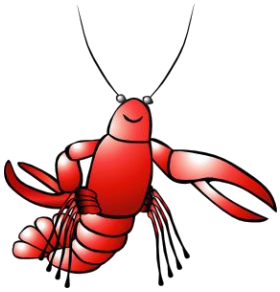
Food Web Crasher



An introduction to food chains and food webs

Activity

Students create a physical food web and watch what happens when an aquatic nuisance species is introduced into the ecosystem.

Grade level: 6-8
Subjects: Ecology, Science
Setting: Classroom or outdoors
Duration: 1 class period
Key Terms: carnivore, consumers, decomposer, food chain, food web, herbivore, omnivore, primary consumer, producers, secondary producer, tertiary consumer, trophic level

Objectives

- Students will become familiar with the different trophic levels that make up a food chain.
- Students will review the different types of consumers in a food chain.
- Students will describe how invasive species may impact a food web.

Materials

- Large ball of yarn or string
- Food Web organism necklaces (30)
- Masking tape (indoors) or sidewalk chalk (outdoors)
- Scissors

Background

All living organisms depend on one another for food. A **food chain** is a simplified way to show how each living thing gets its food. In a food chain, each species occupies a certain position, or **trophic level**, in the chain based on what they eat and where they get their energy. At the very bottom of a food chain are **producers** – or plants. Producers use the suns energy to make the food that supports the other species in the chain. In the Columbia River, producers can be microscopic phytoplankton, algae or aquatic plants like cat-tail and duckweed. **Consumers** make up the next trophic level in a food chain. Consumers are unable to make their own food, so they survive by eating other organisms to obtain the energy they need to live and grow. A typical food chain usually has several consumers, each of which occupies a different trophic level.

Primary consumers are **herbivores** – meaning they eat plants. In the Columbia River primary consumers may include zooplankton, snails, freshwater mussels, and tadpoles.

Secondary consumers may be **carnivores** (meat eaters) or **omnivores** (eat plants and animals). Secondary consumers feed upon primary consumers. In an aquatic environment secondary consumers may include frogs, crayfish, and many fish species.

Tertiary consumers are carnivores that eat other carnivores. Tertiary consumers living in an aquatic environment might include fish species such as cutthroat trout, black bear, river otter, great blue heron, and even humans.

At the final trophic level are the **decomposers**. When plants and animals die, they become food for decomposers like bacteria, fungi and earthworms. Decomposers break this organic material down, releasing the nutrients back into the ecosystem.

In a food chain, energy is passed from one trophic level to another. Each organism passes on only about 10% of the energy that it has received to the next trophic level. The rest is used up in carrying out its life processes (e.g., movement, digestion, reproduction). The amount of available energy decreases at every trophic level, so each level supports fewer individuals than the one before. This is why most food chains have no more than five or six levels. There cannot be too many levels in a single food chain because the animals at the end of the chain would not get enough food/energy to stay alive. Most animals are part of more than one food chain and eat more than one kind of food in order to meet their food and energy requirements. These interconnected food chains form what is called a **food web**.

When an invasive species is introduced into an ecosystem, they compete with native species for important food resources (potentially reducing a common food resource), or they may prey directly on a species that is food for another organism. Changes in one part of a food chain may affect multiple trophic levels as well as the larger food web. For example, New Zealand mudsnail, a tiny invasive freshwater snail, are primary consumers that feed on plant and animal detritus as well as algae - the same food that native aquatic insects and other invertebrates eat. Large populations of New Zealand mudsnail can significantly reduce this important food resource, leaving very little for native snails and aquatic insects to feed on. This may lead to reductions in aquatic insect populations, which may in turn impact native fish species. As fish populations decline, the food chains of other organisms such as river otter or great blue heron may also be affected.

Preparation

- For an introduction of food chains and food webs, check out the following links: http://projects.cbe.ab.ca/chinookpark/curriculum_links/Grade_Pages/grade6/Gr_6_Units/science/foodchains/food_chain.html and http://www.luresext.edu/aquaculture/Aquatic%20ecologyweb.pdf

- Create a basic food chain as a class. Discuss the different roles and trophic levels of the food chain. Discuss what might happen to the food chain if one of the levels experiences a significant increase or decrease in its population.
- Next, create a food web. Again, discuss what happens to the food web when one of the levels experiences a change in population.
- Finally, discuss how an aquatic nuisance species could affect a food chain or food web.

Directions

- Tape five strips of masking tape on the floor in parallel lines, around 5 feet long and 2-3 feet apart. Label the first strip as 1, the second as 2, and so on up to 5. Use sidewalk chalk if you are doing this lesson outside.
- Explain to students that the class is going to create a physical food web to give them an idea of the complicated relationships between all of the living things in an ecosystem. Pass out a food web organism necklace to each student (make sure all trophic levels are represented) and instruct them to look at the card for their trophic level number. Have each student place their card around their neck and sit on the strip of masking tape or numbered chalk line that matches their trophic level number.
- Tell students that they will get the yarn/string ball one or more times during this activity. When they receive it they should lightly loop it around a finger (i.e. keep a hold of it) and pass it on as instructed.
- Give the ball of yarn/string to one "organism" sitting on trophic level 1 (tape strip 1) and have them stand up on the line. Explain that the ball of yarn/string represents the movement of nutrients and energy through a food chain. Have the student pass the ball to a student in trophic level 2 whose organism may prey on or eat their own organism for food. Have the student in trophic level 2 stand as well. Continue to pass the ball up the trophic levels of the food chain, having students stand as they join the food web.
- When the ball of yarn gets to trophic level 4 and is in the hands of the "top predator", explain that the energy and matter from that organism has to move to another level. When an organism dies, it is broken down and consumed by decomposers and the energy is released back into the ecosystem.
- Pass the ball to one of the decomposers in trophic level 5, and finally, pass it back to the bottom of the food chain to a new organism in trophic level 1. Remind everyone to hold on to their string!
- Continue creating new food chains until all of the students are standing, and the food web is relatively complex.
- Now it's time for an invasive species to crash the party. The red swamp crayfish is an aquatic nuisance species that competes with native Columbia River signal crayfish for food and habitat (see Fact Sheet). Red swamp crayfish are omnivorous, feeding on aquatic plants, snails, aquatic insects, juvenile fish and small amphibians.

- Ask the students to hold their yarn up in the air over their heads so they can see the complicated pattern of the web. Using a pair of scissors, the teacher will cut through the links between the native crayfish and the things it eats to represent the impact of the red swamp crayfish (i.e., the native crayfish is not getting any food). The cut strands of yarn should be dropped and the students no longer connected to the web (including the native crayfish) should sit back down.
- Have the students watch as the food web falls apart because the native crayfish are starving and dying, affecting the organisms at the trophic levels above and beneath them. In this way, the students see how an invasive species can disrupt the ecosystem and all the organisms in it.

Evaluation

- After completing the exercise, discuss the following questions as a class:
  - Why did the native crayfish population decline?
  - How did the decline of the native crayfish impact the food web? Give specific examples.
  - What do you think will happen to the trophic levels directly above and below the native crayfish? Will their populations increase, decrease, or stay the same?
  - Do you think the food web will recover from the loss of the native crayfish?
  - How might the introduction of an invasive **Producer** impact a food web?

- Have students draw a basic aquatic food chain, labeling the organisms and their trophic levels. Next, have students select an aquatic nuisance species such as New Zealand mudsnail, bullfrog, red-eared slider, mitten crab, hydrilla, didymo, or grass carp, and write a short descriptive paragraph about how this invasive species would disrupt their food chain.

Extensions

- Have students write a short essay or paragraph that explores the impacts humans may have on food webs (if any).

Source

This activity is an adaption of the Food Web Invaders, activity developed by the Oregon Sea Grant for the "Aquatic Invasions! A Menace to the West" teaching curriculum. Contact: Tania Siemens, AIS and Watershed Health Research Assistant, tania.siemens@oregonstate.edu

Washington State Science & Environmental Science Standards:

6-8 LS2B – Energy flows through an ecosystem from producers (plants) to consumers to decomposers. These relationships can be shown for specific populations in a food web.

6-8 LS2C – The major source of energy for ecosystems on Earth's surface is sunlight. Producers transform the energy of sunlight into the chemical energy of food through photosynthesis. This food energy is used by plants, and all the other organisms to carry on life processes. Nearly all organisms on the surface of Earth depend on this energy source.

ESE Standard 2; The Natural and Built Environment – Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.