

POLAR FEASTS!

(Thanks to Claudia V. Garcia, Anne Giangiulio, Vanessa Lougheed, Bill Robertson, Craig Tweedie, United States)



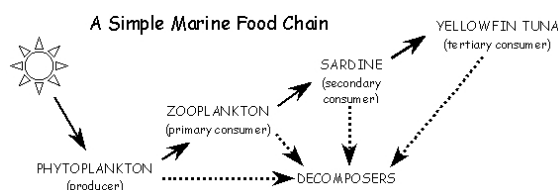
Lesson at a glance



Students discover how different organisms that live in the polar regions depend on each other and what might happen to the food web if one or more organisms start disappearing from it.

Background

All animals must eat other organisms to obtain energy for processes such as cell growth and reproduction, movement, and respiration. This can be represented by a simple **food chain** with arrows connecting the organisms. The arrows show the direction of energy transfer, starting from the sun, then going from one living thing to another.



Primary producers are at the bottom of the food chain. They use energy from the sun, water and carbon dioxide to make food. Most primary producers on land are plants; most primary producers in the ocean are algae, also known as phytoplankton.

Herbivores (primary consumers) are animals that get their energy from eating primary producers.

Carnivores (secondary consumers) get their energy from eating mainly meat from other animals.

Top predators (tertiary consumers) are carnivores at the top of the food chain. Generally, when they are adults, no other animals eat them.

Decomposers such as bacteria and fungi are also an important part of all ecosystems. When an organism that is not eaten by something else dies, its body is broken down by decomposers and nutrients such as carbon, nitrogen, and other elements are recycled in the ecosystem.

Most animals do not eat just one thing, nor are they eaten by only one thing. This results in a **food web** – a complex feeding relationship among organisms that interconnects all organisms in a community. By understanding how a food web is organised, it is easier to make sense of which organisms have stronger interactions within the community.

Time

Preparation: 20 minutes to photocopy and cut out animal cards

Class time: 50-60 minutes

Materials

(per group of 3-4 students)

- Antarctic or Arctic animal cards (included at end of activity)
- small poster board (~30 cm x 50 cm) or space on a whiteboard or chalkboard
- tape
- markers or chalk, depending on board type

Activity Directions

1. Review the concepts of food chains and food webs with the students.

2. Divide them into groups and give each group a set of organism cards. (If you want to compare the two polar regions; give some groups Antarctic and others Arctic cards.)
3. Tell them build a food web, using the information on the cards. They should start with producers and work up to the top consumer. Remind them to study the relationship between each organism carefully.
4. When they are satisfied with the placement of the organisms, they should secure their food web onto the poster board with tape and draw the arrows showing the direction of energy flow.
5. Let them play a food web game with another team to see how well they understand the feeding relationships of the community. Give the following instructions:
 - a. The purpose of the game is to crash your opponents' food web by removing as many cards as possible from their food web in three turns.
 - b. In this game, you cannot eliminate the primary producer – only consumers.
 - c. Start the game by removing an organism from your opponents' food web. Your group will keep the card and discuss what happened to the food web when you eliminated that organism. If there are any animals that feed only on the organism you took out (have no other food source), you may take those cards too.
 - d. Then the other team gets a turn to remove a card from your food web.
 - e. The winning team is the one who gets the most cards from their opponents in three turns.

Discussion

1. Which organism depicted in this food web is a primary producer? Where do producers obtain their energy? (*Algae are the primary producers in this food web and they obtain their energy from the sun by the process of photosynthesis.*)
2. Which organisms in this food web are primary consumers? Which one is the top consumer and why? (*Krill is a primary consumer in the both the Antarctic and Arctic food webs since it feeds on the primary producer, algae. The top consumers in the Antarctic web are the Killer whale and Leopard seals. The top consumer in the Arctic web is the polar bear. These animals are meat eaters or carnivores; they are considered top consumers because they have no natural predators other than humans.*)
3. How do you think tiny krill provide enough energy to sustain whales? (*They are present in huge numbers. A swarm of krill can weigh more than a ton!*)
4. Describe what would happen if krill were to vanish from the ecosystem. (*Krill is a key prey species for many animals like whales, penguins and crabeater seals. Other animals depend indirectly on them. For example, seals and penguins feed on fish that feed on krill. Without krill the population of many organisms would rapidly decline.*)
5. Which organisms have the most selective diets? Can this be an advantage or disadvantage? (*The Antarctic organisms with the most selective diets are the Crabeater Seals and fish; both feed mainly on krill. This can be a disadvantage because they only feed on one organism and will be affected if it declines in numbers.*)

Extensions/Adaptations

1. Have students write journal entries describing how the food web works (using pictures and/or words) and explaining which organisms are the most important based on the results of the game. Have them label the producers and primary, secondary, and tertiary consumers.
2. Children in lower levels can use the game board provided at <http://ipyroam.utep.edu/education/polar-resource-book> to learn about food chains.
3. Students can write up ideas of how humans fit in the web of life.
4. Have students research other organisms that live in the Arctic or Antarctic and add them in the appropriate places to their food webs.

Links

<http://ipyroam.utep.edu/education/polar-resource-book>

Antarctic food web cards

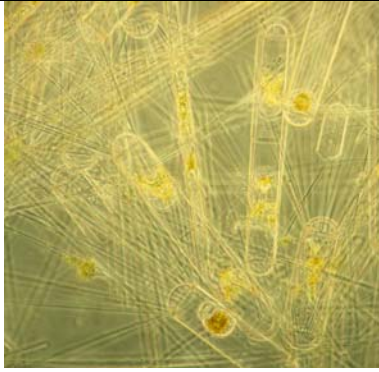


Photo by Patti Virtue

Algae convert solar energy into chemical energy.

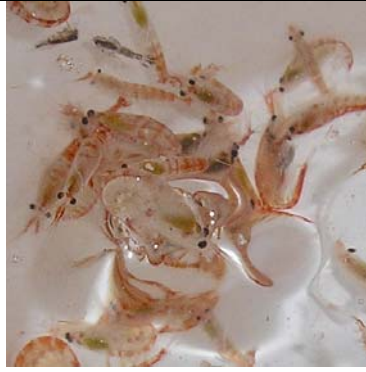


Photo by Simon Marsland

Krill feed on microscopic algae.



Photo by Adrian Boyle

Leopard seals eat a wide variety of prey: krill, fish, penguins and young crabeater seals.



Photo: Sandra Zicus

There are 8 species of **penguins** in or near Antarctica. Most penguins feed on krill and fish.



Photo: Michelle Philips (IPY-ROAM)

Humpback whales feed on krill and small fish.



Photo: NOAA

Orcas (Killer whales) feed on penguins, fish, and some seals (e.g. crabeater seals). They may feed on other species of whales, including young humpbacks.



Photo: Paul Thomson

Many species of **fish** in Antarctica feed on krill.



Photo: IPY-ROAM

Crabeater seals feed on krill (not crabs!).



Photo: Adrian Boyle

Antarctic petrels eat krill, squid and small fish.

Arctic food web cards

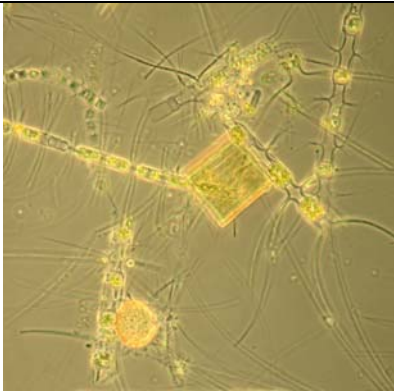


Photo: Patti Virtue

Algae convert solar energy into chemical energy.



Photo: NOAA

Copepods and other invertebrates (animals without a backbone) feed on microscopic algae.



Photo: Sandra Zicus

Polar bears prefer to eat ringed and bearded seals, but will also eat arctic fox, walrus and beluga whales



Photo: Danish Polar Center

Arctic fox eat ringed seal pups.



Photo: NOAA

Arctic cod eat krill and other aquatic invertebrates.



Photo: Sandra Zicus

Ringed seal eat arctic cod, as well as other fish.



Photo: Sandra Zicus

Walrus eat bottom-dwelling organisms such as clams.



Photo: NOAA

Beluga whales eat primarily fish, such as the arctic cod.



Photo: Fisheries and Oceans Canada

Clams eat algae.