species with its mode of transport.

Sample Questions:

- Can you name some ways AIS impact aquatic habitats?
- How do human activities, such as shipping and recreation, contribute to the spread of AIS?
- How did the introduction of each AIS species from the activity change the walleye's habitat?
- What actions can people take to prevent the spread of AIS?
- Reflect on how the role-playing activity helped you understand the challenges native species face because of AIS. What was most surprising or impactful to you?
- How does the presence of AIS affect recreational activities such as boating and fishing?
- What strategies are being used by governments, industries, and local communities to control and manage AIS?
- Can you think of any other ways we could raise awareness or help reduce the spread of invasive species?

Wrap-Up

Students can be evaluated on the discussion following the demonstration or on items listed in step 11.

Extension

- Have the students create a “Public Service Announcement” in the form of posters, signs, audio recordings or videos informing other classes on ways to stop the spread of AIS.

- Visit a local lake, pond or boat access and look for signs of AIS. At the boat landing, see if there are warning signs about one of the invasives. If there are none, ask the water resource manager or fisheries biologist at your local Natural Resources, Environmental Conservation Department or Sea Grant program to post some signs.
- Visit a lake known to contain AIS and monitor the growth in population or the spread in infested areas.
- Have the students identify other AIS.

Resources

Factsheets and Publications:

Factsheets on aquatic invasives can be obtained from state Sea Grant programs. For the closest program, visit the National Sea Grant College Program website and click on “state program.” https://seagrant.noaa.gov/our-story/about-sea-grant/

Ohio Field Guide to Aquatic Invasive Species: https://ohioseagrant.osu.edu/products/dy9gp/ohio-field-guide-to-ais

Attack Pack Aquatic Invader Fact Sheets: https://www.seagrant.wisc.edu/our-work/focus-areas/education/for-educators/attack-pack-a-grab-and-go-teaching-tool/

Great Lakes Aquatic Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/educatorHub.html

Role-Playing Activity Script and Directions

This is a compilation of information about various AIS, directions for conducting the activity "Don't Stop for Hitchhikers!" and suggestions for what to say and do during the activity. Note that italics are used for all sections that are the exact words teachers could say during this activity.

Have students form a large circle. Say:

This large circle represents a lake, and you will hear the story of the mighty walleye (or select a different fish) that lives in a big lake. We are going to do an activity called "Don't Stop for Hitchhikers!" Invasive species are invading lakes and rivers by hitching a ride with you, and there's no stopping them, unless you do something about it. You will all play the part of inhabitants of this lake and learn about invasive species.

Explain the definition of aquatic invasive species.

Aquatic invasive species—organisms introduced into aquatic habitats where they are not native—are worldwide agents of habitat alteration and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants." They compete for food and habitat of native species. Most species introductions are through human activity. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage, but many introductions are accidental. Most non-native introductions are ecologically harmless and some are beneficial, but a few invasive introductions are harmful to recreation and ecosystems. Aquatic invasive species have actually caused the extinction of native species.

Ask for volunteers to play the parts of the lake inhabitants:

I will need volunteers to play the inhabitants of this lake.

Give the first volunteer a picture or drawing of the fish, and take them to the "middle of the lake." Say:

You are the biggest walleye in the lake.

Drop the paper plates on the ground around the inside of the circle, and say:

This is the favorite food (the plain plates) and the favorite sleeping spots (plates with an "X") of the walleye. The walleye swims and eats all over the lake.

Have the volunteer walleye "swim" up to one of the paper plates and pretend to eat or sleep.

Show a picture of the quagga mussel and explain how to identify it, the harmful effects it has on the habitat, and how the invasive is spread. (The introduction of the aquatic invasives can be in any order, but the sea lamprey should be last. For ease of use, this script suggests an order and starts with the zebra mussel.) Read or summarize information below:

Quagga mussels are small, fingernail-sized mussels native to parts of Europe and Asia, which may produce as many as a million eggs per year. They were discovered in Lake Erie in 1989. Quagga mussels have now spread to parts of all the Great Lakes and the Mississippi River basin and are showing up in inland lakes. Quagga mussels clog water systems and irrigation pipes. They have severely reduced and eliminated native mussel species. Microscopic larvae may be carried in live wells or bilge water.

Last Updated: 01/09/2026.

Adult quagga mussels can attach to boats that are docked in the water. Adult life size: 0.5 to 1.5 inch.

Prevention: Tell students: Drain water from live wells in the same lake or river; do not dump in any other body of water. Since quagga mussels can attach to any hard surface, clean your boat and trailer and drain motor before moving to another waterbody.

Use the boat to represent how they are transported.

Give the picture to a group of students (about four or five students depending on the number of students present) and tell them:

You are now the AIS and must remember how it is spread.

Have the group move one or two steps closer to the center of the circle to represent the loss of habitat for the walleye. After the students move in, say:

But the walleye doesn't care, it has other places to sleep or eat.

Introduce the next species. An explanation of ballast water appears with round goby information.

Round goby is a bottom-dwelling fish, native to Eastern Europe, which entered the eastern Great Lakes in ballast water.

Ballast water: Ships take on ballast water for stability during travel. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing so much faster now and harbors are often less polluted, more AIS are likely to survive the journey and thrive in the new waters.

Round gobies are aggressive fish that can grow quickly to a size of up to 7 inches, although most adults are typically 5-6 inches long. The negative qualities of the round goby include: dominating the fishery quickly, having no effective predators, spawning as much as several times per year and competing with native bottom-dwellers like sculpins and log perch. They have proven to be harmful to Great Lakes and inland fisheries.

Prevention: Tell students: Clean off plants and animals from boats, trailers, motors, and gear. Drain water from live well; do not dump that water into any other waterbodies. Let everything dry for five days.

Use the bucket filled with water to represent ballast water.

Each time a new species is introduced and the volunteers take a step forward, the prior groups must take a step forward as well, ultimately covering up all the paper plates and surrounding the walleye.

Have students think about how the habitat for the native animals is reduced to the point of being a threat for the native species' survival each time a new AIS is added. Have students notice that the lake is getting smaller. Ask the students:

Do you notice that the living space is getting reduced and is getting smaller? Think about how the habitat for the walleye is being threatened.

Eurasian watermilfoil was accidentally introduced to North America from Europe, spread westward into inland lakes primarily by boats, and reached Midwestern states between the 1950s and 1980s. It can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. Its floating canopy can also crowd out native water plants. A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats, motors, and trailers can spread the plant to other lakes. Milfoil may become entangled in boat propellers or may cling to keels and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Prevention: Tell students:

Clear and clean off all aquatic plants from boats, motors, and trailers.

Use the boat to explain how Eurasian watermilfoil gets tangled in the trailer and boat prop.

Eurasian ruffe (Pronounced "ruff") was introduced to a Duluth, Minnesota harbor, probably in tanker ballast water, around 1985, and has spread to other rivers and bays around Lake Superior. The ruffe's ability to displace other species in newly invaded areas is due to (1) its high reproductive rate, (2) its feeding efficiency across a wide range of environmental conditions, and (3) characteristics that may discourage would-be predators such as walleye and pike. Eurasian ruffe could be accidentally transported in live wells, bilge water, bait buckets, and ballast water. Adult life size: 3–5 inches.

Prevention: Tell students to:

Empty boat live wells and bilge water at water access points. Empty bait bucket contents in the trash.

Use the bait bucket to demonstrate how ruffe may be spread.

Purple loosestrife is a wetland plant from Europe and Asia that was introduced to the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then later distributed as an ornamental plant, this invasive species is in 46 states and all Canadian border provinces. Purple loosestrife invades marshes and lake shores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands that are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals, including ducks, geese, rails, muskrats, frogs, toads, and turtles. Many rare and endangered wetland plants and animals are also at risk. A major reason for purple loosestrife's expansion is the lack of effective predators in North America. Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic systems, moving water and wind easily spread loosestrife seeds. Plant height: 2–7 feet.

Prevention: Tell students:

If you see them in a wetland area, don't pick them and take them somewhere else. Don't buy purple loosestrife plants from nurseries instead select native loosestrife species where available. Avoid wild seed mixtures that contain purple loosestrife seeds.

Use the seed packet to show how careless gardeners help spread purple loosestrife.

The final invader introduced should be the sea lamprey.

Sea lamprey is an elongated fish with a circular suctioning mouth with sharp rasping teeth on its inner surface and is native to the coastal regions of the Atlantic Ocean. The lamprey entered the Great Lakes through the Welland Canal around 1921. They contributed greatly to the drastic decline of whitefish and lake trout in the Great Lakes. Negative effects of the sea lamprey: One adult can consume 40 pounds of fish as an adult. Adult size: 12–20 inches.

Prevention: Tell students:

Chemical controls, called lampricides, are being used by water resource managers, which help keep sea lamprey populations in check.

Set the rope pieces down parallel to each other about 3 feet apart, for "entering" the edge of the lake. Introduce the ropes as a canal that was built to connect the lake to a river.

Have a volunteer swim through the "canal" and simulate the attack of the sea lamprey. The student can simply touch the walleye on the arm or wrap their arms around the walleye.

Students can resume their seats in the classroom or sit at their current location for a follow-up and review. Ask each group to remind the class how its invader is spread (optional).

What are some other AIS?

Spiny waterflea, rusty crayfish, white perch, flowering rush, curly-leaf pondweed, alewife, and mosquito fish.

Credits

Originally created for ESCAPE Compendium, Great Lakes Sea Grant Network
Created by: Peter L. Edwards, Jay Cooke State Park, Carlton, MN
Modified by: Terri Hallesy, Illinois-Indiana Sea Grant

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

Ripple Effects

Lesson 08: Why Do They Thrive?

Grade Level

7-12th

Subject

Science

Class Time

3 CLASS PERIODS

Next Generation Science Standards

www.nextgenscience.org/

MS-LS2-2
MS-LS2-4
MS-LS2-5
MS- ESS3-3

Great Lakes Literacy Principles

www.cgll.org/purpose-principles/

Principles 5, 6, 8

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Activity at a Glance

Students research the physical, biological, and behavioral characteristics of aquatic invasive species (AIS) that help them to out-compete native species. The activity concludes with an Aquatic Invasive Species Advantage Forum where students present their findings and conclusions.

Objectives

Students will be able to:

- Compare and contrast an AIS with a similar native species.
- Describe their life cycles, habitat needs, physical structures, and behavioral characteristics.
- Identify specific adaptive characteristics of AIS that help them to be successful in the environments to which they are introduced.

Materials

- ☐ Aquatic Invasive Species Advantage Forum Rubric
- ☐ Preserved specimens of native and invasive species from the same habitat (if legal to obtain, i.e. zebra or quagga mussels and native mussels). Detailed anatomical charts will suffice.
- ☐ Photographs of AIS and the native species being researched.
- ☐ Information on the life cycle and behaviors of the animals or plants being compared.
- ☐ Computers or tablets with internet access for student research

Vocabulary

- Adaptation
- Competition
- Dispersal
- Habitat

Last Updated: 01/09/2026.

Background

Animal and plant anatomies and adaptations are often studied in life science classrooms. Animal behavior is studied less frequently, particularly during the middle school or junior high years. Very seldom are the concepts of anatomy, structure, function and behavior looked at collectively to see how they relate to an organism's success in its environment.

This activity takes a more encompassing look at these factors as they pertain to the dispersal, reproduction, and successful establishment of aquatic invasive species over similar native species sharing the same habitats. Not all AIS appear to be harmful, but many are detrimental to native species because of rapid reproduction rates, ability to survive in adverse circumstances, and the lack of predatory pressures. The behavior and physical structures of AIS have an effect on all these facets.

Helpful Hints

- The grade level and purpose of this activity will determine its scope. Teachers may want to limit research to a specific pair of organisms for younger students, or may want to look at AIS as a whole to determine the reasons for their success. This activity can fulfill needs in the curricula for anatomy, animal behavior, adaptations, ecology, social studies, and geography.
- Preserved specimens may be available from science supply companies, or it may be possible to borrow them from local college biology departments, US Fish and Wildlife Services offices, state department of natural resources, environmental conservation departments, or Sea Grant offices.
- Suggested research sites for students can be found under the Resources heading below. Teachers may provide additional resources, if desired.

Procedure

1. Provide a definition of AIS, and have student groups examine preserved specimens or representations (e.g., photographs, line drawings, and anatomical representations) of various aquatic invasive and native species that occupy the same habitats.

2. After students select an AIS and a related native species to research, have them study those specimens or their representations closely. Explain that they will be conducting research to discover why the AIS can thrive in the habitats they were introduced to. The information researched for the aquatic invasive and native species should include: distribution, habitat needs (including needs for food, shelter, and reproduction), life cycles, and analysis of relationships among body structure, behavior, and function.

3. Students conduct research and organize their information on the Aquatic Invasive Species Research Guide worksheet. Then they synthesize the information into conclusions about AIS adaptations.

4. Students present their findings in an "Aquatic Invasive Species Advantage Forum" as representative experts on their researched species.

Wrap-Up

The *Aquatic Invasive Species Advantage* Forum and the Aquatic Invasive Species Research Guide allow sufficient means for evaluating student progress

Extension

- Relate AIS adaptations to a local problem with such a species. Are there fishing lakes being affected by an AIS invasion? What are the far-reaching effects of this invasion? What is known about the adaptations of this species that will help people to understand and control its spread?

Resources

Websites:

Great Lakes Aquatic Nonindigenous Species Information System: https://www.glerl.noaa.gov/glansis/
U.S. Geological Survey, Biological Resources Division, Nonindigenous Aquatic Species (Gainesville, FL): http://nas.er.usgs.gov
US EPA, Aquatic Invasive Species: https://www.epa.gov/greatlakes/invasive-species-great-lakes-0
NOAA: https://research.noaa.gov/identifying-the-great-lakes-top-ten-most-impactful-aquatic-invaders/
Alliance for the Great Lakes: https://greatlakes.org/issues/keeping-invasive-species-out/
Great Lakes Fishery Commission: https://www.glfc.org/invasive-species.php
Great Lakes Now: https://www.greatlakesnow.org/2024/10/great-lakes-most-unwanted-top-10-invasive-species/
Be a Hero, Transport Zero: https://www.transportzero.org/aquatic.html
Aquatic Invaders in the Marketplace: https://takeaim.org/
Invasive Crayfish Collaborative: https://invasivecrayfish.org/

Kits:

Aquatic Invaders Attack Pack: an interactive kit containing preserved specimen of AIS, a classroom guide, fact sheets, and other resources. Available from Illinois-Indiana Sea Grant. Contact Janice Milanovich at janicem@illinois.edu or visit https://iiseagrant.org/education/loanable-kits/

Credits

Originally created for ESCAPE Compendium, Great Lakes Sea Grant Network
Created by: Marlene Schoeneck, Parkers Prairie High School, Parkers Prairie, MN
Modified by: Helen Domske, New York Sea Grant

This lesson has been reviewed for content and accessibility by the Center for Great Lakes Literacy.

Last Updated: 01/09/2026.

Teacher Activity: Aquatic Invasive Species Advantage Forum Rubric

Name _____ **Date** _____ **Class Period** _____

Criteria	**Written content from student research (journal, notes, formal report, etc.)** (50 Points Possible)	**Oral presentation from Aquatic Invasive Species Advantage Forum.** (30 Points Possible)	**Grammar & Spelling.** (10 Points Possible)	**Timeliness** (10 Points Possible)
Exemplary	Developed conclusions fully. Good, logical organization. Used reliable sources. Referenced accurate and relevant facts/examples. (45–50 Points)	Elaborate, quoted sources, correctly answered questions. Referenced accurate and relevant facts/examples. Spoke clearly, did not read from notes. (27–30 points)	All grammar and spelling correct. (9–10 points)	Assignment handed in on time. (10 Points)
Proficient	Satisfactory development of conclusions. Decent organization. Used accurate and relevant facts/examples. (35–45 Points)	Less elaborate, correctly answered questions. Used accurate and relevant facts/examples. Spoke clearly, referred to notes. (21–26 points)	One or two grammar and spelling errors. (7–8 points)	One day late. (8 Points)
Developing	Showed weakness in development of conclusions. Showed some organization. Used some accurate and relevant facts/examples. (25–34 Points)	Less elaborate, answered questions. Used some accurate and relevant facts/examples. Spoke clearly, read directly from notes. (15–20 points)	Three or four grammar and spelling errors. (5–6 points)	Two days late. (6 Points)
Beginning	Minimally developed conclusions. Little or no organization. Little or no use of relevant facts/examples. (16–24 Points)	Simple, unable to answer questions. Used little or no relevant facts or examples. Unclear speech, referred to notes. (10–14 points)	More than four grammar and spelling errors. (3–4 points)	Three days late. (4 Points)
Unacceptable	Incomplete development of conclusions. Unclear ideas. Hard to understand. (0–15 Points)	Incomplete, unable to answer questions. Unclear speech, read notes. (0–9 points)	Very frequent grammar and spelling errors. (0–2 points)	More than three days late. (2 Points)
	Score: / 50	Score: / 30	Score: / 10	Score: / 10

Total Score:	/ 100

Ripple Effects | Why Do They Thrive?

Student Activity: Invasive Species Research Guide 01

Name _____ **Date** _____ **Class Period** _____

Directions: Use this document to collect and organize your research before presenting at the AIS Advantage Forum.

1. **Aquatic Invasive Species** _____
2. **Native Species for Comparison:** _____
3. **Research Questions:**
   a. What are the key similarities and differences between your AIS and native species? (Consider anatomy, behavior, habitat needs, and life cycle.)
   b. How does the AIS affect the native species and its environment?
   c. What adaptations help the AIS survive, spread, and out-compete native species?

Species Profiles

Feature	Aquatic Invasive Species	Native Species
Habitat Needs		
Food Sources		
Shelter Requirements		
Reproductive Strategies		
Life Cycle Stages		
Physical Structures		
Behavioral Characteristics		

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4. **AIS Impact Analysis**
   a. Environmental Impact:_____
   b. Human or Economic Impact:_____
   c. Social or Cultural Impact (if applicable):_____

5. **AIS Adaptation Advantage**
   a. Key Adaptations:_____
   b. How These Help with Dispersal or Survival:_____
   c. Are There Any Known Control Methods?_____

6. **Visuals & Diagrams**
   a. Describe, sketch, or paste visuals that support your research (e.g., food web, life cycle diagram, habitat map, anatomical comparison). Be sure to include the source for credit.

Sources & Notes

Source	Type (Website, Book, Journal Article, etc.)	Key Notes/Questions

7. **Forum Prep: Summary Statement**
   a. You're now an expert on your AIS and will present your research. Write a short summary to help you prepare for your AIS Advantage Forum presentation. Answer the following questions in your summary:
      i. What makes this AIS so successful?
      ii. What are the key similarities and differences between your AIS and native species? (Consider anatomy, behavior, habitat needs, and life cycle.)
      iii. How does the AIS affect the native species and its environment?
      iv. What adaptations help the AIS survive, spread, and outcompete native species?

Last Updated: 01/09/2026.

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Funding is provided by Great Lakes Restoration Initiative via an interagency agreement between the U.S. EPA Great Lakes National Program Office and the National Oceanic and Atmospheric Administration (Grant NA23OAR4170128).

IISG25-HCE-EDU-031

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