

Food Web Invasion

Students develop a food web with ten native species and show the impact of two invasive species.

OBJECTIVES

List at least 10 connections between Great Lakes coastal organisms in a food web

Explain the impacts of changes on a Great Lakes coastal habitat food web

Diagram a food web that shows the interconnectedness of native species and two invasive species

SUBJECT

Ecology

PREREQUISITE

#7: The Great Race for Survival

VOCABULARY

autotroph
decomposer
food chain
food web
heterotroph
invasive species
primary producer
primary consumer
quaternary consumer
secondary consumer
tertiary consumer

MATERIALS

Great Lakes food chain and food web images
paper
pencils
drawing supplies

TIME/DURATION



90 minutes + presentations

SETTING

Indoors
Outdoors

This Great Lakes in My World 9-12 activity is aligned to the Common Core State Standards (as available). This alignment is available on your Great Lakes in My World 9-12 USB flash drive in the “Standards” folder and on-line at <http://www.greatlakes.org/GLiMWstandards>.

BACKGROUND

INVASIVE SPECIES IN THE GREAT LAKES REGION

Invasive species travel, often accidentally, from their native ecosystem to a new ecosystem. Waterborne commerce moves millions of tons of cargo annually through the Great Lakes. Shipping is an economically efficient method of transporting raw materials, finished goods and agricultural products. However, shipping can accidentally introduce nonnative species which may be detrimental to the Great Lakes ecosystem. There are hundreds of examples of invasive species (also known as exotic or nonnative species) around the world. See student pages for additional information.

FOOD CHAINS AND FOOD WEBS

Food chains that show feeding relationships in an ecosystem are part of large and complex foodwebs. By exploring these relationships, students become familiar with the concept of food webs, as well as the different

plants and animals that inhabit coastal habitats along the Great Lakes. There are many ways to model a food web. It is important that the information on organisms is accurate. Students may be creative with this project – it might be a two- or three-dimensional model. It may take the shape of a puzzle, a web, a mural, a graphic computer-design, or visual model.

PROCEDURE

INTRODUCTION

PART ONE: GREAT LAKES FOOD CHAINS AND FOOD WEBS

1. Students read the background information and answer the introductory questions. Students use the Creature Cards to connect the parts of the food web. Teacher shows the Great Lakes ecosystem food chain and food web as models, pointing out the multiple levels. Discuss how energy is transferred throughout the food web.

- Assign each student a coastal habitat: sand dune, wetland or prairie. Then, each student will create a food chain of organisms within that coastal habitat. This food chain should include one autotroph (producer) and at least two heterotrophs (consumers): one primary consumer and one secondary consumer.
- Students divide into groups based on their habitat to create a food web as a group for sand dune, wetland or prairie. Students who created a sand dune food chain gather with other students who created a sand dune food chain. Each group will combine organisms and connections from their food chains to create a food web with at least 10 organisms from their habitat.

PART TWO: GREAT LAKES FOOD WEBS INVASION

- Students then "introduce" an invasive species (from the background information on the student pages) into their habitat's food web and discuss the following in a group: What type of impact does the invasive species have on the habitat's food web? Does it eat something that is a food source for another species? Does it occupy the same habitat or niche as another species? Does it eat species that do not have a natural predator (i.e. another invasive species)?
- Then students introduce a second invasive species into their habitat's food web and discuss the impacts of the second species.
- Each student then re-draws the food web to show the effect that these invasive species could have on other organisms in the habitat. All of the students' food webs might not look exactly the same, as the invasive species may have different effects on the ecosystem. Students are expected to make predictions based-on learned facts, as scientists do; these should not be considered correct or incorrect, but rather as possible implications to the invasion of a non-native species.

DISCUSSION

- 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.
- Discuss the following questions with your students. Help them to be inquisitive and to problem-solve: What is the answer to problems caused by invasive species? 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 in the water? *Preventative measures include: washing off a boat so*

it does not transport invasive species, electric barriers, regulations on shipping ballast water, separation of waterways. Measures to reduce existing numbers of invasives in the Great Lakes include selective poisoning, introducing predators and interfering with reproduction. What are the possible ways in which they could be controlled on land? Remove plant seeds and fragments from clothing, hiking boots, and equipment after enjoying outdoor activities. Learn to identify common invasive plants in your backyard and in the natural areas of your neighborhood, and report these plants to the local Department of Natural Resources.

PART THREE: INVASIVE SPECIES RESEARCH

- Students return to their food web groups to research potential solutions to the damage caused by their species.
- Have students research by looking for articles on their species on the following web site: <http://www.glerl.noaa.gov/res/Programs/glansis/glansis.html> or <http://www.great-lakes.net/envt/flora-fauna/invasive/invasive.html>. Each group should read at least two articles on their species and one article on another species.
- After reading the articles and doing additional research as necessary, students should brainstorm a list of potential solutions. Have each group choose one solution from their list on which to expand.

WRAP-UP

- Students each write a one-page essay explaining the impact of the invasive species they have chosen and a possible solution to the problem.
- Student groups each take five minutes to present their issue and the proposed solution to the class.
- As a class, discuss what can be done to bring about these proposed solutions. What parties (organizations or individuals) in their community or state would be able to affect change?

EXTENSION

- Integrate Language Arts: Turn essays into proposal letters to send to the local, state or federal political officials who are in the best positions 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

See rubric on page 70.

RESOURCES

Please see Resource List for additional information related to native and invasive species.

GREAT LAKES FOOD CHAIN



sun



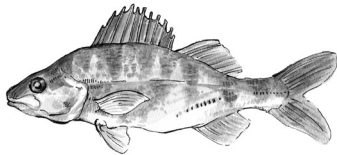
green algae



humans



water strider

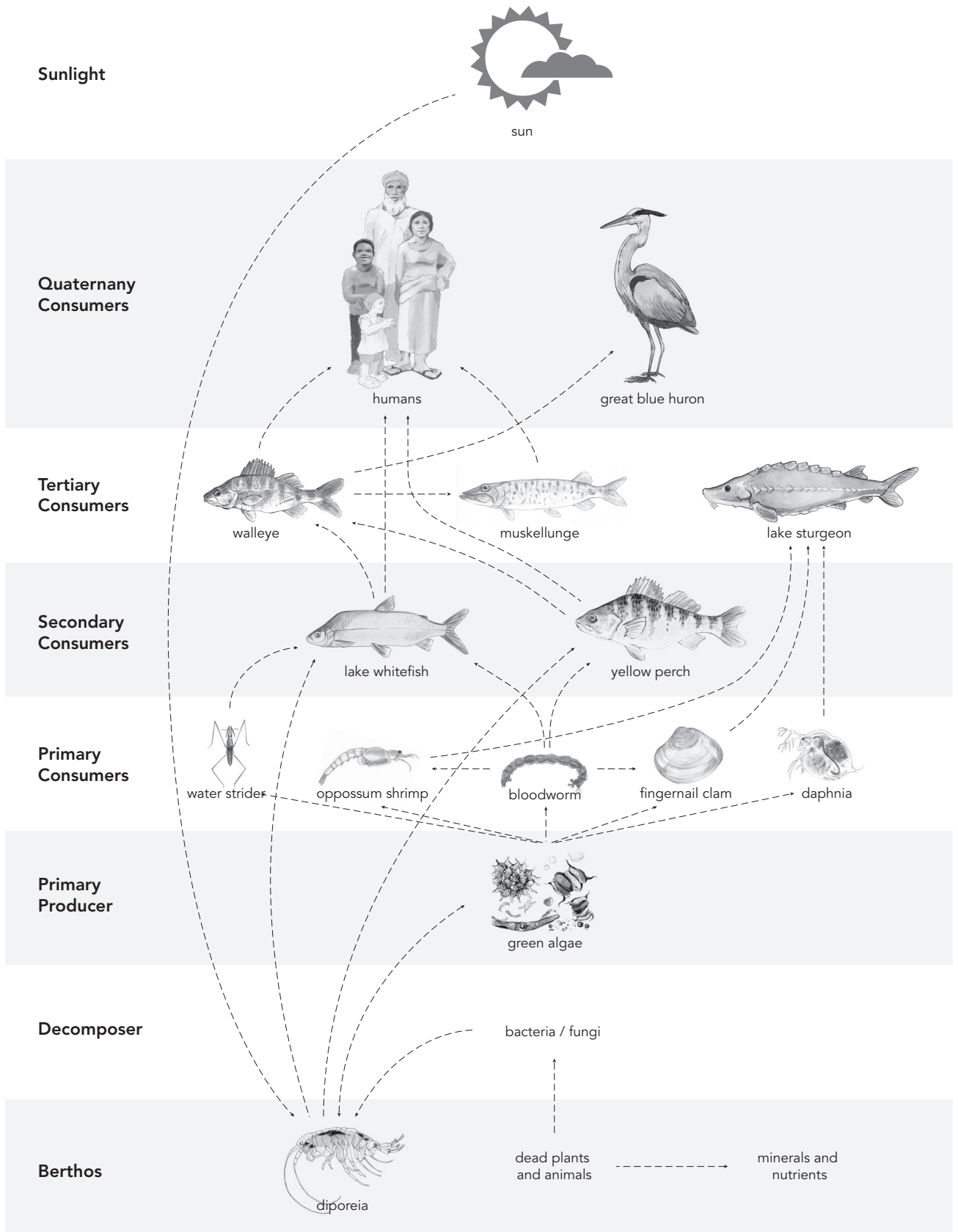


walleye



lake whitefish

GREAT LAKES FOOD WEB



Food Webs Invasion

VOCABULARY

autotroph
 primary consumer
 decomposer
 food chain
 food web
 heterotroph
 invasive species
 primary producer
 primary consumer
 quaternary consumer
 secondary consumer
 tertiary consumer

BACKGROUND

Invasive species arrive, often accidentally, from their native ecosystem to a new ecosystem. There are hundreds of examples of invasive species (also known as exotic or nonnative species) around the world. An “introduced species” is one that has been intentionally brought from their native ecosystem to a new one. Many times invasive or introduced species cannot survive in these new ecosystems or become a non-threatening part of the ecosystem. However, if the new species is successful, one or more native species populations can suffer, altering the ecosystem. The Great Lakes have been altered and have rebalanced throughout history. Our region is dynamic. In this lesson, you should think about how humans and other species have altered the Great Lakes.

Asian carp are just one of many nuisance animal and plant species that have moved or are poised to move between the Great Lakes and Mississippi River basins via the manmade Chicago Waterway System that has connected the basins for more than 100 years. Other invasive species introduced into the Great Lakes and their coastal habitats are: rusty crayfish, spiny water flea, common carp, Eurasian ruffe, sea lamprey, zebra and quagga mussels, Eurasian water milfoil, garlic mustard, Japanese barberry, Japanese honeysuckle, multiflora rose, oriental bittersweet, purple loosestrife, spotted knapweed, and tree-of-heaven. Life cycles, behaviors, habitats and the abundance of organisms in the Great Lakes have been altered by the intentional and unintentional introduction of invasive plant and animal species.

Food chains show feeding relationships and they are woven into larger and more complex food webs within ecosystems. By exploring these feeding relationships, you will become familiar with the concept of food webs, as well as with the different plants and animals that inhabit coastal habitats along the Great Lakes. Throughout this lesson, you will learn about possible problems from, and solutions to, the introduction of invasive species.

INTRODUCTORY QUESTIONS

1. Draw (or write) an example of a simple food chain. Include at least three organisms (plants or animals). These organisms can be from the Great Lakes region, or from a habitat with which you are familiar. Use arrows to show the connections between these organisms.

2. What do you think will happen when an invasive species is introduced to an ecosystem?

GREAT LAKES FOOD WEB

Connect the creatures in this Great Lakes food web. Draw arrows to show how energy is transferred from one organism to its consumer. Use the Creature Cards to help you.

Sunlight



sun

Quaternary Consumers



humans



great blue heron

Tertiary Consumers



walleye



muskellunge



lake sturgeon

Secondary Consumers



lake whitefish



yellow perch

Primary Consumers



water strider



opossum shrimp



bloodworm

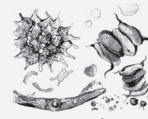


fingernail clam



daphnia

Primary Producer



green algae

Decomposer

bacteria / fungi

Berthos



diporeia

dead plants and animals

minerals and nutrients

FOOD CHAINS

3. Draw an example of a food chain in a _____
(write the name of your coastal habitat on the line above)

Include at least four native species.

FOOD WEBS

4. In a group, combine your food chain with the food chains of your classmates who focused on the same the coastal habitat. This food web should include at least 10 organisms. These organisms should include both autotrophs and heterotrophs, or producers and consumers. Food webs are complex, and they can be messy. Try to organize your food web by showing the layers of the food web from producer to primary consumer all the way up to quaternary consumers and finally to the top predators. Include the sun and decomposers, too. Connect the organisms with arrows to show how energy moves through an ecosystem's food web.

Sketch a food web for your assigned coastal habitat here. Then, as a group, draw your food web on a large poster or chart paper.

FOOD WEB INVASION

As a group, you will “introduce” an invasive species (chosen from the background section) into the habitat’s food web and discuss the following:

5. What type of impact does it have on the habitat’s food web?

6. Does it eat species that do not have a natural predator (i.e. another invasive species?)

7. Does it eat something that is a food source for another species?

8. Does it occupy the same habitat or niche as another species?

9. Now, introduce a second invasive species into the habitat’s food web. What type of impact does it have?

10. On your own, draw the food web again, but this time include these two invasive species. Show the effect these invasive species would have on other organisms in the habitat. Your food web might not look exactly the same as your classmates’.

WRAP-UP QUESTIONS

10. Do you think it is a better solution to let the food web take its own course in finding a new balance or to try and control the invasive species? Why?

11. What are the possible ways in which invasive species could be controlled in the water? On land?

12. What organizations or individuals in their community or in their state would be able to affect change?

RUBRIC

ELEMENTS	☆☆☆☆	☆☆☆	☆☆	☆
FOOD CHAIN: Student participates in discussion of food web models. Given a specific habitat, student independently draws a food chain that includes at least one autotroph and two heterotrophs.	Addresses all of the components	Missing one of the components	Missing two components	Missing three or more components
FOOD WEB: In a group, student shares his/her food chain and compares it to other possible food chains within their assigned ecosystem. As a group, students draw a food web that includes at least ten organisms from this habitat. Student then introduces invasive species into their habitat and reflects on the effects of invasive species on a food web. Independently, student re-draws the food web to display these changes in the habitat. This food web will include ten native species and two invasive species.	Addresses all of the components	Missing one of the components	Missing two components	Missing three or more components
DISCUSSION: Student actively participates in class discussion about the problems invasive species cause and any solutions to balance or control these organisms.	Addresses all of the components	Missing one of the components	Missing two components	Missing three or more components
INVESTIGATING SOLUTIONS: Student works in their ecosystem groups to research potential solutions to the damage caused by the invasive species using the internet and other resources. Student reads at least three articles (two on their species and one on another) to brainstorm possible solutions.	Addresses all of the components	Missing one of the components	Missing two components	Missing three or more components
ESSAY: Student writes a one-page essay explaining the effects of invasive species on an ecosystem. The essay at least one possible solution to a food web invasion. Essay is well-developed and thorough. All ideas presented are supported with evidence from research. Spelling and grammar are accurate. Sources are cited.	Addresses all of the components	Missing one of the components	Missing two components	Missing three or more components