

Who Can Harvest a Walleye?

The Great Lakes are an example of a natural community. In this community the small organisms (living things) outnumber the large organisms. The smaller organisms may be eaten by the larger ones. If we count all the organisms of one kind, then count all the things they eat and all the things that eat them, we can draw a pyramid of numbers that will also show who eats what.

In the "Walleye Game" there are four levels to the pyramid. The largest level is that of algae, the tiny water plants that produce food by photosynthesis. The other levels are all consumers that cannot make their own food. Gizzard shad are small fish that eat algae. Because they are plant eaters, scientists call them herbivores. The walleye is a larger fish. There are fewer walleyes than gizzard shad, so the walleye level is smaller. Walleyes eat herbivores, so scientists say that walleyes are first-order carnivores. The organism that eats the first-order carnivore (a person, in this game) is called a second-order carnivore.

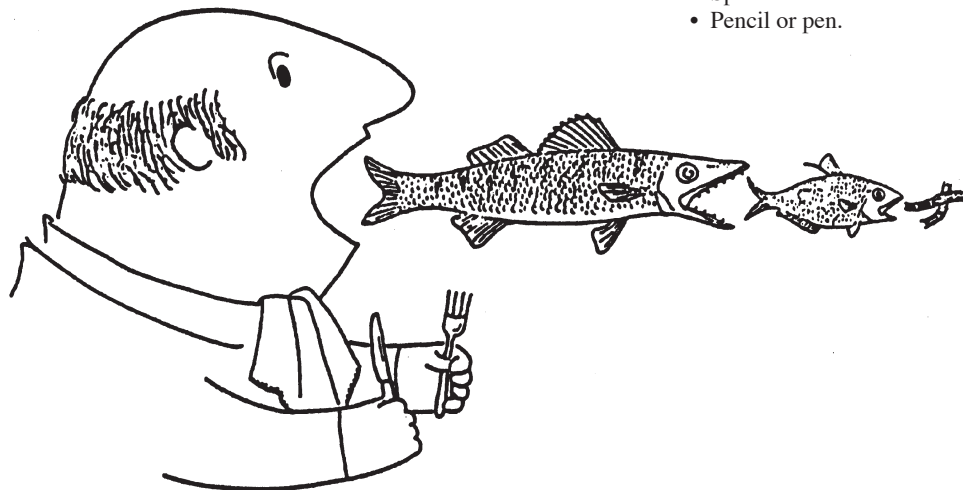
OBJECTIVES

When you have completed this investigation you should be able to:

- Apply the meaning of the following terms as they relate to a biomass pyramid: producer, herbivore, first-order carnivore, second-order carnivore.
- Calculate the relative number of kilograms at each level of the biomass pyramid in a given environment.
- Analyze how different conditions in the environment affect the pyramid.

PROCEDURE

This game shows how factors affecting lower parts of the food chain can affect higher levels as well. The pyramid in this game is a biomass type because it is based on the weight of the organisms in kilograms.



Source

OEAGLS EP-11, *To Harvest a Walleye*, Activity A, by Susan Leach, Gabriele Reil and Rosanne W. Fortner.

Earth Systems Understandings

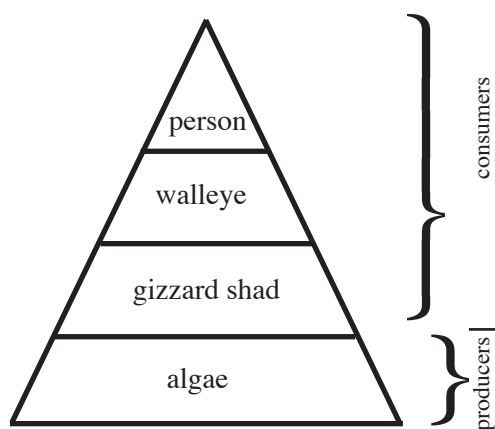
This activity focuses on ESU 4, interactions within Earth systems, and ESU 2, effects of human activities. ESU 6 is involved as the sun is the source of energy for algae to photosynthesize.

Materials

- Walleye Game Board.
- Productivity Cards.
- Biomass Record.
- Markers (buttons).
- Spinner.
- Pencil or pen.

The object of this game is to end at the block labeled "Harvest" with at least one kilogram of fish. You will keep track of kilograms (kg) of organisms on the "Biomass Record." The game is best played by 2-4 individuals.

1. Before playing the game, read through the game board and Productivity Cards to pick out any words that are new to you. Look up the words in the Glossary.
2. Begin at START with 1,000 kg of algae. Record this amount in the "Producers" column of the Biomass record. Spin the spinner to see who moves first. The player with the highest number will move first. Play then goes around the board to the left.
3. Move through each level of the pyramid by moving your marker the number of spaces shown on the spinner. Change your number of kilograms as the board directs. Record the new number of kg on your Biomass Record each time the mass changes.



4. Some sections of the board require you to divide the mass of the organisms by some number. Drop any fractions that you get in your answers.
5. At the end of each level, it is assumed that all organisms are captured by organisms of the next level. You must change columns on the Biomass Record and divide by 10 whenever you pass the algae or fish pictures, even if you don't land on them. (Scientists know that on the average, only 10% of the energy available at one level of a food chain is passed on to the next level.)
6. If at any time you have less than 1 kg left, you must return to block 1 and begin again.
7. The winner of the game is the first player to land at the triangle labeled "Harvest" with at least 1 kg of walleye. You must spin the exact number to land on "Harvest."
8. At the end of the game compare results on your Biomass Record with those of the other players. Compare the kg of biomass that you had at the beginning of each level of the pyramid.
9. List on your worksheet some of the things that happened to your organisms and how they affected your populations as you progressed through the game.

REVIEW QUESTIONS

1. Give an example of the kinds of organisms represented in a food pyramid. What kinds of organisms are on the bottom? Why?
2. Which levels of a pyramid have the least energy available? Why?

See Also

Glossary of the Great Lakes – <http://www.seagrant.umn.edu/pubs/ggl/> to learn about specific terms, organizations, and issues.

GLOSSARY

1. algae bloom: Situation in which algae have multiplied very rapidly.
2. breeding ground: Place where organisms reproduce.
3. carnivore: Animal that eats animals.
4. entrain: To suck fish up into water intake valves from industry. (Such fish are killed by temperature and pressure changes and physical abrasion.)
5. eutrophication: The natural aging process of a lake during which the lake becomes shallower and shallower and warmer and warmer, finally becoming a marshland, and then dry land.
6. food chain: Sequence in that organisms eat and are eaten by other organisms.
7. herbicide: A chemical that kills plants.
8. herbivore: Animal that eats plants.
9. impinge: To suck fish up against industrial intake sieves and hold them there, causing suffocation.
10. landfill: Portion of lake that is diked and filled with gravel, soil, garbage etc., to make more land area.
11. nutrients: Chemicals needed by plants and animals – fertilizers (potassium, phosphorus, nitrogen).
12. organism: Any living thing.
13. producer: Plant that performs photosynthesis and forms the base of the food chain.
14. thermal pollution: Hot water.

BIOMASS RECORD SHEET

	PRODUCERS (ALGAE)	HERBIVORES (GIZZARD SHAD)	FIRST ORDER CARNIVORES (WALLEYE)	SECOND ORDER CARNIVORE (PERSON)
PLAYER 1				
PLAYER 2				
PLAYER 3				
PLAYER 4				

REFERENCES

Almost all biology and ecology texts will have some reference to food chains, pyramids, and webs. The texts below may be useful.

Miller, G. Tyler, Jr., *Living in the Environment: principles, connections, and solutions*. 8th Ed. Wadsworth Pub. Co., Belmont, CA, 1994. 701 p., ill.

Ohio Department of Natural Resources, Division of Wildlife, Publication 185, "Gizzard Shad in Ohio," Life History Notes.

Ohio Department of Natural Resources, Division of Wildlife, Publication 141, "Walleye and Blue Pike in Ohio," Life History Notes.

Reel in a Walleye "online!"

The Internet is also a source of information about fish species. Find out more about walleye by using the address <http://www.seagrant.wisc.edu/greatlakesfish/walleye.html>. Web addresses sometimes change. Do a word search using "walleye" and fish related topics if necessary.

GAME PIECES

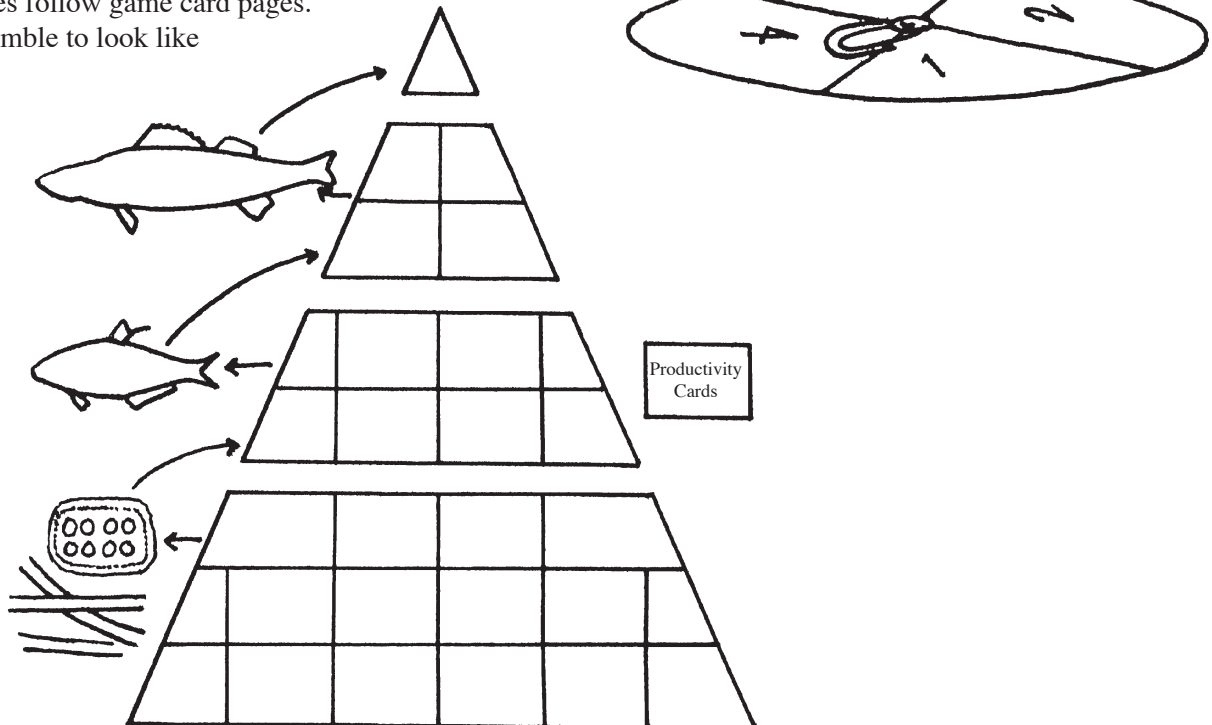
Spinner (one per game)

paper clip and paper fastener attached to cardboard circle, or to a plastic lid marked as shown.

Game Board

Pieces follow game card pages.

Assemble to look like



Productivity Cards (one set per game)

Copy the following two pages on heavy paper. Cut apart and turn upside down on game boards.

Eutrophication speeds up in the shallow parts of lake. Lack of oxygen kills all but 100 kg.

Pollution from a coastal river enters the lake. Lose 100 kg organisms.

ORGANISMS DOUBLE!

Tanker grounds on shoal dumping sulfuric acid. Lose 100 kg.

Oil spill. Lose all organisms. Go back to block 1: begin with 1,000 kg algae.

Sewage treatment plant opens with better cleaning equipment. Lower nutrient levels result because there is less sewage pollution. Lose 50 kg.

An illegal landfill is built near the lake, and wastes seep out into shore areas. Breeding grounds are destroyed. Lose all organisms. Go back to block 1 and begin with 1,000 kg algae.

Grass carp (herbivorous fish from another food chain) are introduced into the lake. They eat 1/2 your algae.

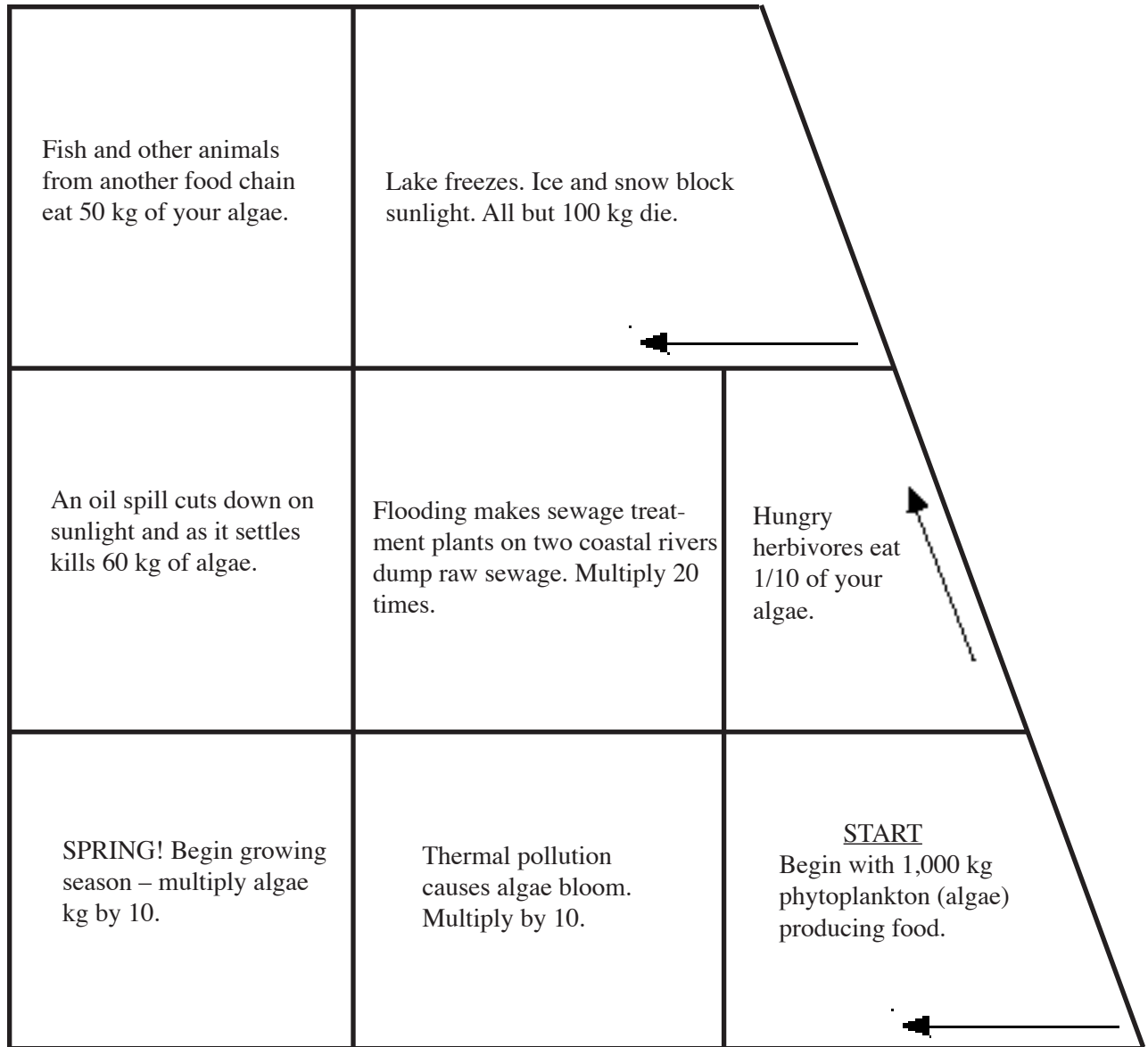
Save this card until you need it. Coast Guard saves the day and cleans up the oil spill. You lose only 1/2 your algae.

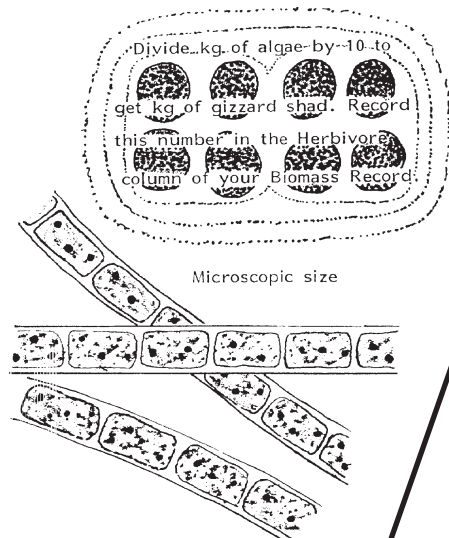
Algae that died in another bloom start to decay and release nutrients into the water. Add 50 kg.

U.S. Army Corps of Engineers stops dumping dredge spoils into the lake. Add 50 kg.

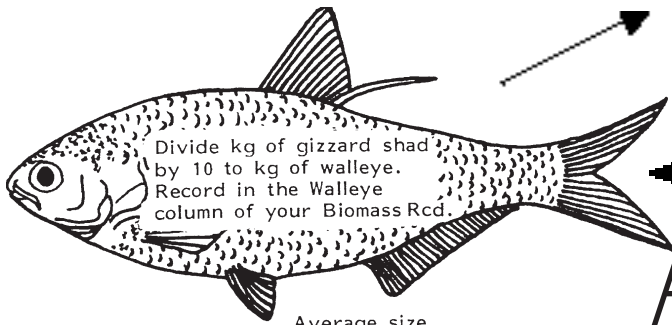
A power plant dumps hot water killing all except blue-green algae. Lose 200 kg.

Walleye game board. Copy onto heavy paper and assemble.





<p>Chemical pollution reduces population by 50 kg.</p>		<p>Draw a productivity card.</p>
<p>Silt from spring floods blocks sunlight. 1/2 algae die.</p>	<p>Microscopic animals eat 1/2 your algae.</p>	<p>A new phosphate detergent makes billowy suds on the lake. Algae bloom but only 1/10 survive due to oxygen lack.</p>
<p>Fertilizer runoff from fields increases algae nutrients. Multiply 20 times.</p>	<p>Draw a productivity card.</p>	<p>Algae bloom uses up oxygen and nutrients. Lose 1/2 your algae.</p>



Average size
30-38 cm.

