EXPLORE
FOOD WEBS: IT TAKES A COMMUNITY

Food Webs: It Takes a Community

Communities are composed of interactions between many factors including the number and types of species, chemical and physical conditions in the environment and the structure and type of habitat. Communities can be defined on scales as small as an oyster bar or as large as the entire Bay. Communities are created from interrelationships between species creating a complex web of connections between animals and their environment. Due to the diversity of habitats within Maryland’s Bays, the food webs they support are also complex.

A food web is often described as the interconnected feeding relationships between organisms in an ecosystem. These relationships are connected through a transfer of energy, and oftentimes have the greatest abundance of organisms at the lowest levels. The consumption of one organism by another is the transfer of energy through calories. The open water, or pelagic, food web is used as an example below.

The first level of this food web is composed of microscopic organisms called phytoplankton. These primary producers use the sun’s energy and transfer it into food in the form of sugars, known as photosynthesis. This process requires sunlight, which isn’t a problem in the fairly shallow Chesapeake Bay (approximately one-fourth of the Bay is less than 6 feet deep). Sunlight fuels the photosynthetic process and oxygen is produced as a result of this reaction. The overall productivity of primary producers is the defining factor on the abundance and survival of the rest of the organisms in the food web. Therefore, this level is the foundation of the food web.

The middle trophic level of the pelagic food web is composed of small floating animals, called zooplankton. Zooplankton feed on the microscopic algae. Juvenile fish and crabs that live in the water column feed on both the plankton and zooplankton. These small juvenile-sized organisms are called nekton.

At the top level of a food web are the predators. Larger fish feed on nekton, which in turn feed upon the largest species of all. In the open ocean, these predators can be toothed whales, dolphins, sharks, tuna and mackerel. In the food webs in Maryland’s Chesapeake and Coastal Bays, predators include bluefish, striped bass, eagles and osprey. People are predators too—we “harvest” seafood and use it as energy.

Organisms that are not consumed alive will eventually die and will be cycled through the detrital food web. This food web is driven by decomposition, and many organisms survive off the energy consumed from decaying plants animals. Organisms that feed off dead matter are often called scavengers and include animals like blue crabs and catfish. Bacteria and other microorganisms are an important part of the detritus cycle as they break organic matter back into nutrients that can again be taken up by primary producers like plankton that are the foundation of the food web.

Chesapeake Bay Food Web with Trophic Levels

PELAGIC
- Top
  - PREDATORS: Striped bass, bluefish, croaker, osprey, eagles

PELAGIC (water column)
- Middle
  - PRIMARY PRODUCERS: Phytoplankton, plants
  - OTHERS: bacteria, particulate organic matter

BENTHOS (bottom)
- Lower
  - DECOMPOSERS: Bacteria, worms
  - OTHERS: benthic diatoms
Food Webs of the Chesapeake Bay, Tributaries and Coastal Bays

High School Student Assignment

The plants and animals that live in the Chesapeake Bay, its tributaries, and the Coastal Bays have specific habitat requirements for food, light, temperature, water, nutrients, and shelter and others. Some species use different habitats during different stages of their life cycle. All living organisms depend on one another for food. By reviewing the relationships of organisms that feed on one another, we begin to see how all organisms—including humans—are linked.

1. Research one of the following Habitats and create a Food Web of organisms found in this habitat (see resource pages): tidal wetland or fringe marsh; SAV bed; aquatic reef; open bay; benthos; sandy beach.
   - Include a minimum of 10 organisms.
   - The food web should be a true web with multiple branches.
   - Use arrows to show the flow of energy from the organism being eaten to the organism that eats it (see Forest Food Web example).

2. Identify and label each organism as (use all that apply):
   - Producer
   - Primary Consumer
   - Consumer
   - Decomposer
   - Scavenger
   - Omnivore
   - Herbivore
   - Carnivore
   - Autotroph
   - Heterotroph

3. Identify and label each relationship in the food web as one of the following:
   - Mutualism
   - Commensalism
   - Parasite
   - Host
   - Predator
   - Prey

4. Describe the effect of three of the following abiotic factors on the food web:
   - Dissolved oxygen
   - Temperature
   - Light
   - pH
   - Salinity
   - Turbidity
   - Nutrients

5. Human activities can change environmental conditions, oftentimes causing stress on living resources. These stressors are often referred to as “limiting factors,” because they limit the growth or survival of species. List the human activities that can impact individual organisms in the food web or habitat. Select one stressor and describe how it affects the species in the food web or the habitat. Describe the type of chain reaction (if any) the stressor will cause in your food web or habitat.

6. What influence can shoreline erosion have on your particular habitat and food web?

7. Explain how diversity and the roles or niches of different organisms in a food web help to stabilize populations in the ecosystem.
Example: The Forest Food Web

The Forest Food Web diagram illustrates the relationships in a simple food web and the energy flow between organisms (indicated by arrows). A food web can illustrate the importance and sensitivity of the interdependent relationships between and among species—and why changes to one part of a food web most likely results in an effect or shift in another.

Source: www.stephsnature.com
# Food Web Species

<table>
<thead>
<tr>
<th>Phytoplankton Zooplankton Invertebrates</th>
<th>Diatoms</th>
<th>Dinoflagellates</th>
<th>Algae</th>
<th>Worms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copepod</td>
<td>Amphipod</td>
<td>Shrimp</td>
<td>Jelly Fish</td>
<td>Horseshoe Crab</td>
</tr>
<tr>
<td>Maryland blue crab</td>
<td>Submerged Aquatic Vegetation (SAV)</td>
<td>Eel Grass (salty water)</td>
<td>Widgeon grass (mildly brackish to salty)</td>
<td>Redhead grass (fresh to moderately brackish)</td>
</tr>
<tr>
<td>Wetland &amp; Marsh Plants</td>
<td>Salt marsh cordgrass (high to moderate salinity)</td>
<td>Salt meadow cordgrass (high to moderate salinity)</td>
<td>Salt marsh grass (fresh to moderately brackish)</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>Striped Bass</td>
<td>American Shad</td>
<td>Menhaden</td>
<td></td>
</tr>
<tr>
<td>Birds</td>
<td>Piping plover (endangered)</td>
<td>Bald eagle (threatened)</td>
<td>American black duck</td>
<td></td>
</tr>
<tr>
<td>Other Vertebrates</td>
<td>Delmarva fox squirrel (endangered)</td>
<td>White tailed deer</td>
<td>Diamondback terrapin (protected)</td>
<td>Nutria (invasive species)</td>
</tr>
</tbody>
</table>
**GLOSSARY**

**FOOD WEBS TERMS**

**Abiotic** Describing a non-living component of an environment, also called inorganic. Examples: light, water, temperature.

**Autotroph** An organism that produces food molecules inorganically by using light by photosynthesis. This organism does not require outside sources of organic food energy for survival. Autotrophs are primary producers in all food webs.

**Biotic** The living components of the environment.

**Carnivore** An organism that consumes living animals or parts of living animals.

**Community** A group of plants and animals living and interacting with one another in a specific region under relatively similar environmental conditions.

**Commensalism** Relationship between two species in which only one species benefits whereas the other is unaffected.

**Consumer** An organism that eats other organism for food. Also called heterotrophs, different kinds of consumers include carnivores, herbivores, and omnivores.

**Decomposer** An organism that feeds on dead material or excrement, breaking down complex organic compounds into simple organic or inorganic ones that are then available to enter the food web as nutrients.

**Dissolved Oxygen** The amount of oxygen measured in water.

**Detritus** Dead plant, animal or other organic matter.

**Ecosystem** All of the interactions between living and non-living entities within a community.

**Estuary** A semi-enclosed body of water that has connection to the open sea and in which water from the ocean mixes with fresh water inflows (examples: a bay, mouth of a river, salt marsh, lagoon).

**Food Chain** Single path taken as different organisms consume other organisms for energy.

**Food Web** Interaction of all the food chains in a particular habitat to form a complex feeding system. This is different from a food chain in that an organism may have multiple food sources instead of just one.

**Habitat** The arrangement of food, water, shelter, or cover and space suitable to animals’ needs.

**Herbivore** An organism that consumes plants or phytoplankton for energy; also known as a primary consumer.

**Heterotroph** Any living organism that obtains its energy from organic substances produced by other organisms.

**Host** A living organism that is being fed on by another organism (called the parasite).

**Inorganic** Matter other than plant or animal; inorganic matter is not alive and may not contain carbon; sometimes called abiotic.
**Keystone Species**  A species that has a major influence on the structure of an ecosystem. Its presence impacts many other members of the ecosystem, and if its population dwindles or disappears, there can be far-reaching consequences for the ecosystem.

**Limiting Factors**  Chemical or physical factors that limit the existence, growth, abundance, or distribution of an organism. Examples include: food, water, shelter, space, disease, predation, climatic conditions, pollution, harvesting (fishing, trapping, netting, etc.) poaching, and accidents.

**Mutualism**  Association between two organisms of different species where by both benefit from the relationship, also called symbiosis.

**Niche**  The function or position of an organism or a population within an ecological community.

**Omnivore**  An organism that eats both plants and animals.

**Organic**  Compounds containing carbon, living matter, or compounds derived from living matter.

**Organism**  A living plant or animal that has one or more cells. Examples include: plants, animals, fungi, bacteria.

**Parasite**  An organism that feeds on or in another organism (called the host).

**pH**  A scale from 0-14 used to measure the alkalinity or acidity of a substance; 7 is neutral, below 7 is acid, and above 7 is alkaline.

**Plankton**  Those organisms suspended in an aquatic habitat that controls their movement; usually microscopic, including bacteria, algae, protozoan, rotifers, larvae, and small crustaceans (phytoplankton are the plant plankton; zooplankton are the animal species).

**Predator**  A consumer organism that feeds on prey.

**Prey**  An organism that is consumed by a predator.

**Primary Consumer**  An organism that occupies the second trophic level in a food chain; these organism are herbivores and feed directly on producers.

**Producer**  Organisms, such as plants or phytoplankton, that produce their own food; also called autotrophs.

**Salinity**  Concentration of dissolved salts found in a sample of water; measured as total amount of dissolved salts in parts per thousand (ppt).

**Scavenger**  An organism that feeds on dead organisms.

**Shelter**  A structure that shields or protects, especially against weather and danger.

**Silt**  The fine-grained sediment carried by water.

**Trophic Level**  Position occupied by a species or group of species in a food chain.

**Turbidity**  A measure of the cloudiness of water caused by suspended particles.