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

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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.

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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.

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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

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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.

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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

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

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

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

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