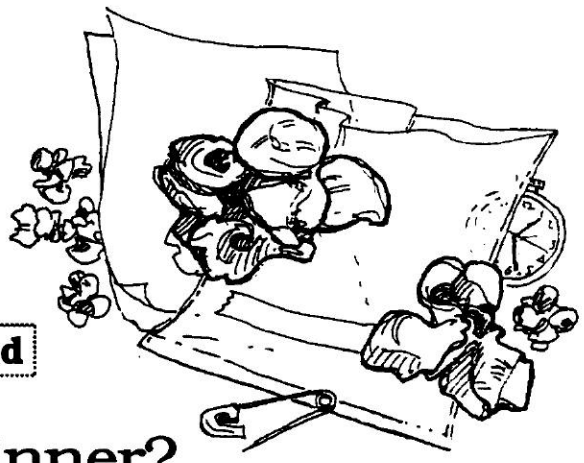
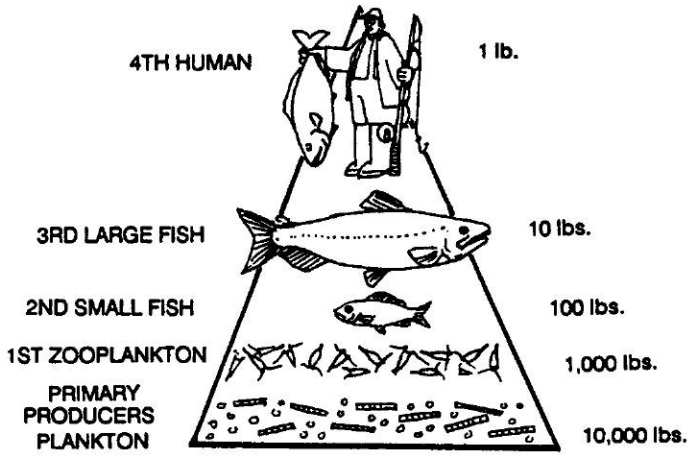


Teacher Background

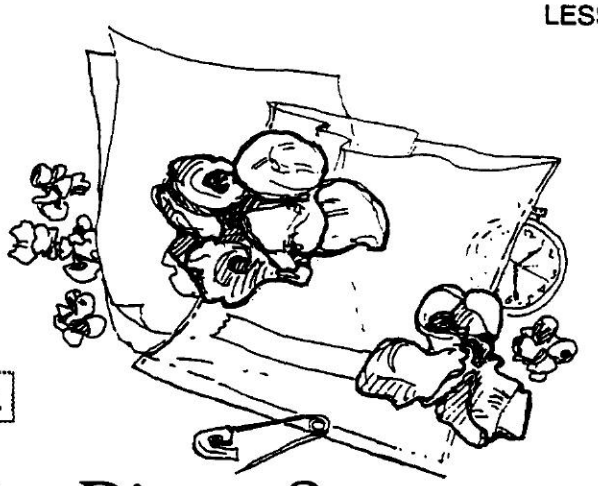
Who's For Dinner?

A widely accepted theory from the field of ecology holds that an organism at one trophic level is maintained by eating approximatley 10 times its own weight in food from the next lower trophic level. In our food chain, this means that it takes 10 times as much salmon (by weight) to sustain a heron, and likewise, 100 times the heron's weight in copepods are needed to maintain the salmon which the heron eats. This concept is often expressed as a pyramid, with horizontal layers representing producers and the various levels of consumers.



WHO'S FOR DINNER, will involve your students in a role playing game that graphically illustrates this principle. By playing this game, they will discover that the number of organisms in each tropic level helps determine whether the food chain as a whole can survive.

In WHO'S FOR DINNER? your students will play the roles of copepods, salmon, and herons. The first link in the food chain will be detritus, represented in the game by popcorn, spread over an outdoor game area. The student copepods "eat" the detritus, by placing it in plastic bag "stomachs", the student salmon "eat" the copepods, and the heron, in turn, "eat" the salmon. The object of the game is for each animal to get something to eat without being eaten during the timed course of the game. Students will quickly discover they need to manuipulate the size of each population or some animals will become extinct.



Lesson Plan

Who's For Dinner?

Student Objectives:

- Students will explore the concept of a food chain by playing an active role playing game which simulates an estuary food chain for salmon smolts.
- Students will discover that there is an important balance between food and prey organisms which must be maintained or the system breaks down.

Space:

WHO'S FOR DINNER? is best played outdoors on a grassy area about 15 meters square; however, a gymnasium or parking lot will also work.

Materials:

- 4-5 liters of popped corn
- One per student, ANIMAL STOMACHS

  (plastic sandwich bags, each marked with a strip of masking tape 4 cm from bottom of bag)
- 3 stacks of colored paper

  including approximately: 30 sheets yellow, 20 sheets green, 20 sheets blue
- Two safety pins per student
- watch with a second hand
- clipboard and paper
- marking pen
- One copy per student, WHO'S FOR DINNER?
- Loud whistle for starting and stopping the game

Procedure

1. Hand out plastic bag "stomachs" to all your students, and divide your class into thirds. One group will play the part of copepods, one will represent salmon, and one will be heron. Pin a sheet of yellow paper to the front and back of each copepod. Use pink paper to label salmon and blue paper for heron.

   The fact that you have a surplus of colored paper will allow you to change the population numbers as the game progresses.

2. Spread 3/4 of the popcorn over the playing area.

3. When the game starts, copepods will "eat" detritus by picking up popcorn and putting it in their "stomachs." Salmon will "eat" copepods by lightly tagging copepods, whereupon, the contents of the copepods' stomachs are transferred to the stomachs of salmon. When a heron captures a salmon, he or she takes the salmon's whole stomach. Note that herons do not eat copepods and salmon do not eat detritus. Tagged students go to the sidelines and wait for the end of the round.

4. Blow the whistle and say "Go!" You may want to stop the first game after only a minute or so, since one of two things usually happens immediately. Either all the copepods are tagged before they have a chance to forage, or all the salmon are eaten immediately, allowing the copepods to continue gathering popcorn freely and "get fat."

5. Analyze how many animals actually survived. For a copepod to survive, popcorn must fill the stomach bag to the bottom of the tape (4 cm). For the salmon or heron to survive, popcorn must fill the bag to the top of the tape (6 1/2 cm). Chart the survival numbers for each animal on your clipboard. If at least one of each kind of animal survives, you have an on-going food chain. Return the popcorn to the playing area after each round of the game.

6. Now ask your students for suggestions on how to change the game so that after a 5-minute round, a better balance between the remaining animals results. Experiment with rule variations which might accomplish this. Here are some changes your students may suggest:

   - Change the number of copepods, salmon or heron.
   - Let the copepods come back as another copepod once after being captured and giving up their popcorn.
   - Provide a "safety zone" for copepods and/or salmon where they can be safe. This could represent the shelter of an eelgrass bed.
   - Timed releases: let the copepods go first and forage unmolested. One minute later release the salmon, and later the herons,
   - Spread out more popcorn.

   Change only one rule at a time. Before actually testing it, have your students predict with a show of hands what they think will be the outcome of each rule change. Afterwards, tabulate the survival numbers of each animal again.

7. Back in the classroom, have the students answer the questions in the student text, WHO'S FOR DINNER? After they have finished, use these questions as the basis for a discussion.

   Other possible questions for discussion:

   - Which variation provided the most realistic conditions? *(answers may vary)*
   - Would (or did) shelter make a difference to the survival of copepods? salmon? *(probably it would)*
   - Are there any plants or animals which are not part of any food chains? *(No)*

Answer Key:

1. There is no single correct answer to this question, but hopefully students have discovered that the size of the predator population must be significantly smaller than the population it feeds upon. In other words, the copepod population needs to be larger than the salmon population, which must be larger than the heron population for a balance to exist.

2. If less detritus is present, more copepods would starve, therefore more salmon and herons would probably starve as well.

3. If no salmon were present, the copepod population would grow dramatically, so long as food is available. If detritus became scarce, some copepods would starve.

4. If no salmon were present, the entire heron population would starve.

5. Yes. The food chain in this game, and in an actual estuary depends upon detritus. Sea grasses and large algae are the largest source of detritus in an estuary. Students may also mention the important role of plants in providing shelter for salmon in an estuary.

6. Answers may vary. A vegetarian will have a very simple food chain, while a person who eats seafood, such as salmon may have a relatively long one. Here are some examples:

Sun → Corn → Human

Sun → Grass → Beef → Human

Sun → Eelgrass (as detritus) → Copepod → Salmon smolt → Ling cod → Human

Who's For Dinner?

After playing the game "Who's for Dinner?" think carefully about each of the following questions, then write the answers below:

1. Assume that the goal of the game is to keep all three animal species from going extinct. From your experience playing the game, how would you balance the players? How many players should play the parts of copepods, salmon and heron? *(Remember -- a species must have survivors after each round to keep from going extinct.)* Use the number of students in your class as the total number of players.

Copepods _____
Salmon _____
Herons _____
Total _____

2. What would happen if only half as much detritus were present?

3. Suppose that one year no salmon were present. What would happen to the copepod population?

4. What would happen to the heron population that year?

5. Do salmon in an estuary need plants to survive? Explain your answer.

6. Make a diagram of one food chain you are part of. Begin your food chain with the sun, and end the food chain with you.