#258

Food web

The network of flows of energy and materials that arises as organisms in a locality eat or consume other living organisms or their parts. In addition to living organisms, a food web sometimes includes flows between organisms and the abiotic or dead biotic environment. A food chain is one connected route through a food web. Thus, a food web can be viewed as the collection of all food chains in a locality. *See* ECOLOGICAL ENERGETICS.

Food webs are important in nature because the availability of food to eat and the risk of being eaten influence the population dynamics and the evolution of virtually all living species. Human survival depends on the successful management of food webs in agriculture and fisheries. Also, understanding food webs can help ecologists to solve practical environmental problems. For example, toxins and pollutants are sometimes concentrated along the paths in food webs. Control of agricultural pests by using natural or introduced enemies, control of disease-carrying organisms, treatment of industrial wastewater, and conservation of wildlife depend on how adding or deleting species affects food webs.

Food webs are described in physical and chemical terms (for example, biogeochemistry) and in terms of the natural history of biological species (morphology, genetics, physiology, behavior, and demography). Usually, the feeding connections among species direct the flows of carbon, nitrogen, phosphorus, and other major constituents of living organisms. Specific chemicals sometimes influence the choice of organism consumed, as when organisms embody chemicals that are toxic or attractive to potential consumers.

In terrestrial habitats and surface waters, the major components of most food webs are the green plants (autotrophs), which synthesize nutrients from inorganic compounds and sunlight; the herbivores, which feed on green plants; and the carnivores, which feed on herbivores. Additional important components of food webs are the recyclers, the parasites, and the omnivores. The recyclers (decomposers, detrivores, and saprovores) are organisms that subsist on dead organisms, waste products (such as shed leaves, fur, or molts), and excreta. Omnivores may eat all other components. In habitats without light, such as the sea floor and caves, food webs are based on nutrients that fall from above, are imported by streams, or are fixed from hydrothermal vents by bacteria.

Body size strongly influences the organization of food webs. For example in natural communities when one animal species eats another, the prey is usually smaller than the predator. As smaller animals are generally more abundant, animals that are separated from autotrophs by more feeding links in a food chain are expected to be rarer than animals that are closer to autotrophs in the same food chain.

Food webs vary in space and time. A web dominated by a large terrestrial or marine predator may cover tens to hundreds of square kilometers; different local webs within the same large area could occur in areas of square meters or hectares. In a given region, webs may change seasonally or during ecological succession.

A food web is sometimes depicted graphically, showing the direction in which food flows (see **illus.**). A web can also be described quantitatively by using a feeding matrix, that is, a table of numbers with one row for each species consumed, one column for each consumer species, and numerical entries to represent the quantity of food consumed or the frequency of feeding. *See* ECOLOGICAL COMMUNITIES; ECOSYSTEM; POPULATION ECOLOGY.

Joel E. Cohen

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Typical food web characteristic of the protected rocky shore community of southern New England. Solid lines suggest major tropic interactions, broken lines minor ones. Such webs provide useful but incomplete biological descriptions, since not all prey are listed, and certain categories of consumers (birds, snails) and prey (detritus, benthic algae) can include many individual species. *(After D. C. Edwards et al., Mobile predators and the structure of marine intertidal communities, Ecology, 63(4):1175–1180, 1982)*

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