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Importance of Phytoplankton and their impact to the Global Ecosystem: An Overview

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Abstract

Diatoms that resemble plants, armor-plated coccolithophore, photosynthesizing bacteria (cyanobacteria), and other organisms are all examples of phytoplankton. Similar to terrestrial plants, phytoplankton uses photosynthesis to convert solar energy into chemical energy by using chlorophyll to absorb light. They exhale oxygen while consuming carbon dioxide. All phytoplankton photosynthesize, but some also consume other species to gain additional energy. Phytoplankton populations can expand rapidly under the correct circumstances, a phenomenon known as a bloom. Oceanic blooms are plainly discernible in satellite photos and can span hundreds of square kilometres. Although a bloom may extend for several weeks, a phytoplankton's life cycle is typically only a few days. The present paper highlights the importance of phytoplanktons and its role as far as global ecosystem is concerned.

Keywords: Phytoplankton, Ecosystem, Importance

Introduction

Microalgae, sometimes referred to as phytoplankton, are similar to terrestrial plants in that they have chlorophyll and need sunlight to survive and develop. The upper ocean, where sunlight may reach the water, is where the majority of phytoplankton floats since they are buoyant. Additionally, phytoplankton needs inorganic elements such phosphates, sulphur, and nitrates, which they use to make proteins, lipids, and carbohydrates.

The dinoflagellates and diatoms are the two primary groups of phytoplankton. Dinoflagellates have complex shells covering their bodies and a whip-like tail that they utilise to navigate through the water. Diatoms have shells as well, but they are constructed of a different material and have a stiff structure with interlocking components. In a balanced ecosystem, phytoplankton provide food for a wide range of sea creatures including shrimp, snails, and jellyfish. When too many nutrients are available, phytoplankton may grow out of control and form harmful algal blooms (HABs). These blooms can produce extremely toxic compounds that have harmful effects on fish, shellfish, mammals, birds, and even people.

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Classification of Phytoplankton

Almost all oceans and freshwater bodies on Earth have phytoplankton, which are microscopic protists and bacteria that photosynthesize. Phytoplankton are the major producers in water, similar to plants on land. They convert carbon dioxide that is dissolved in the water into organic compounds, which supports the aquatic food web. The Earth's carbon cycle depends heavily on phytoplankton, which also serves as the foundation of the marine food web.

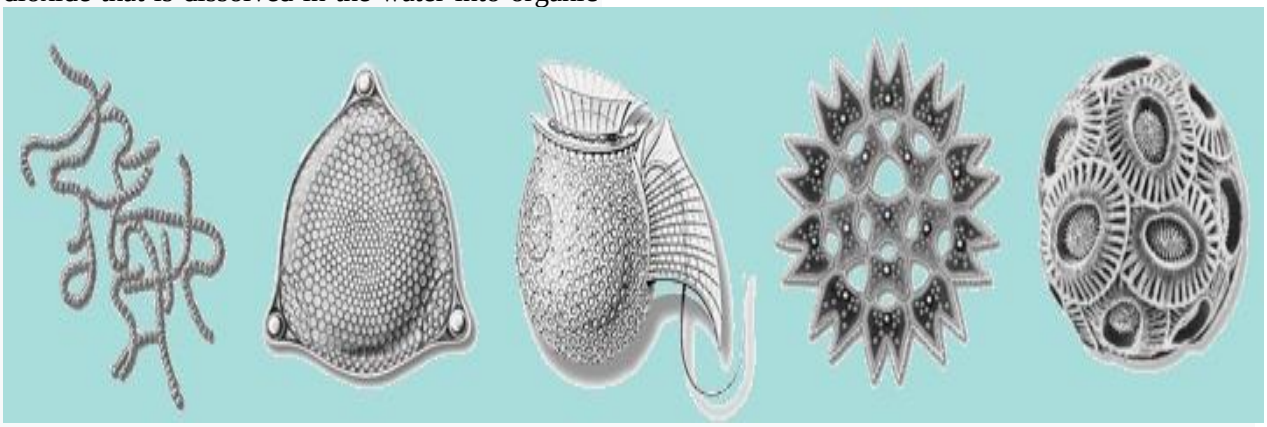


Fig. 1: Cyanobacteria, diatom, dinoflagellate, green algae and coccolithophore (L–R).

Microalgae, which are also referred to as phytoplankton together with cyanobacteria, are the primary producers of marine photosynthetic organisms. From photosynthesising bacteria (cyanobacteria), to diatoms that resemble plants, to armor-plated coccolithophores, phytoplankton is incredibly diverse.

Role of Phytoplankton

The fate of nearby trophic levels is influenced by marine phytoplankton, which also contributes to nutrient cycling and the management of climatic dynamics and, ultimately, limits fishing catches. Marine phytoplankton accounts for around 50% of the world's primary output (50 Pg C year). The group of organisms known as marine phytoplankton is incredibly diverse, and this diversity, which includes a wide range of life cycles, is a crucial element that influences the entire structure of marine ecosystems. The primary factor affecting the fitness of planktonic organisms is the diversity of functional features that vary among and within species and taxonomic groups.

In the diagram on the right, the compartments influenced by phytoplankton include the atmospheric gas composition, inorganic nutrients, and trace element fluxes as well as the transfer and cycling of organic matter via biological processes. The photosynthetically fixed carbon is rapidly recycled and reused in the surface ocean, while a certain fraction of this biomass is exported as sinking particles to the deep ocean, where it is subject to ongoing transformation processes, e.g., remineralization.

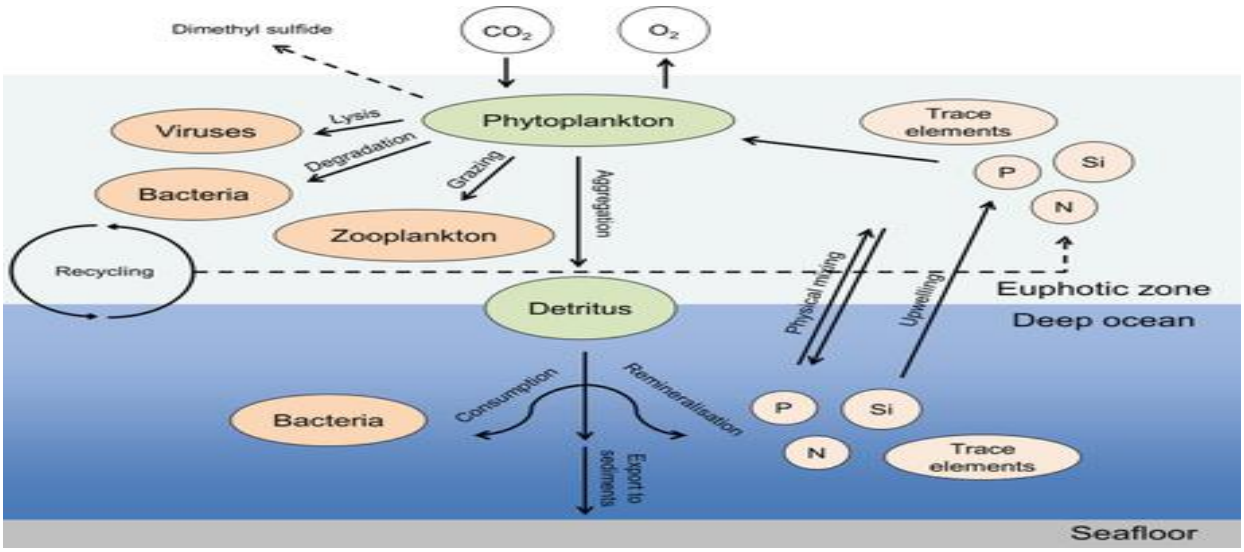


Fig. 2: Role of phytoplankton on various compartments of the marine environment

Importance of phytoplankton

Food web: The primary producers and the base of the aquatic food web, phytoplankton feed everything from minute, animal-like zooplankton to massive whales. Additionally, little fish and invertebrates graze on the organisms that resemble plants before being consumed by larger animals.

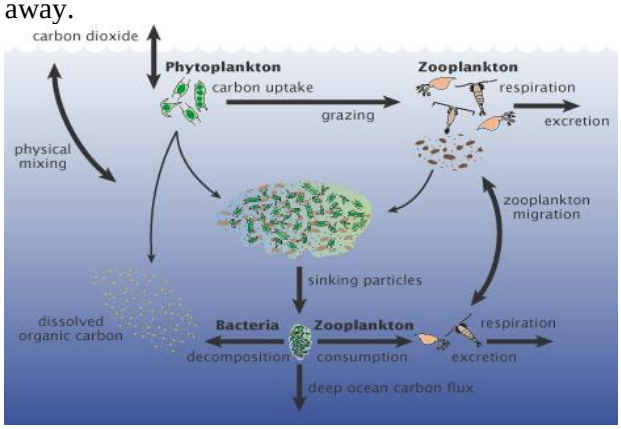
Additionally, phytoplankton might signal impending illness or death. Certain phytoplankton species are to blame for "red tides" or toxic algal blooms because they create potent biotoxins. When people consume polluted seafood, these toxic blooms can also destroy marine life.

Dead fish washed onto a beach at Padre Island, Texas, in October 2009, following a red tide (harmful algal bloom).

Phytoplankton cause mass mortality in other ways. In the aftermath of a massive bloom, dead phytoplankton sink to the ocean or lake floor. The bacteria that decompose the phytoplankton deplete the oxygen in the water, suffocating animal life; the result is a dead zone.

Climate and the Carbon Cycle

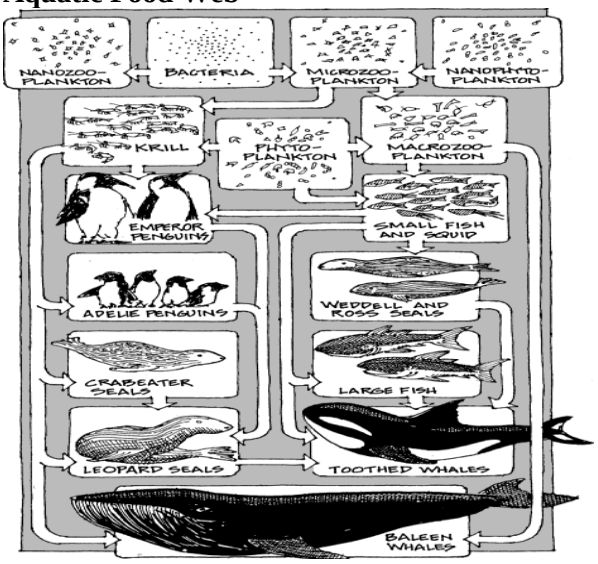
Phytoplankton consume carbon dioxide through photosynthesis at a rate comparable to that of forests and other terrestrial plants. When phytoplankton die, part of this carbon is taken to the deep ocean, and some is moved to various ocean strata as phytoplankton are consumed by other organisms, who then reproduce, produce waste, and eventually pass away.



The majority of the carbon dioxide that is transferred from the atmosphere to the ocean is

done so by phytoplankton. In the same way that carbon is held in a tree's wood and leaves, when carbon dioxide is converted into carbon during photosynthesis, it is integrated into the phytoplankton. When phytoplankton is consumed or decomposes, the majority of the carbon is returned to the near-surface waters, but some is lost to the depths of the ocean.

Aquatic Food Web



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