16.3B: Planktonic Communities

Plankton (singular plankter) are any organisms that live in the water column and are incapable of swimming against a current.

Learning Objectives

• Recall Planktonic communities

Key Points

• Plankton are primarily divided into broad functional (or trophic level) groups: Phytoplankton, Zooplankton, and Bacterioplankton.
• Plankton cover a wide range of sizes, including microscopic to large organisms such as jellyfish.
• Plankton community into broad producer, consumer, and recycler groups.

Key Terms

• trophic: Describing the relationships between the feeding habits of organisms in a food chain.
• plankton: Plankton (singular plankter) are any organisms that live in the water column and are incapable of swimming against a current. They provide a crucial source of food to many large aquatic organisms, such as fish and whales.
• organisms: An organism is any contiguous living system (such as animal, fungus, micro-organism, or plant). In at least some form, all types of organisms are capable of response to stimuli, reproduction, growth and development, and maintenance of homeostasis as a stable whole.
Plankton (singular plankter) are any organisms that live in the water column and are incapable of swimming against a current. They provide a crucial source of food to many large aquatic organisms, such as fish and whales.

These organisms include drifting animals, plants, archaea, algae, or bacteria that inhabit the pelagic zone of oceans, seas, or bodies of fresh water. That is, plankton are defined by their ecological niche rather than phylogenetic or taxonomic classification.

Although many planktic (or planktonic) species are microscopic in size, plankton consists organisms covering a wide range of sizes, including large organisms such as jellyfish.

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Figure: **Diatoms**: Assorted diatoms as seen through a microscope. These specimens were living between crystals of annual sea ice in McMurdo Sound, Antarctica. Image digitized from original 35mm Ektachrome slide. These tiny phytoplankton are encased within a silicate cell wall.

Phytoplankton (from Greek phyton, or plant), autotrophic, prokaryotic, or eukaryotic algae live near the water surface where there is sufficient light to support photosynthesis. Among the more important groups are the diatoms, cyanobacteria, dinoflagellates, and coccolithophores.

Zooplankton (from Greek zoon, or animal), small protozoans or metazoans (e.g. crustaceans and other animals) that feed on other plankton and telonemia. Some of the eggs and larvae of larger animals, such as fish, crustaceans, and annelids, are included here.

Bacterioplankton, bacteria and archaea, which play an important role in remineralising organic material down the water column (note that the prokaryotic phytoplankton are also bacterioplankton).

This scheme divides the plankton community into broad producer, consumer, and recycler groups. However, determining the trophic level of some plankton is not straightforward. For example, although most dinoflagellates are either photosynthetic producers or heterotrophic consumers, many species are mixotrophic depending upon circumstances.

Aside from representing the bottom few levels of a food chain that supports commercially important fisheries, plankton ecosystems play a role in the biogeochemical cycles of many important chemical elements, including the ocean's carbon.
Primarily by grazing on phytoplankton, zooplankton provides carbon to the planktic foodweb, either respiring it to provide metabolic energy, or upon death as biomass or detritus. Typically more dense than seawater, organic material tends to sink. In open ocean ecosystems away from the coasts this transports carbon from surface waters to the deep. This process is known as the biological pump, and is one reason that oceans constitute the largest carbon sink on earth.

It might be possible to increase the ocean's uptake of carbon dioxide generated through human activities by increasing plankton production through "seeding," primarily with the micronutrient iron. However, this technique may not be practical at a large scale. Ocean oxygen depletion and resultant methane production (caused by the excess production remineralizing at depth) is one potential drawback.

The growth of phytoplankton populations is dependent on light levels and nutrient availability. The main factor limiting growth varies from region to region in the world’s oceans. On a broad scale, growth of phytoplankton in the oligotrophic tropical and subtropical gyres is generally limited by nutrient supply, while light often limits phytoplankton growth in subarctic gyres. Environmental variability at multiple scales influences the nutrient and light available for phytoplankton. As these organisms form the base of the marine food web, this variability in phytoplankton growth influences higher trophic levels. For example, at interannual scales phytoplankton levels temporarily plummet during El Nino periods, influencing populations of zooplankton, fishes, sea birds, and marine mammals.

The effects of anthropogenic warming on the global population of phytoplankton are an area of active research. Changes in the vertical stratification of the water column, the rate of temperature-dependent biological reactions, and the atmospheric supply of nutrients are expected to have important impacts on future phytoplankton productivity. Additionally, changes in the mortality of phytoplankton due to rates of zooplankton grazing may be significant.

Freshly hatched fish larvae are also plankton for a few days as long as they cannot swim against currents. Zooplankton are the initial prey item for almost all fish larvae as they switch from their yolk sacs to external feeding. Fish rely on the density and distribution of zooplankton to match that of new larvae, which can otherwise starve. Natural factors (e.g., current variations) and man-made factors (e.g. river dams) can strongly affect zooplankton, which can in turn strongly affect larval survival and therefore breeding success.