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Topic: Properties of water (biological)

Course title: Water and water resources

Paper: CC3

Unit: 2

Semester: 2

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Phytoplankton:

Derived from the Greek words phyto (plant) and plankton (made to wander or drift), phytoplankton are microscopic organisms that live in watery environments, both salty and fresh.

Some phytoplankton are bacteria, some are protists, and most are single-celled plants. Among the common kinds are cyanobacteria, silica-encased diatoms, dinoflagellates, green algae, and chalk-coated coccolithophores.

About 1% of the global biomass is due to phytoplankton.

cyanobacteria



diatom



dinoflagellate



green algae



coccolithophore



Phytoplankton are extremely diverse, varying from photosynthesizing bacteria (cyanobacteria), to plant-like diatoms, to armor-plated coccolithophores (drawings not to scale). (Collage adapted from drawings and micrographs by Sally Bensusen, NASA EOS Project Science Office.)

Like land plants, phytoplankton have chlorophyll to capture sunlight, and they use photosynthesis to turn it into chemical energy.

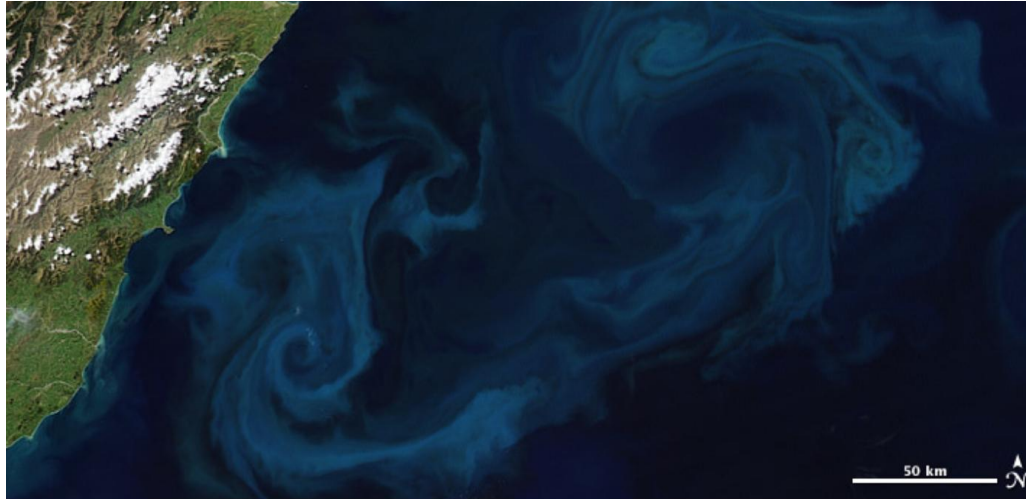
They consume carbon dioxide, and release oxygen. All phytoplanktons photosynthesize. They are autotrophic in nature.

Phytoplankton growth depends on the availability of carbon dioxide, sunlight, and nutrients.

Phytoplanktons require nutrients such as nitrate, phosphate, silicate, and calcium at various levels depending on the species. Some phytoplanktons can fix nitrogen and can grow in areas where nitrate concentrations are low.

They also require trace amounts of iron which limits phytoplankton growth in large areas of the ocean because iron concentrations are very low. Other factors influence phytoplankton growth rates, including water temperature and salinity, water depth, wind, and what kinds of predators are grazing on them.

When conditions are right, phytoplankton populations can grow explosively, a phenomenon known as a bloom. Blooms in the ocean may cover hundreds of square kilometers and are easily visible in satellite images. A bloom may last several weeks, but the life span of any individual phytoplankton is rarely more than a few days.



Phytoplankton can grow explosively over a few days or weeks. This pair of satellite images shows a bloom that formed east of New Zealand between October 11 and October 25, 2009. (NASA images by Robert Simmon and Jesse Allen, based on **MODIS** data.)

Importance of phytoplankton

The food web

Phytoplankton are the foundation of the aquatic food web, the primary producers, feeding everything from microscopic, animal-like zooplankton to multi-ton whales. Small fish and invertebrates also graze on the plant-like organisms, and then those smaller animals are eaten by bigger ones.

Phytoplankton can also be the harbingers of death or disease. Certain species of phytoplankton produce powerful biotoxins, making them responsible for so-called “red tides,” or harmful algal blooms. These toxic blooms can kill marine life and people who eat contaminated seafood.

Phytoplankton obtain energy through the process of photosynthesis and must therefore live in the well-lit surface layer (termed the euphotic zone) of an ocean, sea, lake, or other body of water. Phytoplankton account for about half of all photosynthetic activity on Earth.

Their cumulative energy fixation in carbon compounds (primary production) is the basis for the vast majority of oceanic and also many freshwater food webs (chemosynthesis is a notable exception).

While almost all phytoplankton species are obligate photoautotrophs, there are some that are mixotrophic and other, non-pigmented species that are actually heterotrophic (the latter are often viewed as zooplankton).

Benthos is the community of organisms that live on, in, or near the seabed, river, lake, or stream bottom, also known as the benthic zone.

This community lives in or near marine or freshwater sedimentary environments, from tidal pools along the foreshore, out to the continental shelf, and then down to the abyssal depths.

What is Phytobenthos?

'Phytobenthos' means plants of the seabed, both intertidal and subtidal, and both sedimentary and hard. Such plants belong almost entirely to the algae although seagrasses, which form meadows on some subtidal and intertidal areas, are flowering plants or angiosperms.

Phytobenthos are vascular plants, heterotrophic organisms and photosynthetic algae (including cyanobacteria) living on or attached to substrate or other organisms in surface waters.

The term benthos, coined by Haeckel in 1891, comes from the Greek noun βένθος "depth of the sea".

Benthos is used in freshwater biology to refer to organisms at the bottom of freshwater bodies of water, such as lakes, rivers, and streams.



Zooplankton :

Zooplanktons are heterotrophic (sometimes detritivorous) plankton (cf. phytoplankton). Plankton are organisms drifting in oceans, seas, and bodies of freshwater.

The word zooplankton is derived from the Greek zoon (ζῷον), meaning "animal", and planktos (πλαγκτός), meaning "wanderer" or "drifter". Individual zooplankton are usually microscopic, but some (such as jellyfish) are larger and visible to the naked eye.

Zooplankton is a categorization spanning a range of organism sizes including small protozoans and large metazoans.

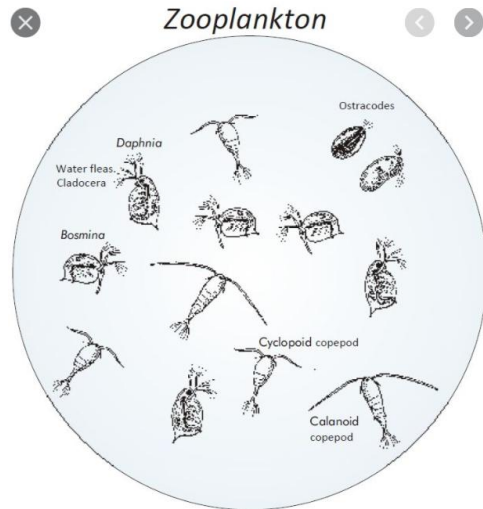
It includes holoplanktonic organisms whose complete life cycle lies within the plankton, as well as meroplanktonic organisms that spend part of their lives in the plankton before graduating to either the nekton or a sessile, benthic existence.

Although zooplankton are primarily transported by ambient water currents, many have locomotion, used to avoid predators (as in diel vertical migration) or to increase prey encounter rate.

Zooplankton feed on bacterioplankton, phytoplankton, other zooplankton (sometimes cannibalistically), detritus (or marine snow) and even nektonic organisms.

As a result, zooplankton are primarily found in surface waters where food resources (phytoplankton or other zooplankton) are abundant.

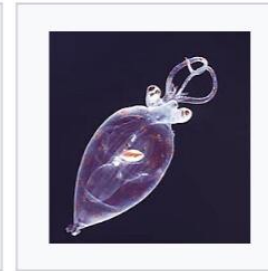
Through their consumption and processing of phytoplankton and other food sources, zooplankton play a role in aquatic food webs, as a resource for consumers on higher trophic levels (including fish)



Segmented worm



An amphipod



Juvenile planktonic squid



Ocean sunfish larvae (2.7mm)

Macroinvertebrates :

A healthy waterway will have a large number of different types of macroinvertebrates present with no one type dominating the system. A polluted waterway will have only a few different types of macroinvertebrates present, often in large numbers and generally include things like aquatic worms, water fleas and non-biting midge larvae.

Aquatic macroinvertebrates are small animals that live for all, or part, of their lives in water. There are many different types of macroinvertebrates such as dragonfly larvae, mosquito larvae, water fleas, beetles and snails.

Some of these are sensitive to pollution whereas others can live in very polluted waters. Because of this variability in sensitivity to pollution, macroinvertebrates make good biological indicators.

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Some aquatic macroinvertebrates spend their entire lives living in water, although many just live in the water when they are immature. As they reach maturity, larvae metamorphose and leave the water, spending their adult life on land. In many cases, the insects are adults for a very short time.

For example, many mayflies live in streams for months to years but last on land for just a few days. During this time, they mate and lay their eggs in or near water so the cycle can continue.

WHY CARE ABOUT AQUATIC MACROINVERTEBRATES?

- Aquatic macroinvertebrates live in many different types of aquatic habitats. Some live in fast moving streams, consuming leaves, twigs, and other plant material that falls into the water. Others live in wider, sunnier rivers or shallow ponds, scraping algae off rocks or on the surfaces of large aquatic plants.
- Many are predators, and prey upon other macroinvertebrates. Some live within the soft sediments at the bottom of lakes and ponds and others capture food that is drifting along in the current. In all these settings, macroinvertebrates provide an important food source for fish and other predators.
- Because different types of macroinvertebrates tolerate different stream conditions and levels of pollution, their presence or absence is used to indicate clean or polluted water. For example, most larvae of caddisflies, mayflies, and stoneflies cannot survive in polluted water so streams with these bugs are assumed to have good water quality.
- The absence of these organisms in a water body, however, does not necessarily indicate that the water quality is poor. Other natural factors, such as temperature and flow, also come into play.

FACTORS THAT INFLUENCE MACROINVERTEBRATE HEALTH

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Dragonfly Larva



Dragonfly Adult



Happy reading..