

## Details



**Completion Time:** About a week

**Permission:** Download, Share, and Remix

## At the Top: Trophic Leves to Food Chains

### Overview

PolarTREC teacher Andrea Skloss' lesson was inspired by her Chukchi Sea Ecosystem Study aboard the USCGC Healy. In order to understand why this area is a biological hot spot of productivity, scientists must study components such as the trophic levels and more.

### Objectives

In organisms and environments, the student knows that interdependence occurs among living systems and the environment and that human activities can affect these systems.

### Lesson Preparation

The lesson is designed in a 5E format. The following vocabulary will be discussed: producer, consumer, trophic levels, food web, food chain, predator, prey, herbivore, carnivore, omnivore, energy pyramid, ecosystem, epibenthic, anthropogenic, bioaccumulation, and biomagnifications.

### Procedure

**Engage:** What is a predator? (An organism that hunts and eats another) Is a snail a predator? (Yes) Name some predatory snails in the Gulf of Mexico. (Olive snail, Welks, Oyster drills, and etc.) In the Chukchi Sea a predatory snail called the Neptunia is at the top of the trophic level in the epibenthic realm.

### *Explore/Explain: Food Chains, Food Webs, and Energy Pyramids*

There are several ways to introduce or review the above concepts; card sorts, ink stamps or student created drawings, food web string demonstration, and candy corn energy transfer. Working in groups of 2-3, have Arctic and local card sets including producers, herbivores, and carnivores (provide arrows to show the flow of energy). Have students create a food chain first

## Materials

- Arctic cards and teacher created local environment cards (producers to tertiary consumers-see attached)
- Plant and animal stamps (optional)
- Ball of string
- Tags representing organisms in a food web
- Plastic bag containing 100 candy corns
- Used oil
- Straw or hay
- Styrofoam strips
- Nylon hosiery strips
- Sand
- Dish soap
- Cotton balls
- Feathers

and then a food web using the cards (check out the Arctic food web on this website [www.harcourtschool.com/activity/food/food\\_menu.html](http://www.harcourtschool.com/activity/food/food_menu.html)). Next students may create their own food chains and food webs using their own drawings or ink stamps. Label the drawings in the food chain with the words producer, primary consumer, secondary consumer, and tertiary consumer. To further illustrate food webs, have students wear tags representing an organism in the local or Arctic environment (producer to tertiary consumer). Have students face each other in a large circle. Hand a student who represents a producer the ball of string and have the student tell everyone what herbivore (primary consumer) would eat them as they pass the string to the new person while the string end remains in the original student's hand. Students continue to pass the string until all students are holding tightly to a part of the unraveled ball of string. The finished product will look like a web. An extension of this activity is to have one person in the web drop their string to represent the loss of that species from the ecosystem. As others feel their string loosen; they too drop their string. Ask the students what they observed and what this represents (the whole ecosystem begins to collapse).

View the following website for an interactive tutorial on energy pyramids and select the ocean icon after the introduction page. [www.harcourtschool.com/activity/science\\_up\\_close/314/deploy/interface.html](http://www.harcourtschool.com/activity/science_up_close/314/deploy/interface.html). There is a 10 percent rule that exists at each of the trophic levels or in an energy pyramid and this can be demonstrated using candy corn. Have four volunteers (each representing producer to tertiary consumer) come to the front of the room. The producer will hold the bag containing the 100 candy corns. The primary consumer will take 10 candy corns from the producer. The secondary consumer will take one candy corn from the primary consumer. The tertiary consumer will take the white tip off of one candy corn from the secondary consumer.

*Explain:* Have students read the three PolarTREC Skloss' journals titled:

"You are what you eat":

<http://www.polartrec.com/expeditions/chukchi-sea-ecosystem-study/journals/2013-08-09>

"Trace Metals":

<http://www.polartrec.com/expeditions/chukchi-sea-ecosystem-study/journals/2013-08-04>

"Being at the Top is Where it's at":

<http://www.polartrec.com/expeditions/chukchi-sea-ecosystem-study/journals/2013-08-14>

Ask the following questions: What is a Trophic Level? (an organism's place or position within a food chain) Epibenthic? (surface bottom dweller) What analysis can be used to determine what an organism eats? (lipid biomarkers and isotopes N15 and C13) What organism occupies the lowest trophic level in the Chukchi Sea? (microalgae) The highest? (Neptunea a predatory snail) Besides microalgae, what other carbon sources are available for the organisms at the highest trophic levels? (phytoplankton, benthic diatoms known as microphytobenthos, and terrestrial plant matter) Why was a baseline study conducted in the Chuk-

chi Sea? (to determine if there is a change in the ecosystem by natural or anthropogenic means) What is biomagnification? (increased amount of some element or compound as it goes up the trophic level) What is bioaccumulation? (increase of a chemical within an individual organism.) What is anthropogenic? (caused by man)

### Extension

Explore/Elaborate: How does an oil spill or pollution affect an ecosystem? (It can kill or reduce the number of organisms in food chain.) Have students (groups of 3-4) simulate an oil spill clean-up selecting only two items from the following: straw or hay, Styrofoam strip, nylon hosiery strip, spoonful of sand, a drop of dish soap, cotton ball, or a feather. In a large specimen bowl filled half-way with water, place one or two drops of used oil near the center of the bowl. Sand and dish soap will be placed on top of the spill and all other items will be placed partially in the water at the bowl's edge moving towards the area of the oil spill. With the preselected clean-up items, clean up the spill. Replace oil as needed between clean-up trails. Have students record their observations and be prepared to discuss the results in a full class debriefing. Have students write how using sand (sinking bonding agent) or dish soap (dispersant) appears to remove the oil from the surface, but in fact creates an additional problem. (Dispersants break the oil into smaller units making it accessible to smaller organisms and sinking agents place the oil on the ocean sediments causing suffocation or contamination of the benthic community.)

### Resources

- Interactive Ocean Energy Pyramid Tutorial ([www.harcourtschool.com/activity/science\\_up\\_close/314/deploy/interface.html](http://www.harcourtschool.com/activity/science_up_close/314/deploy/interface.html))
- Arctic Food Web ([www.harcourtschool.com/activity/food/food\\_menu.html](http://www.harcourtschool.com/activity/food/food_menu.html))
- Animation: Sea-Ice Ecosystem ([http://nature.ca/education/cls/lp/lpasi3danim\\_e.cfm](http://nature.ca/education/cls/lp/lpasi3danim_e.cfm))
- Video: Arctic Diatom Marine Research (3 min. 4 sec.) ([http://nature.ca/education/cls/video/varct\\_e.cfm](http://nature.ca/education/cls/video/varct_e.cfm))
- PowerPoint: Arctic Sea Ice and the Food Web ([http://nature.ca/education/\\_doc/lpasi\\_e.ppt](http://nature.ca/education/_doc/lpasi_e.ppt))
- Photo Gallery (pictures from PowerPoint) ([http://nature.ca/education/cls/lp/lpasi\\_ph\\_e.cfm](http://nature.ca/education/cls/lp/lpasi_ph_e.cfm))
- Arctic Food Web Game ([http://nature.ca/ukaliq/030act/017\\_fwb\\_e.cfm](http://nature.ca/ukaliq/030act/017_fwb_e.cfm))
- Food Web from The Gates of the Arctic National Park (<http://arcticonationalpark.webs.com/foodwedtrophiclevels.htm>)
- Virtual Lab...Model Ecosystem...select Antarctic Ocean Seashore ([http://www.mhhe.com/biosci/genbio/virtual\\_labs/BL\\_02/BL\\_02.html](http://www.mhhe.com/biosci/genbio/virtual_labs/BL_02/BL_02.html))

### Assessment

Evaluate: Using a minimum of six science vocabulary terms create a six paneled cartoon strip about a tertiary consumer or write a 300 word story in the tertiary consumer's view of "A Day in the Life of..."



## At the Top: Trophic Levels to Food Chains

### **Credits**

Andrea Skloss, [skloss@paisd.net](mailto:skloss@paisd.net)

## **National Science Education Standards (NSES)**

### **Content Standards, Grades 5-8**

Content Standard A: Science As Inquiry

- a. Abilities necessary to do scientific inquiry
- b. Understandings about scientific inquiry

Content Standard B: Physical Science

- c. Transfer of energy

Content Standard C: Life Science

- d. Populations and ecosystems
- e. Diversity and adaptations of organisms

Content Standard F: Science In Personal and Social Perspectives

- a. Personal health
- b. Populations, resources, and environments
- c. Natural hazards
- d. Risks and benefits
- e. Science and technology in society

Content Standard G: History and Nature of Science

- a. Science as a human endeavor
- b. Nature of science

### **Other Standards**

Next Generation Science Standards (6-8 grade) Science, Technology, Society and the Environment Standards

2. Influence of Engineering, Technology, and Science on Society and the Natural World

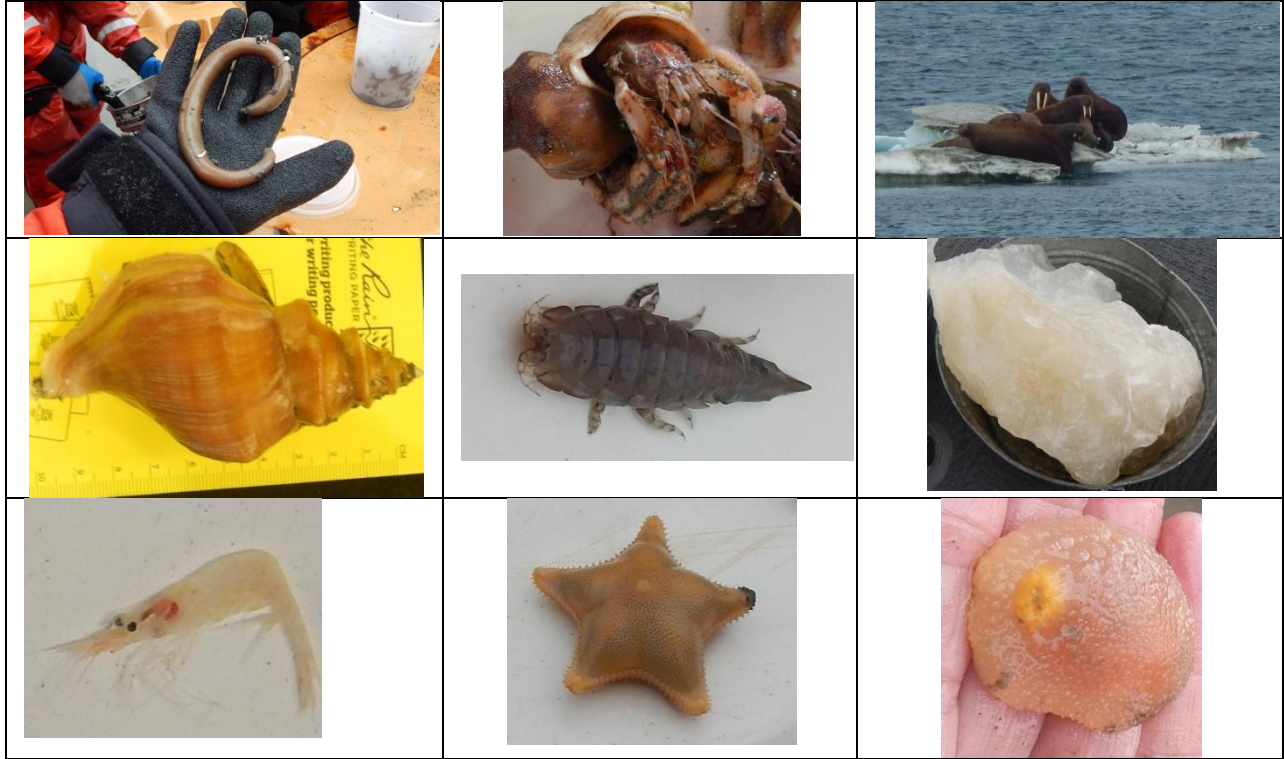
Crosscutting Concepts

4. Systems and System Models

7. Stability and Change

Texas Standards: 7.5c, 7.10 a-c, 7.1ab, and 8.11a-d

### Sample Arctic Sorting Cards



### Oil Spill Data Table

Item	Percent cleaned	Item	Percent cleaned
Cotton		Styrofoam strips	
Dish soap		Straw	
Feathers		Sand	
Nylon Hose			