

3.3 Energy Flow in Ecosystems

Lesson Objectives

-  Trace the flow of energy through living systems.
-  Identify the three types of ecological pyramids.

Lesson Summary

Food Chains and Food Webs Energy flows through an ecosystem in one direction from primary producers to various consumers.

- ▶ A **food chain** is a series of steps in which organisms transfer energy by eating and being eaten. Producers, such as floating algae called **phytoplankton**, are at the base of every food chain.
- ▶ A **food web** is a network of all the food chains in an ecosystem. Food webs are very complex. Small disturbances to one population can affect all populations in a food web. Changes in populations of **zooplankton**, small marine animals that feed on algae, can affect all of the animals in the marine food web.

Trophic Levels and Ecological Pyramids Each step in a food chain or food web is called a **trophic level**. Producers make up the first trophic level. Consumers make up higher trophic levels. Each consumer depends on the trophic level below it for energy.

An **ecological pyramid** is a diagram that shows the relative amounts of energy or matter contained within each trophic level in a food chain or food web. Types of ecological pyramids are pyramids of energy, pyramids of biomass, and pyramids of numbers:

- ▶ Pyramids of energy show relative amounts of energy available at different trophic levels.
- ▶ Pyramids of **biomass** show the total amount of living tissue at each trophic level.
- ▶ A pyramid of numbers shows the relative numbers of organisms at different trophic levels.

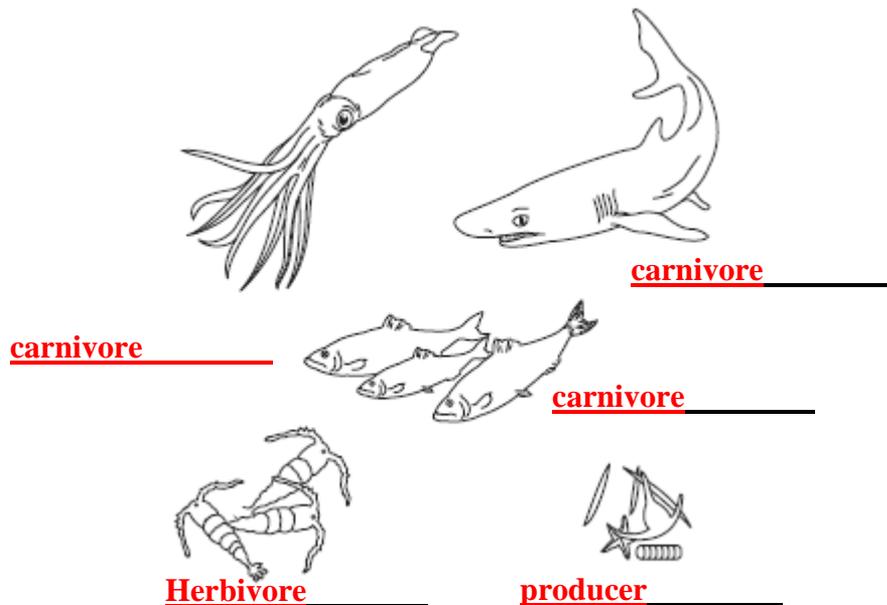
Food Chains and Food Webs

1. Complete the table about feeding relationships.

Feeding Relationships	
Relationship	Description
Food Chain	Series of steps in which organisms transfer energy by eating and being eaten.
Food Web	Network of complex interactions formed by the feeding relationships among the various organisms in an ecosystem.

Use the food chain to answer Questions 2–4.

2. Draw arrows between the organisms to show how energy moves through this food chain. Write *producer*, *herbivore*, or *carnivore* under each organism.



3. Explain how energy flows through this food chain. _____

Phytoplankton are photosynthetic. They produce carbohydrates which allow the zooplankton to feed on, which are eaten by small fish, which is eaten by the squid, and finally the shark. (Remember this is a flow of energy from producers to top carnivores)

4. What would happen to this food chain if a disturbance caused a serious decline in the shark population? **Shark population would decline. This would cause the squid population to increase (no natural predators). As a result of an overpopulation of squid the fish population would decrease so much that many of the squid would not be able to feed and die off.**

5. **VISUAL ANALOGY** play in the diagram, and how is it represented? _____
- SKIP**

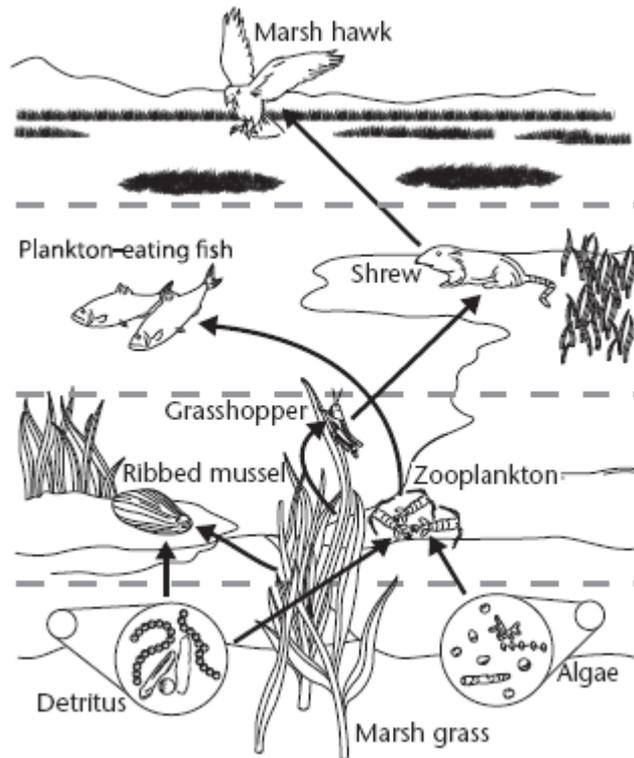


Trophic Levels and Ecological Pyramids

Write True or False on the line provided.

- False 6. Primary consumers always make up the first trophic level in a food web.
- True 7. Ecological pyramids show the relative amount of energy or matter contained within each trophic level in a given food web.
- False 8. On average, about 50 percent of the energy available within one trophic level is transferred to the next trophic level.
- False 9. The more levels that exist between a producer and a given consumer, the larger the percentage of the original energy from producers is available to that consumer.

Use the diagram to answer Questions 10–17.



Match the organism with its trophic level. A trophic level may be used more than once.

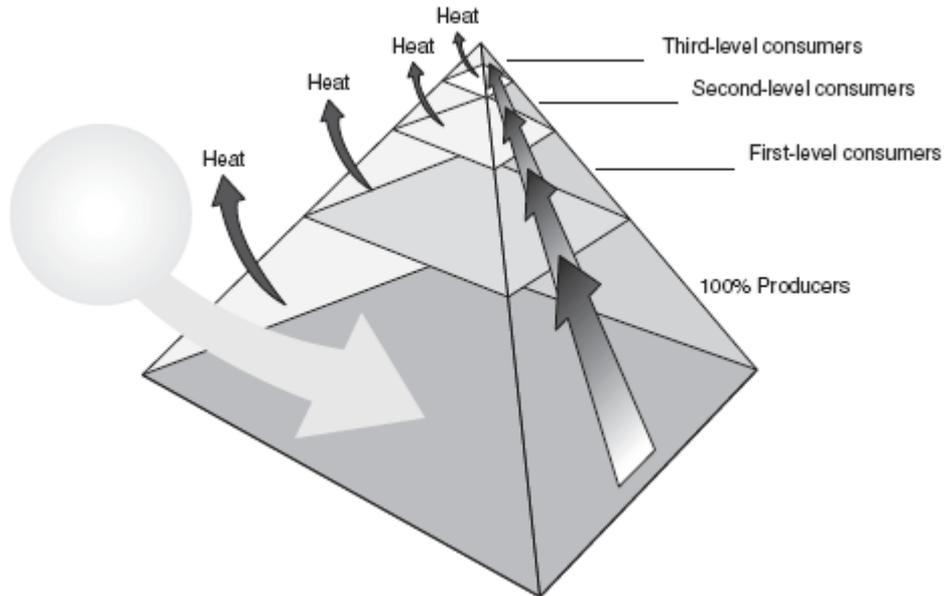
Organism

- A** _____ 10. algae
- B** _____ 11. grasshopper
- A** _____ 12. marsh grass
- D** _____ 13. marsh hawk
- C** _____ 14. plankton-eating fish
- B** _____ 15. ribbed mussel
- C** _____ 16. shrew
- B** _____ 17. zooplankton

Trophic Level

- A. primary producer
- B. first-level consumer
- C. second-level consumer
- D. third-level consumer

18. Complete the energy pyramid by writing the source of the energy for the food web and how much energy is available to first-, second-, and third-level consumers.



For Questions 19–21, complete each statement by writing the correct word or words.

- 19. A pyramid of BIOMASS illustrates the relative amount of living organic matter available at each trophic level in an ecosystem.
- 20. A pyramid of NUMBERS shows the relative numbers of individual organisms at the trophic levels in an ecosystem.
- 21. A pyramid of ENERGY shows the relative amounts of energy available at the trophic levels of a food chain or food web

Apply the Big idea

22. Identify which type of ecological pyramid best traces the flow of matter through an ecosystem. Explain your answer.

Biomass pyramid. They show the amount of organic material at each trophic level.

Energy is contained within the bonds of organic materials therefore energy is already incorporated into a biomass pyramid.

Numbers pyramid is not as accurate because organisms are all different sizes and contain different amounts of organic material and energy.
