

ACTIVITY

29

EATING AND BEING EATEN

WHAT ARE SOME OF THE FEEDING RELATIONSHIPS AMONG THE PLANTS AND ANIMALS THAT LIVE IN A POND?

SCIENCE SKILLS:

- organizing
- inferring
- predicting
- experimenting
- communicating

CONCEPTS:

- The numbers of predators and of prey have a direct relationship which is a result of the way in which energy passes through the food chain.
- Predators and prey have specific ways of dealing with each other.

SAMPLE OBJECTIVES:

- Students will be able to produce a model of the way energy passes through a food chain.
- Students will be able to develop feeding strategies appropriate to different levels of the food chain.
- Students will be able to suggest changes in the rules of the simulation which test new ideas about feeding strategies.

INTRODUCTION:

This simulation builds on Activity 28 by adding the next levels of the food chain, those animals which feed on other animals, PREDATORS. The activity may be broken down and taught on several days, starting with the introduction to the concept of food webs. There are a number of possible variations which the students may want to try once they have begun to play the game.

MATERIALS:**For each student:**

- 15 markers (poker chips, plastic counters or other non-destructible small items)
- small paper or plastic bag

For the teacher:

- plastic or crepe paper flagging or cloth strips in three colors
- whistle
- pad or chalk board and pen or chalk
- copies of the data sheet and food web
- optional: pictures of pond animals (the *Golden Guide to Pond Life* by George Reid is a great source)

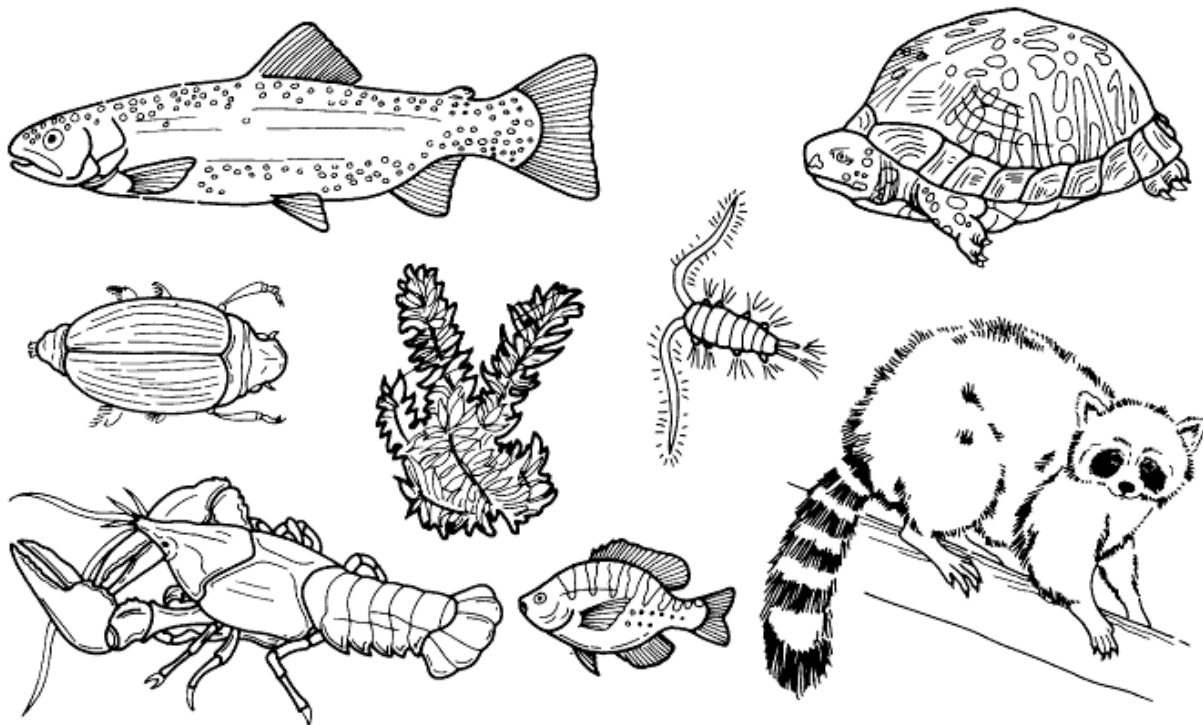
LESSON PLAN:

BEFORE CLASS: Do Activity 28 prior to this exercise. Pick a location to do the exercise with alternate plans for bad weather if you are going to be outside. See Activity 28 for discussion about safety.

DURING CLASS:

METHODS: Get settled either indoors or outdoors and explain that the class is going to pretend to be the animals in a pond. Ask them to name some animals they might find in a pond. Big and little fish, frogs, crayfish, tiny zooplankton, insects, beavers and raccoons are some answers that are possible. Have pictures of as many pond animals and plants as you have handy and the food web diagram to illustrate. Explain that in our pond we are going to have groups of kinds of animals that represent levels based on who eats whom.

Where does the food come from? From plants which use light to do photosynthesis. Some of these plants are tiny phytoplankton while others are rooted green plants that grow under the water or along the edge of the pond. Write the words phytoplankton and green plants at the bottom of the board. Show pictures of pond plants and phytoplankton. Introduce the word **PRODUCERS** for those things that make food. Who might eat these plants? The tiny animals called zooplankton eat phytoplankton as the students learned in Activity 28. Many insects and the crayfish feed on the plants. Write insects, crayfish, beavers and zooplankton above the plants on the board and draw an arrow up to them. Explain you are drawing a diagram of the path food takes in the pond. Those animals that eat plants are called **HERBIVORES**.



Who eats the herbivores? The little fish and frogs as well as some bigger fish. Add them to the next level along with an arrow. Animals that eat other animals are called **CARNIVORES**. The animals that get eaten are called **PREY**. Finally, who eats the carnivores? The big fish and the raccoon who are the **TOP CARNIVORES**. Do they just eat the level below them? No, they also eat the crayfish from the lower level. Can the students see the **FOOD WEB** or **FOOD CHAIN** forming as you draw the lines between the levels? (One way to illustrate the web is to pass out cards with the names of different animals and have the students pass a ball of yarn from

the persons with the lowest levels of the food chain or web to those higher up.)

Now for the game. The students are going to play a game which is really doing an experiment. Just like an experiment, there are rules. They are going to be the animals in a pond food chain and are going to feed on each other.

The food plants or phytoplankton (poker chips or plastic counters) are scattered over a wide area. Unlike Activity 28, in this game they are going to assume that there are more plants than the herbivores can eat: that food is not limiting.

Assign 1/3 of the class to be zooplankton, crayfish and insects. Give them the same colored strip of cloth to wear and a plastic bag. They are all HERBIVORES. Scatter 20 food items for each herbivore. That means 20 x one third the number of students in your class. These are the plants in the pond. The herbivores must get their food by picking it up. To live, they must get 10 pieces of plant food before the end of the game. If they do not get 10 pieces before the game is done, they have died of starvation.

Give another 1/3 of the class a second color arm band or sash and a plastic bag. They are the CARNIVORES, the frogs and small fish. To eat, they must tag a herbivore. The herbivore gives up his food bag and sits down as he has been "eaten" by the predator and is out of the game. The predators must collect 20 pieces of food from the herbivore food bags to be alive at the end of the game. They must stop eating when they have passed the 20 item mark. If they do not get 20 pieces before time is called, they have died of starvation.

The remaining students are the TOP CARNIVORES. They get the third color of cloth and a plastic bag. They feed by tagging either the herbivores or the carnivores who must give up their bags and sit down when tagged as they have been "eaten." The top carnivores need 40 pieces of food to be alive at the end of the game. They should stop eating when they have passed 40 food items.

Caution the students about rowdy behavior and running into each other. Making them keep one foot dragging on the ground at all times should help slow them down. Give them several minutes following the above rules and then stop them.

RESULTS:

It is time to sit down and analyze what has happened. Use the board and data sheet to record what happened. Do the students think this model worked like a real pond food chain? What was the cause of death in most cases for the herbivores? For the carnivores? Were the proportions the same at the end as the beginning? What levels of the food web do they think should have the most animals?

The original proportions are intentionally wrong. They were chosen because they do not work. The students should be able to see the lack of balance. The top carnivores are going to eat all their prey. With none left to reproduce, the top carnivores will starve to death. The numbers at each level should be more like a pyramid. If all the herbivores get eaten, they will not leave

any offspring, and the rest of the levels will starve to death in the future.

Let your students discuss these questions. Then let them pick one thing to change about the original rules, other than changing the amount of phytoplankton. Continue to scatter 20 pieces for each herbivore. Run the game (the experiment) again from the beginning. Would it be a "fair test" if they changed more than one thing at a time? No. In order to compare the first with the second experiment there can be only one difference (variable). Otherwise they cannot tell which difference caused the different result. Here are some changes that they might make:

1. Change the number of herbivores or top carnivores. If the proportions are changed by deleting some students, you can keep within the rules of changing only one thing at a time. If you delete some in one run, they can be added in the next run. For example, most of the top carnivores can be removed. After seeing what the result is, they might be added as herbivores in a subsequent test.

2. Give the herbivores some places where they can hide or are safe from the carnivores. Draw a safe zone with string or rope or use something like a hula hoop. They can run out to grab a bite to eat and then hide. But remember, they have to get 10 pieces of food or they die of starvation. An example might be the burrows in which crayfish hide.

3. The carnivores may also be given a refuge in which they are safe from the top carnivores. Have the students give you some guesses as to how frogs or small fish might hide from predators. Both might be able to hide in vegetation. The food might be in the open while tagging a tree or pole is "safe." Another possibility which protects the herbivores is that some feed when the predators are not active such as at night. Have 30 second safe times periodically when the top carnivores rest and stop eating. In actual fact, many predators catch their prey at dawn and dusk.

Have the students discuss the strategies they used to catch prey while not being caught. The smart top carnivore will let his prey alone until they have eaten enough to be of value when caught.

CONCLUSIONS:

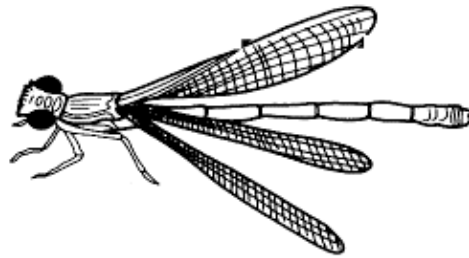
In order for the food web or chain to be realistic, the students must have some individuals from each level alive at the end of the model. These animals will be the ones that reproduce, making the next generation. Make adjustments until this happens. It requires very few top carnivores (perhaps one), a few carnivores and lots of herbivores. This exercise illustrates that there are fewer animals in each succeeding level of the food chain. It also introduces the concepts of predator-prey interactions and the strategies that predators and prey use in feeding and hiding from predators.

USING YOUR CLASSROOM AQUARIUM:

Have your students identify the feeding level of each of the different kinds of animals in your classroom aquarium. Is your aquarium a balanced ecosystem with regard to predator-prey relationships? If you have more predators than prey, what do you do to enable the predators to survive? You feed them food produced outside the tank. What changes would have to be made to create a balance in your aquarium?

EXTENSIONS:

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1. Have the students write several paragraphs about how it made them feel to be "eaten" or to not get enough to eat and to "starve." Most wild animals must face these problems routinely.
 2. If your school has computer software that includes food chain simulations, set one up so that the students may experiment with it. Have them compare their model used in class with that of the computer. Identify which animals were producers, consumers, etc. Did the computer model give similar results?
 3. Have students do an analysis of common domestic farm animals with regard to their place in the food chain. It becomes apparent rapidly is that most of the major animals we depend on for meat, milk or eggs feed low on the food chain. Why? Each animal uses food to produce heat and movement as well as for growth. Energy spent on heat, movement, digestion and chemical work inside its body is lost. Only energy which is used for growth is available to the next level of the food chain. Less food would be available if we fed on carnivores rather than herbivores. Examples: cows, sheep, horses, rabbits, geese, and goats eat plant material; chickens and pigs are feed primarily plant material, although they may also get fish meal or other animal products. The two carnivores that are common on farms are kept for behaviors that relate to their feeding habitats. Cats kill rodents that would steal grain from the farmer. Dogs hunt by chasing things, making them natural at herding cows or sheep. They also bark at the sign of intruders.
 4. Have the students analyze their own diets to see where they feed on the food chain. Western diets are much higher in animal protein than those of many underdeveloped countries where people cannot afford to waste the food energy that would be lost from grain by feeding it to animals and then eating the animals. Research the diets of other countries and compare how much plant food versus animal food is eaten.
 5. Have a food tasting session to sample nutritious foods that are all plant material. Since plants do not have the complete protein that animal products do, combinations of plants are needed to provide balance. A good vegetarian cookbook from the library will explain how to plan a vegetarian diet for good nutrition.
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DATA SHEET FOR ACTIVITIES 29 AND 30

First run

feeding level	no. live at beginning	no. eaten	no. that starved	no. alive at end
herbivores	12	12	-	0
carnivores	6	-	2	4
top carnivores	2	2	-	0

results _____

Second run

feeding level	no. live at beginning	no. eaten	no. that starved	no. alive at end
herbivores				
carnivores				
top carnivores				

results _____

Third run

feeding level	no. live at beginning	no. eaten	no. that starved	no. alive at end
herbivores				
carnivores				
top carnivores				

results _____

