

Food Web Background

Introduction

Every living organism needs energy to sustain life. Organisms within a community depend on one another for food to create energy. The simplest of these feeding relationships is referred to as a food chain. A food chain is a linear arrangement of at least three organisms in which each uses the organism below as its food source. For example, grass → deer → humans. Within an ecosystem, there are many interactive food chains which create a food web. Both abiotic and biotic factors are involved in food webs.

Biotic Factors

At the bottom of a food web are producers, or autotrophs, which produce their own food through photosynthesis, such as trees and shrubs. Consumers, or heterotrophs, are those organisms that cannot make their own food, and therefore must eat producers or other consumers to gain energy (e.g. birds and rabbits). Primary consumers or herbivores feed solely on producers. There are three types of secondary consumers: omnivores, carnivores, and decomposers. Omnivores eat both plants and animals, carnivores eat only other consumers, and decomposers are those organisms that consume dead materials. Decomposers are not to be confused with scavengers, as scavengers are considered carnivores that eat parts of dead animals. Decomposers are recyclers and consume all parts of dead materials. Without them, nutrients would not cycle back into the environment, therefore making it impossible for other organisms to sustain life. Last are tertiary consumers, or top predators of an ecosystem. Examples here are grizzly bears and humans.

Abiotic Factors

Although not often included in the food web, abiotic factors or the non-living aspects of an ecosystem (water, sunlight, temperature, etc.) play an important role. Climate will decide which food resources, and how much water and sunlight, are available to organisms in any given environment. Water and sunlight are necessary for plant growth and photosynthesis, and also provide animals with the basic needs of survival.

Food Webs and Food Chains

In every environment there are different food webs. Although the organisms may be different, the order, producers, primary consumers, secondary consumers, and tertiary consumers, is always the same. For the purpose of this lesson, we will focus on aquatic food chains, both salt and freshwater.

Saltwater

Micro-organisms known as plankton are key players in the food web of a marine environment. Occupying the photic or sunlit portion of the water are two types of plankton, phyto- and zooplankton. Phytoplankton or plant plankton account for 95% of the primary productivity in the ocean. Zooplankton or animal plankton eat phytoplankton, and thus are primary consumers. Moreover, larger zooplankton eat smaller zooplankton; small bait fish eat larger zooplankton; and large predatory fishes eat the small bait fish. This series of feeding relationships make up the marine food chain. When you factor in other species that feed on the same organism, then the chain becomes a web. {See Figure 1}

Freshwater

At the base of the freshwater food web are producers such as algae, duckweed, and lily pads. Just like on land, plants in water undergo photosynthesis and provide aquatic organisms with oxygen. Freshwater primary consumers include zooplankton and invertebrates. Smaller prey fish that consume the invertebrates are secondary consumers. Predator species at the top level include largemouth bass, smallmouth bass, walleye, chain pickerel, and perch. Humans and carnivorous birds (ospreys) are also included in the freshwater food chain.¹ {See Figure 2}

Human Impacts

In many food webs, humans are usually the top predator and are responsible for the decline in population, or in some cases, the endangerment or even extinction of many species. In aquatic food webs, humans are the top predator when they fish or when they buy and sell fish. Overfishing, introduction of non-native species, and bioaccumulation are just a few examples of how humans impact aquatic food webs.

Example: Bioaccumulation

Pollution can accumulate from species to species, moving up the food chain until it eventually affects the whole food web. This process is known as bioaccumulation. For example, in a saltwater ecosystem, clams filter out pollutants in the water such as heavy metals, coliform bacteria from sewage contamination, and oil. However, when pollutant levels are high, they build up inside of the clams, concentrating the toxic substances. Higher on the food chain, a blackfish eats the clams and stores the toxins in its body.

Additional Resources

Water on the Web

http://waterontheweb.org/under/lakeecology/11_foodweb.html

Vocabulary

- **Abiotic Factors**: non-living aspects; i.e. water, sunlight, atmospheric gases, temperature, wind, and climate
- **Biotic Factors**: living aspects of the environment; i.e. plants and animals
- **Carrying Capacity**: population number an ecosystem can support.
- **Consumers**: heterotrophs; those that cannot perform photosynthesis; use organic substrates to get energy; i.e. herbivores and carnivores
- **Decomposers**: consume dead organisms; heterotroph; i.e. bacteria, some insects, and fungi
- **Ecosystem**: Community of organisms and their environment; working together
- **Food Chain**: An arrangement of the organisms of an ecological community according to the order of predation in which each uses the next usually lower member as a food source
- **Food Web**: Interactive food chains in an ecosystem
- **Producers**: autotrophs; those that produce oxygen through photosynthesis; i.e. plants

ⁱ “The Food Web,” Water on the Web. 3 March 2004. 11 December 2008
<http://waterontheweb.org/under/lakeecology/11_foodweb.html>.