

STAAR Science Tutorial 52 **TEK 8.11D: Food Webs & Symbiosis**

TEK 8.11A: Describe producer/consumer, predator/prey, and parasite/host relationships as they occur in food webs within marine, freshwater, and terrestrial ecosystems.

Energy Roles & Food Webs

- It is essential for each organism in an ecosystem to have a source of energy to survive. In all land and most aquatic ecosystems, the original source of energy supporting all life is radiant (electromagnetic) energy from the Sun.
- **Producers** are the organisms that have the ability to obtain energy from a non-living source such as the Sun or deep-sea volcanic vents. On land and in shallow aquatic ecosystems, plants are the producers that create food for the rest of the ecosystem through the process of **photosynthesis**. In this chemical reaction, carbon dioxide (CO₂) and water (H₂O) (the reactants) are broken down and recombined into sugar (C₆H₁₂O₆) and oxygen (O₂)(the products).
- In deep-sea ecosystems near volcanic vents and in rock, there are organisms called **chemotrophs** that can use chemical energy instead of radiant energy to survive. The chemical reaction varies with the ecosystem, but generally uses available chemical energy to make food in a process called **chemosynthesis**.
- An organism that uses photosynthesis or chemosynthesis to produce food is also known as an **autotroph**, which means "self-feeding".
- **Consumers** (also called **heterotrophs**) are organisms that cannot make their own food. They obtain their food by eating producers. Consumers can further be classified by what they eat:
 - **Omnivores** eat both plants and animals. Examples of omnivores are humans and bears.
 - **Herbivores** eat only plants. Examples of herbivores are cows and antelope.
 - **Scavengers** are animals that eat the bodies of already dead animals. A buzzard is an example of a scavenger.
 - **Carnivores** only eat other animals that they have killed. Examples of carnivores are wolves and lions. Some animals that are usually carnivores may also eat dead animals they find. Examples of carnivores that may act as a scavenger are coyotes and hawks.
- **Decomposers** are organisms that break down waste and dead organisms not already eaten by scavengers, so that the life-essential elements and compounds can be returned to the environment. The two main classes of decomposers are bacteria and fungi.
- The energy role of an organism, shown by its position in a food web, is called its **trophic level**. In land ecosystems, there are usually four trophic levels: producer,

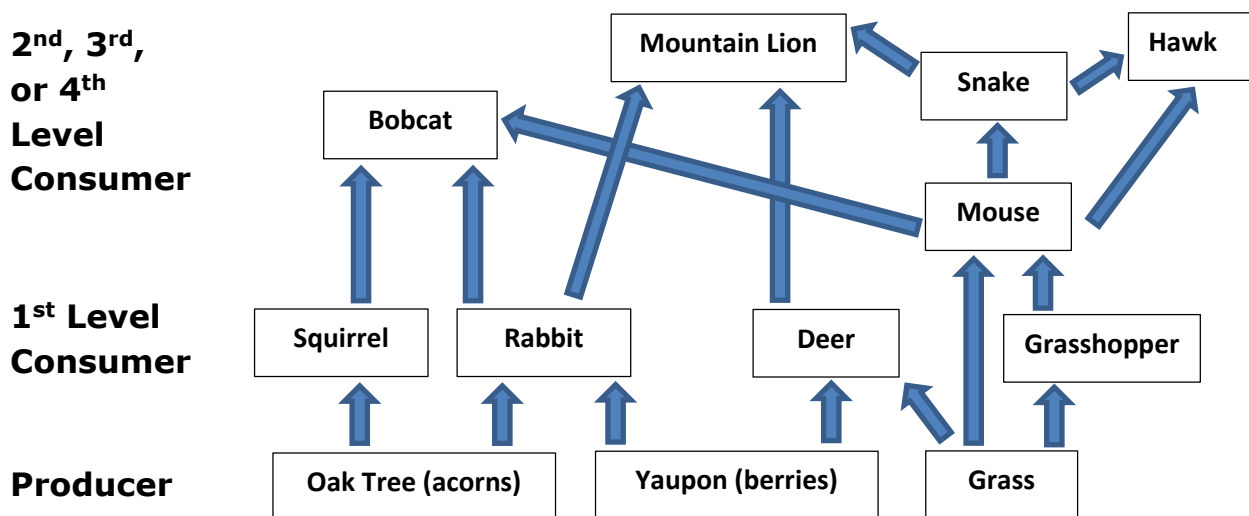
1st level consumer, 2nd level consumer and 3rd level consumer. Producers produce the food to support themselves and everyone above them in the food web. The 1st level consumers eat the producers. The 2nd level consumers eat the 1st level consumers, and the 3rd level consumers eat the 2nd level consumers.

- Animals can occupy more than one trophic level, depending on what they eat. For example, humans are both a 1st and 2nd level consumer when they eat a hamburger. The bun, lettuce and tomato are all plants, making the human a 1st level consumer. The hamburger patty is processed from a cow which ate only plants. This part of the hamburger makes the human a 2nd level consumer.
- A **predator** is a carnivore that hunts other animals (its **prey**) for food. For example, wolves are natural predators of caribou and moose, their prey. Predators control the population of prey species, and eliminate the weaker individuals within the prey population, serving to make the prey population stronger and better adapted.
- A **food chain** is a description of one particular sequence of “feeding events”—organisms eating one another. It does not describe all of the possible food sources eaten by an organism, just one possible sequence. The arrows point in the direction of energy flow.



In this food chain, the oak tree is the producer, the squirrel is the first-level consumer, and the bobcat is the second-level consumer.

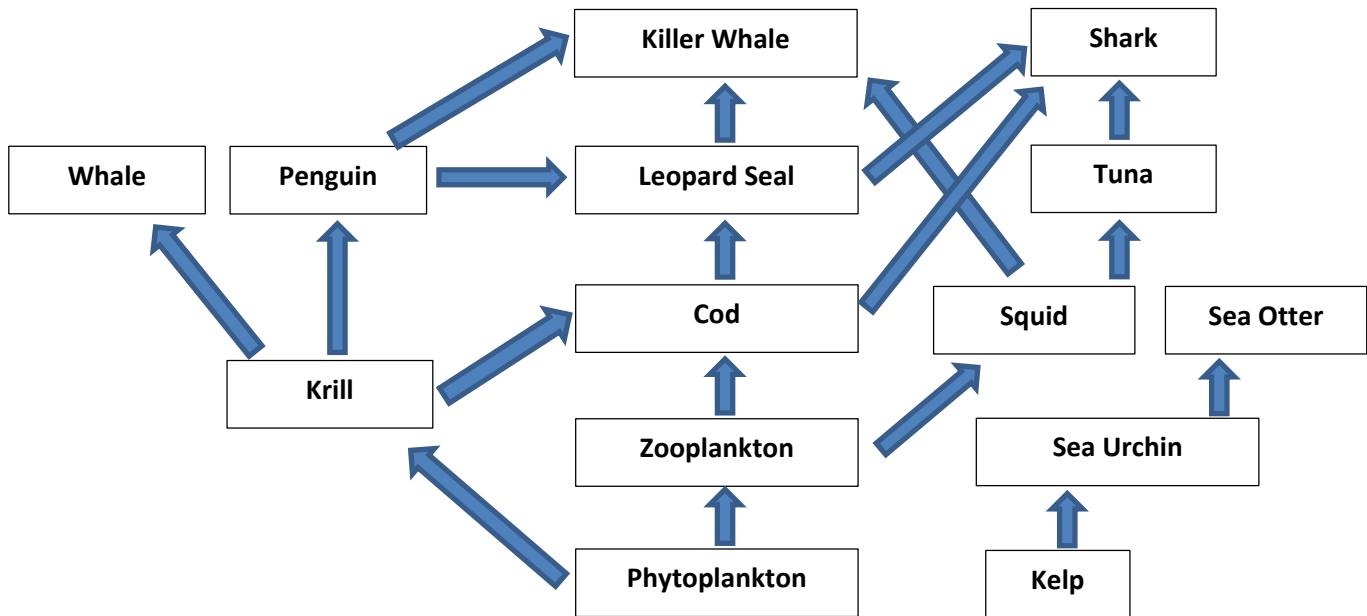
- A **food web** is a more complete diagram of the energy flow and predator-prey relationships within an ecosystem. It shows a number of overlapping food chains in one diagram. The arrows in a food web show the direction of energy flow, from the prey to the predator. Because each predator has more than one prey species, its trophic level is found of tracing the energy flow along one of several possible paths.



In this **terrestrial (land) food web**, the squirrel, rabbit, deer, mouse and grasshopper are all 1st-level consumers when they eat plants. But the mouse (an omnivore) can also be a 2nd-level consumer when it eats the grasshopper that ate the plant. The mountain lion is a 2nd level consumer when it eats the deer or rabbit, but

it is a 3rd-level consumer when it eats the snake (that ate the mouse that ate the grass). The hawk is a 2nd, 3rd or 4th level consumer, depending on what it eats and what its prey ate. The bobcat is a 2nd-level consumer when it eats the squirrel or rabbit, but might either be 2nd or 3rd level consumer when it eats the mouse, depending on what the mouse ate.

- In a **marine food web**, there can be more trophic levels, because of the great variety of fish sizes, and the microscopic size of most producers in the ocean. In addition, there are marine mammals and birds that also extend the food web.



- In a **freshwater food web**, there are fewer trophic levels, because there are no large predator fish or mammals such as sharks or killer whales. There is a greater crossover between land and water animals, however.
- When one species population is removed from a food web, through disease, habitat destruction or excessive hunting by humans, the population of other species up and down the food web will be affected. It may open up a niche for another species to move into the area, or for an existing species to expand its food sources. It may reduce the population of the predators of that removed prey species, unless they have other food sources to take the place of the removed species.

Symbiosis

- A **symbiotic relationship**, also called **symbiosis**, is a close relationship between different species that benefits at least one of the species in the relationship.
- There are three different kinds of symbiotic relationships, classified by whether one or both of the species benefits from the relationship, or whether one species in the relationship is harmed.
- **Mutualism** is a symbiotic relationship in which both species benefit from the relationship. For example, humans often keep working animals to help them on farms and ranches. A sheep herder works with a sheep dog to control and protect his flock. The sheep herder feeds and cares for the dog, and the dog provides help in herding sheep. Another example of a mutualistic relationship is lichen, a mixed

colony of an algae and a fungus. The fungus extracts nutrients from the solid rock the lichen lives on, and the algae uses those nutrients and sunlight to make food for both the algae and the fungus.

- **Commensalism** is a symbiotic relationship in which one species benefits while the other species is not affected positively or negatively. For example, a cowbird follows cows and other grazing animals around, waiting for grasshoppers and other insects to jump out of the grass as the cow moves. The cow is not affected by the cowbirds, but the cowbird is helped by the cows.
- **Parasitism** is a symbiotic relationship in which one species benefits (the parasite) while the other is harmed (the host). Fleas and ticks on a dog are examples of parasites. Parasites usually do not kill their host, but usually do harm their health, sometimes enough to shorten their live span. (Note that the STAAR tested TEK quoted at the top of this tutorial specifically lists parasite-host relationships as a testing concept.)
- Parasites often inhabit the bodies of their host for part of their life cycle, and cannot reproduce without the host species. The parasite responsible for malaria needs both mosquitos and humans to complete its life cycle. Some ticks rely on three different hosts to complete their life cycle.

Practice Questions

1. The original source of energy for most life on Earth is the _____.
2. _____ is the process in which a plant uses radiant energy from the Sun to turn _____ and _____ into _____ and _____.
3. _____ is the process in which a bacteria takes chemical energy from its environment to make food.
4. _____ or _____ are organisms that can make their own food.
5. _____ or _____ are organisms that must eat other organisms to get their food.
6. The four kinds of consumers, classified by the type of food that they eat, are (1) _____; (2) _____; (3) _____; and (4) _____.
7. A _____ eats only plants.
8. A _____ eats only animals that it kills itself.
9. An _____ eats both plants and animals.
10. A _____ eats the bodies of already-dead animals.

11. _____ break down waste and the remains of dead organisms. The main types are _____ and _____.
12. A _____ is a carnivore that eats a _____ species.
13. A description of one particular sequence of "feeding events" is a _____.
14. A _____ shows a number of overlapping food chains in one diagram, giving a more complete diagram of the energy flow and predator-prey relationships within an ecosystem.
15. In the terrestrial (land) food web shown above, list all of the producers: _____.
16. In the terrestrial (land) food web shown above, list all of the 1st level consumers: _____.
17. In the terrestrial (land) food web shown above, list all of the 2nd level consumers: _____.
18. In the terrestrial (land) food web shown above, list all of the 3rd or higher level consumers: _____.
19. In the marine food web shown above, list all of the producers: _____.
20. In the marine food web shown above, list all of the 1st level consumers: _____.
21. In the marine food web shown above, list all of the 2nd level consumers: _____.
22. In the marine food web shown above, list all of the 3rd or higher level consumers: _____.
23. _____ is a close relationship between different species that benefits at least one of the species in the relationship.
24. _____ is a symbiotic relationship in which both species benefit from the relationship. Examples include _____.

25. _____ is a symbiotic relationship in which one species benefits while the other species is not affected positively or negatively. Examples include _____.

26. _____ is a symbiotic relationship in which one species benefits (the parasite) while the other is harmed (the host). Examples include _____.

27. Describe the life cycle of a parasite that relies on its host for part of its reproductive cycle. _____

