

Fish Food!

Adapted from: “Marsh Market” in WOW!: The Wonders of Wetlands. The Environmental Concern Inc., 1995. AND All the Rivers Run. Cuyahoga Valley Association and National Park Service, 1996.

Grade Level: basic

Duration: 40 minutes

Setting: classroom, outside, gym

Summary: Students research organisms in a food web and then make a living food web by linking themselves with string.

Objectives: Students will become familiar with the food items and predators of organisms. Moreover, they will come to understand the interconnectedness of a community.

Related Module Resources:

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Vocabulary: food chain, trophic levels, food web, primary producer, primary consumer, secondary consumer, tertiary consumer, herbivore, carnivore, detritivore, scavenger, decomposer, top predator, omnivore

Materials (Included in Module):

- reference books
- large ball of string (yarn)
- Organism Cards with yarn attached

Additional Materials (NOT Included in Module):

- index cards (optional)

ACADEMIC STANDARDS: ENVIRONMENT AND ECOLOGY

7th Grade

4.3.C Explain biological diversity.

- explain the complex, interactive relationships among members of an ecosystem

4.6.A Explain the flows of energy and matter from organism to organism within an ecosystem.

- explain energy flow through a food web
- identify niches for producers, consumers and decomposers within an ecosystem

10th Grade

4.7.A Explain the significance of diversity in ecosystems.

- explain the role that specific organisms have in their ecosystem

12th Grade

4.6.A Analyze the interdependence of an ecosystem.

- analyze the relationships among components of an ecosystem

BACKGROUND:

A **food chain** is a series of organisms linked by their feeding (predator / prey) relationships. It shows the flow of energy through a system. The first organism is eaten by a second, the second by a third, and so on, in a series of feeding levels or **trophic levels**. In most ecosystems, food chains are linked together in **food webs**, with many branches and interconnections. Webs may involve more than 100 species, with predators often feeding on more than one type of prey, and prey often being pursued by several different predators. The relations in a food web are important dimensions to an ecosystem.

Plants are the foundation of many food chains. They are known as **primary producers** because they provide the food at the bottom of the chain. They produce this food themselves through photosynthesis, using light energy to make carbohydrates and other compounds, which then becomes a source of chemical energy. On land, plants are the main primary producers and algae are in aquatic systems. Producers dominate the earth; 99% of all organic matter in the living world is made up of plants and algae.

Organisms that eat plants or algae are called **herbivores**. They are classified as **primary consumers** because they are the first link in the food

chain that eats another organism for food. Of the organic material consumed by herbivores, much is eliminated undigested. Most chemical energy is “lost” maintaining essential life functions and activities. A small fraction of the chemical energy is converted to new animal biomass, which represents energy available to the next trophic level.

Secondary consumers eat primary consumers. These organisms are **carnivores**, animals that eat other animals. Only a small amount of the organic substance present in the body of the herbivore becomes incorporated into the body of a carnivore. **Tertiary consumers** eat secondary consumers.

Although some tertiary consumers are carnivores, many are **detritivores**, organisms that live on the refuse or **detritus** (freshly dead or partially decomposed organic matter) of a community. This can include dead leaves, branches, tree trunks, roots of annual plants, feces, carcasses, and even discarded exoskeletons. Detritivores can include **scavengers**, which eat dead prey rather than living prey, and **decomposers**, such as fungi, bacteria, and some insects. Decomposers can be considered consumers, but they are different because they have specialized abilities to utilize sources of chemical energy, such as cellulose and nitrogenous waste products, that cannot be used by other animals. Decomposers help release nutrients back into the soil, allowing more plants to grow.

Because of this significant loss of available energy between trophic levels, food chains rarely exceed five links. **Top predators** (animals themselves free of predation) usually are usually only part of a three or four link chain.

It is important to realize that these categories are broad. Some organisms fit into more than one group. For example **omnivores** eat both plants and animals. Therefore they may be a primary consumer in one food chain and a secondary consumer in another.

In aquatic ecosystems fish are often the organisms at the top of the food chain. They are often the secondary and tertiary consumers. The producers in an aquatic ecosystem are algae and aquatic plants. These producers are consumed by the primary consumers, which are often small fish and aquatic macroinvertebrates. These organisms are consumed by the secondary consumers, which are other fish. However, organisms in this category may also be omnivores. Tertiary consumers may be the large fish in a particular ecosystem or they could be mammals, birds, or other organisms that eat fish and do not live in the water. Some fish are also scavengers and eat dead or decomposing matter for food.

OVERVIEW: Students become connected in an aquatic food web that they create. They will wear organism illustrations around their neck and pass yarn to an organism that they eat or are eaten by, learning their organism’s role in the ecosystem.

PROCEDURE:

1. Make a list the plants and animals that live in a stream, pond, or wetland community – be as specific as possible for the group involved. (Include such things as fish, insects, crayfish, algae, and even mussels.)
2. Pass out the Organism Cards and show them all the different types of creatures that could be on the list. Assign each student to be one of the organisms that is on the Organism Cards.
3. Have them research the food preferences and predators of that organism. Students can use the books included in the Fish Module, such as the Peterson's Guide to Freshwater Fish or Pennsylvania Fishes by the Pennsylvania Fish and Boat Commission, or go to the library to research their fish. If you think they may forget, you may want them to write down their findings on an index card.
4. Categorize the organisms as primary producers, herbivores, carnivores, omnivores, scavengers, or decomposers. This can be done by making a list on a chalkboard.
5. Have the students put the Organism Card around their neck.
6. Have the class stand in a circle. Pick a student who is representing a plant/algae/primary producer. Give them a ball of yarn and have them wrap the end once around their hand. You might want to ask the group why you chose this student to begin the food web.
7. Have them pass the ball of yarn to an organism that eats that plant. That person should also then wrap the yarn around their hand and pass the ball on again to an organism that they would eat or be eaten by. They should try to pass it to someone who has not received the yarn yet. The students that did the research on the organism can help to decide where the ball should be passed. For reference, enclosed is a list of the organisms represented on the cards with their diets and what they are eaten by.
8. Toward the end, if students are having trouble finding something they eat or are eaten by, you may need to ask them to find something that they interact with in some other way (i.e. Two insects might live under the same rock, a raccoon relies on the insects to feed the fish, which the raccoon eats).
9. When all possible connections have been made, the web is completed. At this point, have the students move in a manner that stretches the web taut.
10. Discuss what would happen if an organism disappeared from the web. How might this happen?

11. As the students come up with ideas that might harm or eliminate a member of the chain, have that member pull the string. Then, anyone who feels the string move should raise their hand. These people should all tug on the string in unison and everyone who has been affected, by that tug should raise their hand. OR Have the eliminated person drop his or her string. Now make the web taut again, which will require the people connected to the person who dropped out to move back away from the circle – reshaping / disrupting the web. Eliminate another, creature/person and reshape again.

DISCUSSION:

Have the students talk about what ways the organisms would be affected by those that pulled/dropped the string. Help them come to the conclusion that the organisms are all connected in some way and are therefore dependent on each other.

Also discuss with students how energy is lost from one trophic level to another.

If herbicides were added to a waterway and they killed all the aquatic plants and algae, how might this affect trout living in the stream? *Trout may eat insects that rely on the aquatic plants for food. Without the plants, these insects may not survive and the trout may need to find a new food source. In addition, there may be a concern of bioaccumulation of toxins in the trout if they eat insects that have ingested herbicides.*

EVALUATION:

- Identify an organism's role in a food chain – i.e. tertiary consumers, decomposer, etc.
- Recognize that the members of a community interact in a number of ways that make them interconnected.
- Identify the food and predators of a number of organisms in a stream or wetland community.
- Provide a list of organisms and have students create a food web using the list.
- Describe how a number of members of a community can be affected when one organism is disturbed.
- List a creature in each of the following categories: primary producer, primary consumer, secondary consumer, omnivore, scavenger, decomposer, herbivore, and carnivore.

EXTENSIONS AND MODIFICATIONS:

- Change cards and do it again.
- Have the students decide and research what organisms they would like to represent. Instead of using the enclosed creature pictures, have them create their own picture. This can be done from magazines or with a simple drawing.
- Repeat the activity in other types of habitats. Students will need to create their own pictures or simply write a tag with the name of their creature in this case.
- Try using the version of this activity that is not fish based.

NOTES (TEACHERS, PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

Activity Version: February 2002

Organism	This Organism Eats	This Organism Is Eaten By...
Alderfly Larvae	Insects, including other Alderfly Larvae	Fish, Other Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Alewife	Zooplankton, shrimp, small fish, fish eggs, larval fish	Other Fish
Algae	Autotrophic- photosynthesis	Zooplankton, snail, Mosquito Larva, Aquatic Macroinvertebrates
Blackfly Larvae	Algae, Micro-organisms, Plant Debris	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Blacknose Dace "redfin"	Tiny aquatic invertebrates: blackfly larvae, midge larvae, algae, diatoms (type of algae)	Other Fish
Bluntnose Minnow	Algae, insect larvae, diatoms	Other Fish
Bowfin	Fish, Crayfish, Frogs, Aquatic Macroinvertebrates	Larger Bowfins
Bullhead	Aquatic plants, aquatic insect larva, snails, freshwater clams, crayfish, small fish	Walleye
Caddisfly	Detritus, Algae, Aquatic Micro-Organisms	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Coarse Particulate Organic Matter	--	Detritivore Aquatic Macroinvertebrates
Common Carp	Plants, Fish Eggs, Small Aquatic Macro-Invertebrates	Predatory Mammals
Common Shiner	Aquatic Macroinvertebrates	Other Fish
Cranefly Larvae	Algae, Detritus	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Crappie	Crayfish, leeches, crustaceans, insects, small fish	Walleye and other large carnivorous fish
Crayfish	Plants, Aquatic Macroinvertebrates, Detritus,	Raccoon, Otter, Fish
Creek Chub	Aquatic Invertebrates, Plant Material, Tiny Crustaceans, Mollusks	Larger Fish that live in creeks i.e.- Trout, Salmon, Smallmouth Bass, Largemouth Bass

Organism	This Organism Eats...	This Organism Is Eaten By...
Damselfly Nymph	Insects, Other Aquatic Macroinvertebrates	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Dragonfly	Tadpoles, Insects, Other Aquatic Macroinvertebrates	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Fine Organic Particulate Matter	--	Detrivore Aquatic Macroinvertebrates
Frog	Insects, Arachnids	Raccoons, Snakes, Small Mammals, Fish
Gar	Other Fish, Crustaceans	Top of the food chain
Johnny Darter	Zooplankton, Midge Larva, Mayflies, Small Insects, Worms, Snails, Caddisfly Larva	Larger fish
Lamprey	Parasitic Relationship with Host, Sucks Fluids, Whitefish and Trout	King Henry I and Alexander the Great (check the web if you don't believe it!)
Largemouth Bass	Fish, Crayfish, Frogs, Snakes, Mammals, Birds	Large Carnivorous Fish (before it is full grown)
Leech	Blood of other Organisms	Fish
Logperch	Aquatic Insects, Mayfly Nymphs, Caddisfly Larvae, Midge Larvae, Their own Eggs	Larger Fish
Mayfly Larvae	Plants and Detritus	Fish, Crayfish, Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Mudworm	Mussels	Fish
Mussel	Zooplankton, Phytoplankton, Detritus	Mudworms (parasitic relationship), Otters, Raccoons
Perch	Small Insects, Zooplankton, Crayfish, Snails, Small Fish	Larger Fish- such as Walleye
Pike	Fish, Frogs, Tadpoles, Birds, Muskrats, Mice, Crayfish, Leeches, Large Aquatic Insects	Eagle, Bear
Pumpkinseed	Snails, Insects	Largemouth Bass
Rock Bass	Large Aquatic Insects, Crayfish, Fish	Large Carnivorous Fish
Roundworms	Plants and Animals	Aquatic Insects, Crayfish, Fish
Scud	Detritus, Vegetation	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtle
Sculpin	Aquatic Invertebrates	Larger Fish, Otter, Muskrat
Shad	Zooplankton, Worms, Small Fish	Largemouth Bass

Organism	This Organism Eats...	This Organism Is Eaten By...
Smallmouth Bass	Insect Larvae, Crayfish, Fish	Large Carnivorous Fish
Smelt	Tiny Aquatic Organisms, Aquatic Insect Larvae, Small Fish	Larger Fish
Snail	Algae, Moss, Fungi, Bacteria, Rotifers	Fish, Birds, Mammals, and Parasitic Worms
Stonefly	Plants and Detritus and Mayfly Nymph	Fish, Alderfly Larvae, Crayfish, Damselflies, Dragonflies, Other Predatory Aquatic Macroinvertebrates, Frogs, Salamanders, Toads, Raccoons, Turtles
Sturgeon	Bottom Dwelling Invertebrates: Sludgeworms, Midges, Shrimp, Bivalves	
Tiger Muskellunge	Fish	Top of Food Chain
Trout	Aquatic Invertebrates, Insects, Water Penny	Bears, Eagles, Heron, Egrets, Raccoons, Otters
Tubiflex Worms	Detritus	Small Fish, Aquatic Macroinvertebrates
Walleye	Small Fish	Top of Food Chain
White Bass	Fish	Large Carnivorous Fish
White Sucker	Zooplankton, Bottom Dwelling Aquatic Insects, Mollusks, Crustaceans	Larger Fish
Zooplankton	Phytoplankton, Fine Particulate Matter	Non-Predatory Aquatic Macroinvertebrates