INVESTIGATE

# 13 | Invasive Issues

GRADE LEVEL

6-8


## summary

Students research and present findings on invasive species, then research and write about possible solutions.

## objectives

- Explain how specific invasive species have impacted the lake food web.
- Suggest possible solutions to problems caused by invasive species in the Great Lakes.

## prerequisite

What's New?

## vocabulary

*Invasive species:* plant or animal that enters an ecosystem to which it is not native and competes with one or more native species for food, shelter and/or reproductive opportunities

*Biodiversity:* biological variety in an environment as indicated by numbers of different plants and animals

## setting


## subjects

Language Arts, Ecology

## standards

This Great Lakes in My World activity is aligned to the Common Core State Standards and to state learning standards in:

Illinois
Indiana
Michigan
Minnesota
New York
Ohio
Pennsylvania
Wisconsin

This alignment is available on your Great Lakes in My World CD in the "Standards" folder and on-line at http://www.greatlakes.org/GLiMWstandards.

## materials

- Journals
- Pencils
- Poster board
- Markers
- Research materials

## background

Please see the background section of the "What's New?" activity. The list of invasive species includes: rusty crayfish, spiny water flea, bighead and silver carp, Eurasian ruffe, sea lamprey, zebra mussel, Eurasian water milfoil and quagga mussel.

## procedure

1. Introduce the activity by telling the class they're going to build upon what they've learned about invasive species. Create a large chart to hang on the wall that duplicates the one on the journal page for this activity. Break students into eight teams to research invasive species. Each team should choose one species.

2. Teams research the species to answer the questions in the chart. Students should record the research in their journals, then enter concise responses on the class and journal chart

3. Each team should give a five-minute presentation on their findings. Discuss the following questions as a class: What are the most common ways in which these species enter the Great Lakes? *Ballast water carried by ships, through canals made by humans.* What characteristics are shared by successful invasive species? What can happen when an invasive species successfully establishes itself in an ecosystem?

4. Discuss the changes that the lake food web has undergone as a result of the introduction of new species. How long do students think the food web will continue to change? *This answer is dependent on predator-prey relationships and on habitat requirements of the invasive and native species and how habitats change with invasive species.* Is the food web stable, or in balance right now with the invasive species? *No.* Will the food web become stable again over time? *Possibly- Right now, native organisms spend a lot of energy competing with new organisms for food and space. Over a very long period of time, organisms co-evolve so that they can live in balance and expend less energy competing with each other. In the meantime, the food web as we know it could change drastically and decrease in biodiversity.*

5. Students work in their groups to draw diagrams of the lake food web that include the invasive species.

## wrap-up

1. Make clear the difference between the short- and long-term time scales. The imbalance in ecosystems caused by invasive species may be corrected through evolution, but this happens over a very long period of time (thousands of years). In the more immediate future, invasive species may do considerable damage to an ecosystem.

2. What is the answer? Do students think that the best solution to this problem is to let the food web take its own course in finding a new balance or to try to control the invasive species? What are the possible ways in which invasives could be controlled? *Preventative measures include things such as electric barriers or regulations on shipping ballast water. Measures to reduce existing numbers of invasives in the Great Lakes include selective poisoning, introducing predators and interfering with reproduction.*

3. Students should go back into their groups to research potential solutions to the damage caused by their species.

4. Have students begin research by looking for articles on their species on the following web site: http://www.glerl.noaa.gov/res/Programs/glansis/glansis.html.
   Each group should read at least two articles on their species and one article on another species.

5. After reading the articles and doing additional research as necessary, students should brainstorm a list of potential solutions. Have groups each choose one solution from their list on which to expand.

6. Students should each write a one-page essay in their journals explaining the impact of the invasive species they have chosen and a possible solution to the problem.

7. Student groups should each take five minutes to present their issue and proposed solution to the class.

## extension

Turn essays into proposal letters to send to the officials best in a position to affect change. If you choose to do this, it is important to first discuss with students that while they are capable of making change, people are not always successful on their first attempt.

## assessment

Rubric on page 87

| Name | Latin Name | Origin | When Arrived in Great Lakes | How Arrived in Great Lakes | |
|---|---|---|---|---|---|
| **alewife** | *Alosa pseudoharengus* | Atlantic coast | Before 1931 | Canals and the St. Lawrence River | |
| **bighead and silver carp** | *Hypophthalmichthys nobilis and Hypophthalmichthys molitrix* | Originally from China, now in Mississippi River | Not yet arrived; currently in upper Illinois River less than 55 miles from Lake Michigan; a permanent electric fish barrier is being constructed to prevent their advance towards Lake Michigan | Escaped into the Mississippi River from aquaculture facilities in the early 1990s when the facilities were flooded | |
| **Eurasian ruffe*** | *Gymnocephalus cernuus* | Northern Europe- Black and Caspian Seas | 1980s | Arrived in ballast water from a ship | |
| **Eurasian water milfoil** | *Myriophyllum spicatum* | Europe, Asia and North Africa | 1940s | Introduced as an aquarium plant | |
| **Hydrilla** | *Hydrilla verticillata* | Africa | 1960 | Aquarium trade | |
| **purple loosetrife*** | *Lythrum salicaria* | Northern Europe | Early 1900s | Intentionally imported for its beautiful flowers | |
| **quagga mussel** | *Dreissena bugensis* | Eurasia | 1989 | Arrived in ballast water from a ship | |
| **round goby** | *Neogobius melanostomus* | Black Sea | 1986-1988 | Arrived in a ship's ballast water brought into St. Clair River or Lake St. Clair | |
| **rusty crayfish** | *Orconectes rusticus* | Ohio River Basin | 1960s | Used as bait by fishermen and released by science classes who had them as pets | |
| **sea lamprey** | *Petromyzon marinus* | Atlantic Ocean, St. Lawrence and Hudson Rivers and possibly Lake Ontario | Arrived in 1830s, established by 1938 | Through the Welland Canal | |
| **spiny water flea** | *Bythotrephes cedarstromi* | Northern Europe | Lake Huron 1984, in all Great Lakes by 1987 | Arrived in ballast water from a ship | |
| **white perch*** | *Morone americana* | Atlantic coast | 1930s-1950s | Canals | |
| **zebra mussel** | *Dreissena polymorpha* | Caspian Sea region of Poland, Bulgaria and Russia | About 1985 | Arrived in ballast water from a ship | |

*** = not a Creature Card**

| | Habitat | Food Source | Impact on Food Web | Other Impact | Notes |
|---|---|---|---|---|---|
| | Lakes and oceans | Phytoplankton, zooplankton, and small crustaceans | Competes for food | Large numbers die off, can clog water intake pipes and contaminate beaches | Thrived when sea lamprey ate the fish that prey upon it |
| | Surface layers of open water | Plankton | Would likely compete for food with native fish; are large and consume large quantities of food | Have the potential of destroying the $1 billion commercial and recreational fishing industry on the Great Lakes | Silver carp species are bothered by boat motor noises and leap several feet out of the water, injuring boaters |
| | Fresh and brackish waters, usually near river mouths | Highly variable diet including mollusks, insect larvae, small fish, and crustaceans | Aggressive competitor for food | Reproduces quickly; its not eaten because of spiny fins; has a variable diet | Tolerates varying water conditions |
| | Full sunlight; lives in water to depths of 1-3m/ 3-9ft | Sunlight | Forms thick mats that choke out native vegetation | Disrupts water recreation | Thrives in warm water and spreads quickly |
| | Any partially sub-merged body of water with a salinity level of less than 7% | Oxygen and sunlight | Forms tall and thick stalks and shade or choke out all native vegetation | Disrupts water recreation and grows until the surface | Reproduces at an incredibly fast rate |
| | Moist to wet ground in prairies and streambanks | Sunlight | Destroys habitat for other wetland plants | Its roots choke waterways | |
| | Freshwater lakes up to 33m/98ft | Plankton | Competes for food | See “zebra mussel” | Reproduces quickly; lives at greater depth than zebra mussels |
| | Lake bottom; found in all Great Lakes and some nearby lakes | Small fish, zebra mussels, fish eggs | Compete with native sculpin for resources; reduces top predators by consuming their eggs | | Reproduces quickly; is more likely to find prey than to become prey |
| | Lakes, ponds, and streams in areas where there is debris on the bottom | Aquatic plants and insects, fish eggs, small fish | Displaces native crayfish; reduce the number and types of aquatic vegetation in invertebrates. | | |
| | Freshwater lakes and oceans | Lake trout | Upsets the ecosystem balance by removing top predators | Destroys fish by sucking blood and tissues | Had great impact on the commercial fishing industry of the 1950s |
| | Throughout Great Lakes and some inland lakes | Plankton | Competes with small fish for food, but its spiny tail prevents it from being eaten | | |
| | Marine; spawn in coastal streams; now found in freshwater lakes | Eggs of walleye and white bass | Competes with yellow perch and other fish in shallow water; consumes eggs of other fish | Reduced number of walleye impacted fishing industry | |
| | Freshwater; native to the Caspian and Black Seas; now in all Great Lakes and some inland lakes; depths of 2-7m/ 6-23 ft | Plankton | Competes for food by filtering large amounts of plankton, which has reduced this population | Accumulates on objects, such as boat hulls, and clogs water pipes | Increases water clarity through filter feeding, which increases algae growth and decreases abundance of plankton |

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journal pages

| FIRST NAME | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAST NAME | | | | | | | | | | | | | | | | | | | | |

[1] Species name: .....

[2] Species is from: .....

[3] When did it arrive in the Great Lakes? .....

[4] How was it introduced? .....

.....

[5] What is its habitat? .....

.....

[6] What is its food source? .....

.....

[7] Describe its impact on the food web. .....

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[8] Draw a diagram of the lake food web including the invasive species. Describe how the native species are impacted by the invasive species.

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journal pages

| FIRST NAME | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAST NAME | | | | | | | | | | | | | | | | | | | | |

Titles, authors and dates of research articles:

1. .....

.....

2. .....

.....

3. .....

.....

Brainstorm a list of potential solutions to the negative impact your species has had on the lake food web. This may include methods of preventing more of this species from entering the Great Lakes and/or methods of reducing numbers already in the lakes. Narrow down your list to one solution - circle this solution.

1. .....

.....

2. .....

.....

3. .....

.....

**Write!**
On a separate sheet of paper, write a composition explaining the impact of the invasive species you have chosen, and a possible solution to the problem.

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journal pages

| FIRST NAME | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAST NAME | | | | | | | | | | | | | | | | | | | | |

Fill in the row on the chart for the species your group chose. During the presentations, fill in the rest of the chart.

| SPECIES NAME | Originally from | Year it arrived in the Great Lakes | How it was introduced | Habitat (shelter or space occupied) | Food Source | Impact on Lake Food Web |
|---|---|---|---|---|---|---|
| | | | | | | |
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