BHARATHIDASAN UNIVERSITY
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Programme: M.Sc., Marine Biotechnology

Course Title : Important marine Organisms and their behavior

Course Code: 21 CC 4a

Unit-I

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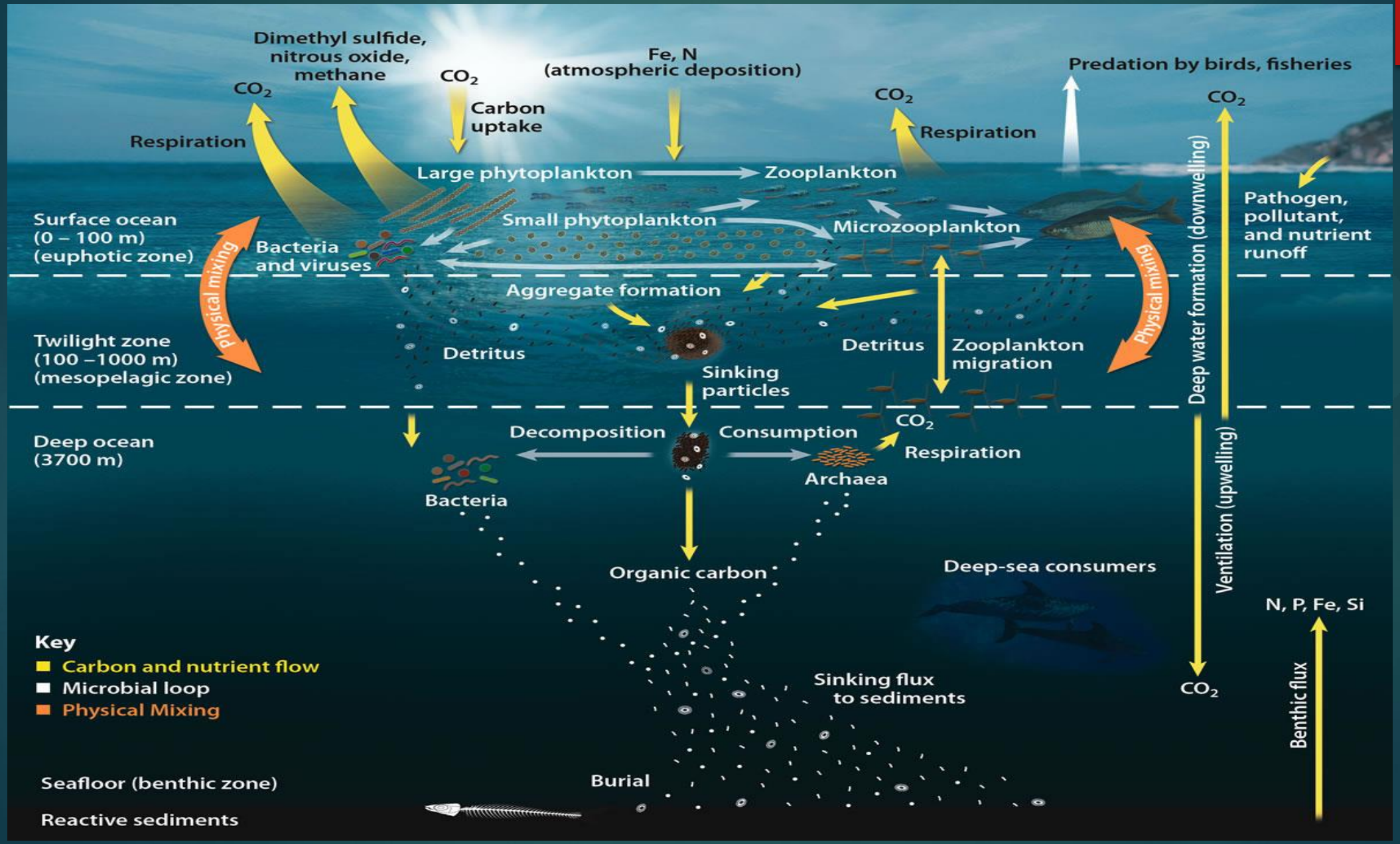
Introduction

- Marine environment comprises salt water environment with coastal area and open ocean.
- Like terrestrial ecosystem, aquatic or marine environment has its own ecosystem and energy transfer mechanisms.
- Producers, consumers and decomposers, specific to marine system.
- Unlike land, they have special adaptations and morphology .
- **Estuaries, salt marshes, mangrove forests, coral reefs, the open ocean, and the deep-sea ocean** are the major ecosystems.
- Distribution of organisms in these ecosystems may change but are inter related.
- Among them the largest producers exists in ocean waters.



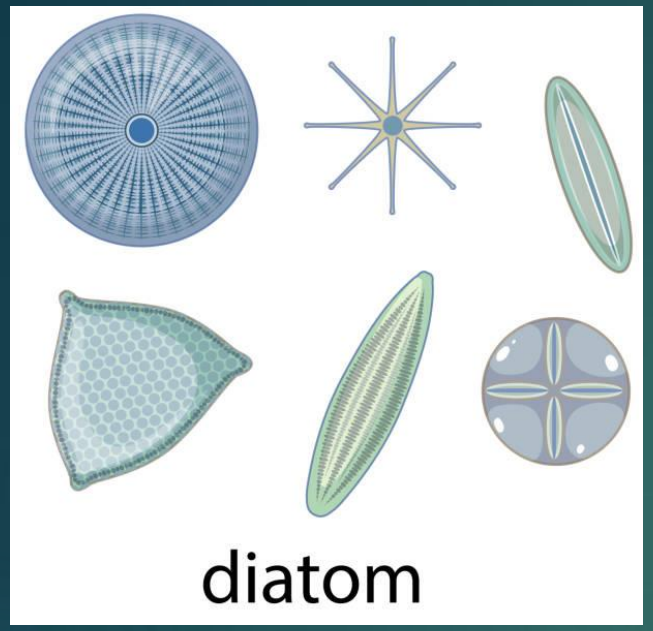
Zonal distribution of organisms

Marine flora

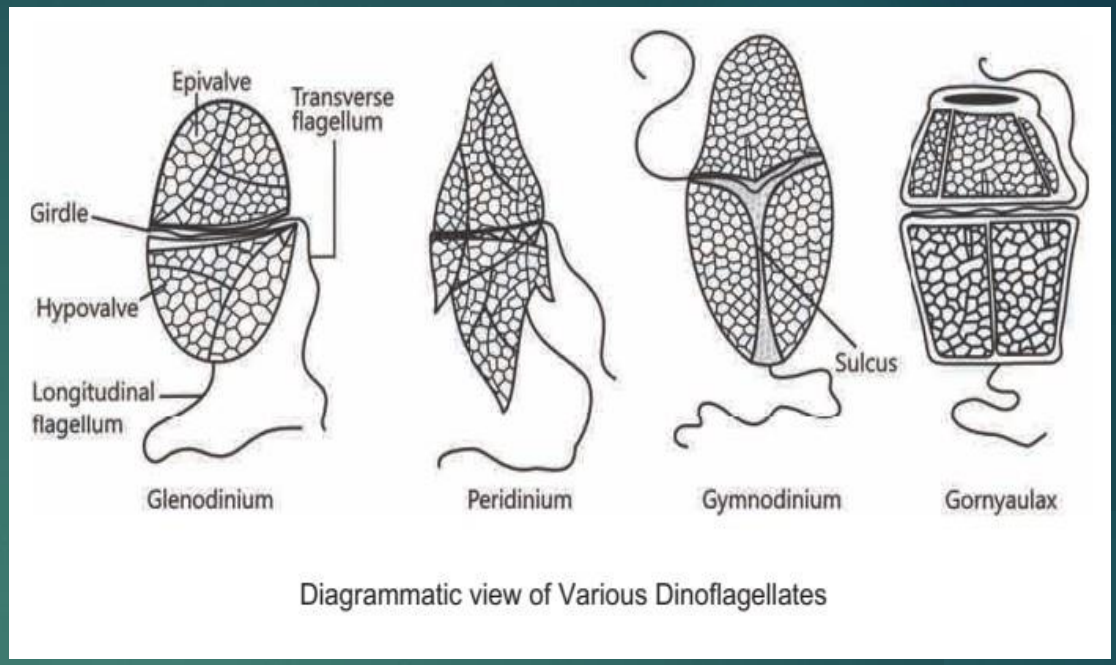
- Many fascinating photosynthetic organisms populate the oceans, but for the most part they are very different from the land plants that surround us.
- Most, in fact, are not considered plants at all and therefore are not members of the kingdom Plantae. Non-plant photosynthetic organisms include photosynthetic bacteria and unicellular algae and the seaweeds. Some biologists, however, consider some or all seaweeds to be plants.
- **Phytoplankton, algae, seaweeds, seagrass and mangroves** includes marine flora.
- There are always exceptions, a few seaweeds that are not primary producers but parasites of other seaweeds.

1.Phytoplanktons

- The phytoplankton, for example, include species of all size classes from the picoplankton to the megaplankton. Phytoplankton contain chlorophyll.
- Some phytoplankton are known to migrate to deep water at night to take in nutrients and move up to shallow, sunlit water the next day to carry out photosynthesis.
- Phytoplankton perform more than 95% of the photosynthesis in the ocean. This amounts to nearly half the world's primary production and produces nearly half the oxygen in our atmosphere.
- Diatoms, Dinoflagellates and cyanobacteria are part of phytoplanktons.
- The most abundant phytoplankton are cyanobacteria and various groups of protistan pico- and nanoplankton, including coccolithophorids, cryptophytes, and silicofl agellates. Among the larger net phytoplankton, diatoms and dinofl agellates are dominant.



diatom

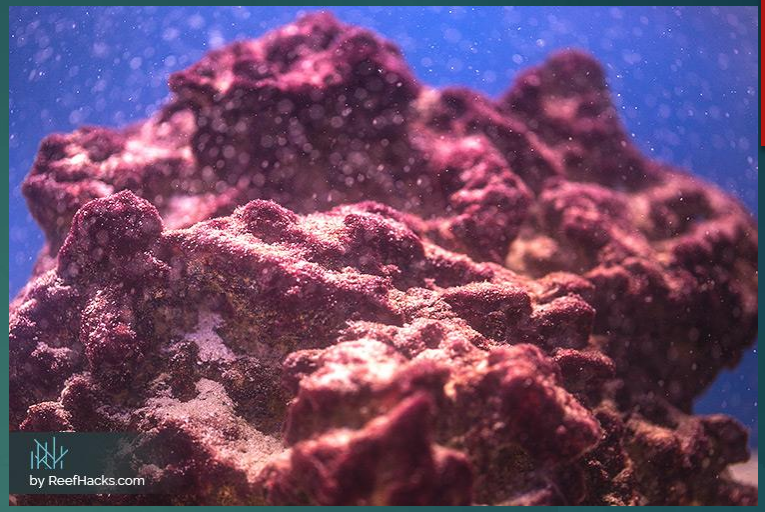


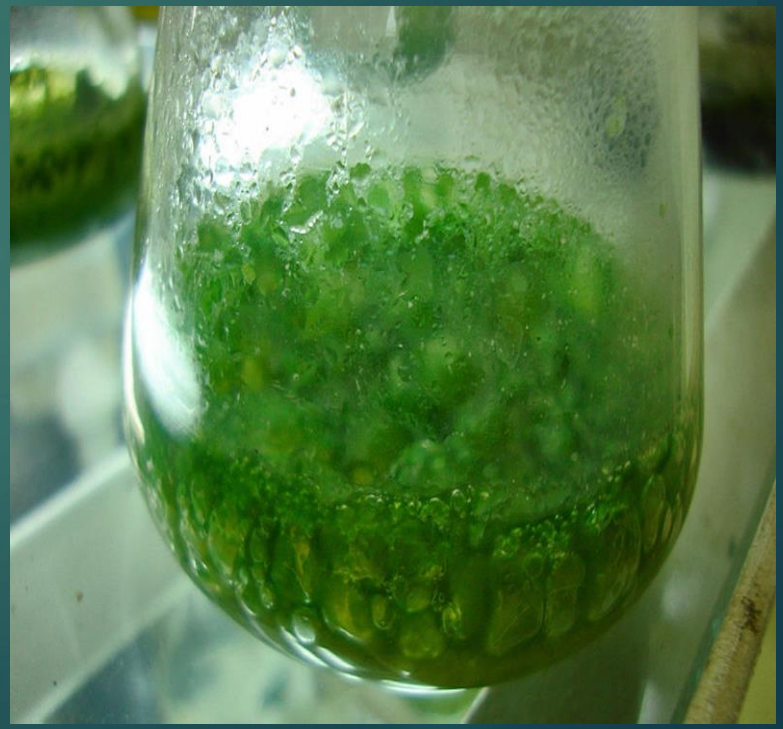
Diagrammatic view of Various Dinoflagellates

cyanobacteria

Structural features

- Cyanobacteria:-
- In addition to having chlorophyll a, as do eukaryotic photosynthetic organisms, most contain a bluish pigment called **phycocyanin**. Most marine cyanobacteria also have a reddish pigment, **phycoerythrin**.
- The visible color of the organism depends on the relative amounts of the two pigments. When phycocyanin predominates, the bacteria appear blue-green; when phycoerythrin predominates, they appear red.





- **Diatoms:-**
- Diatoms (division, or phylum, Bacillariophyta) are unicellular, though many species aggregate into chains or star-like groups. Diatom cells are enclosed by cell walls made largely of silica (SiO_2), a glass-like material.
- This glassy shell, or frustule, consists of two tightly fi tting halves often resembling a fl at, round, or elongated box.
- The characteristic color of diatoms is due to yellow and brown carotenoid pigments, in addition to two types of chlorophyll, a and c. Diatoms are effi cient photosynthetic factories, producing much-needed food (the food being the diatoms themselves), as well as oxygen, for other forms of life.
- Favorable environmental conditions, such as adequate nutrients and light, trigger periods of rapid reproduction called blooms.
- The glassy frustules of dead diatoms eventually settle to the bottom of the sea fl oor. They may form thick deposits of siliceous material that cover large portions of the ocean fl oor. Such biogenous sediments are known as diatomaceous ooze, a type of siliceous ooze.

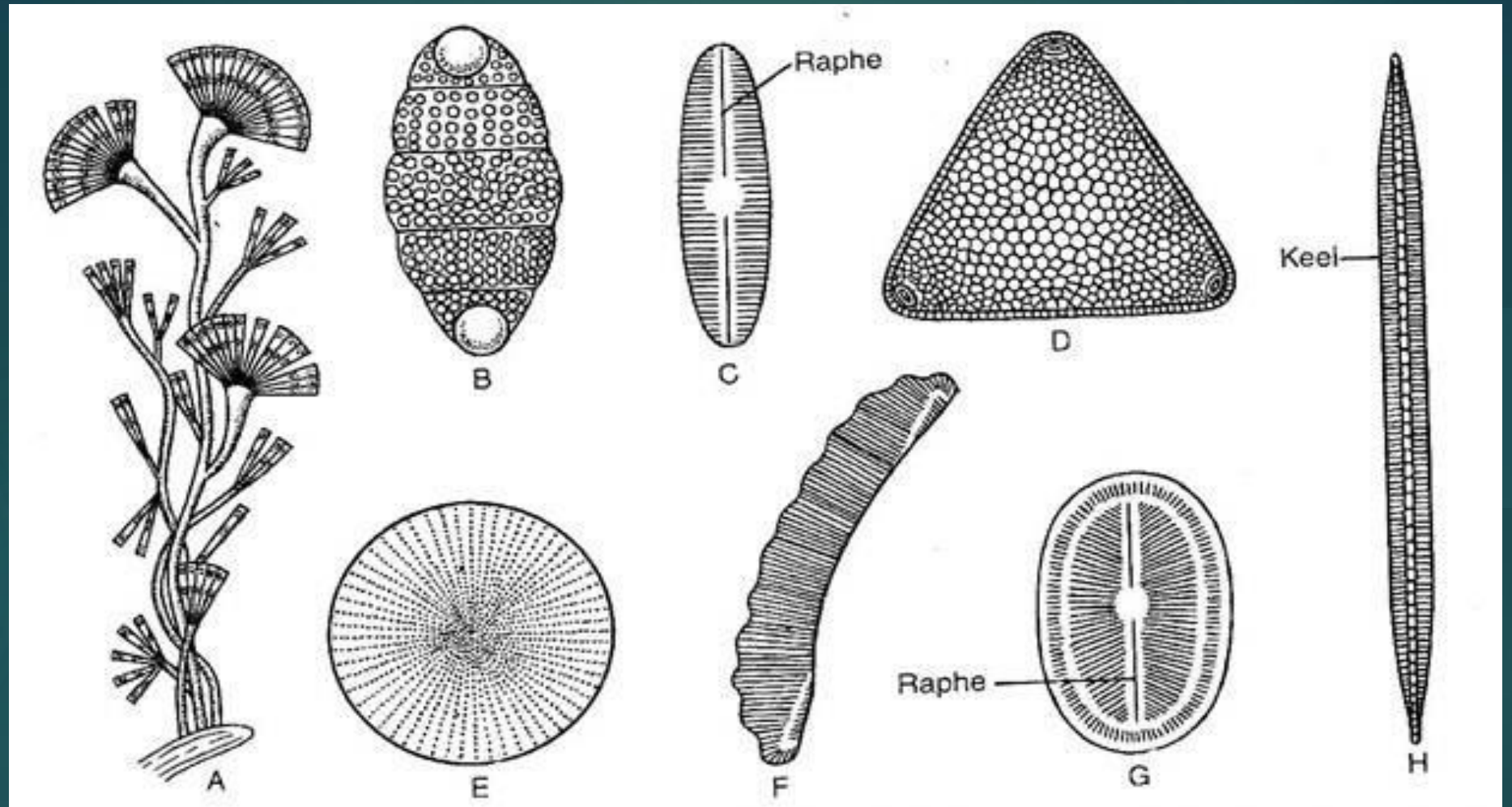
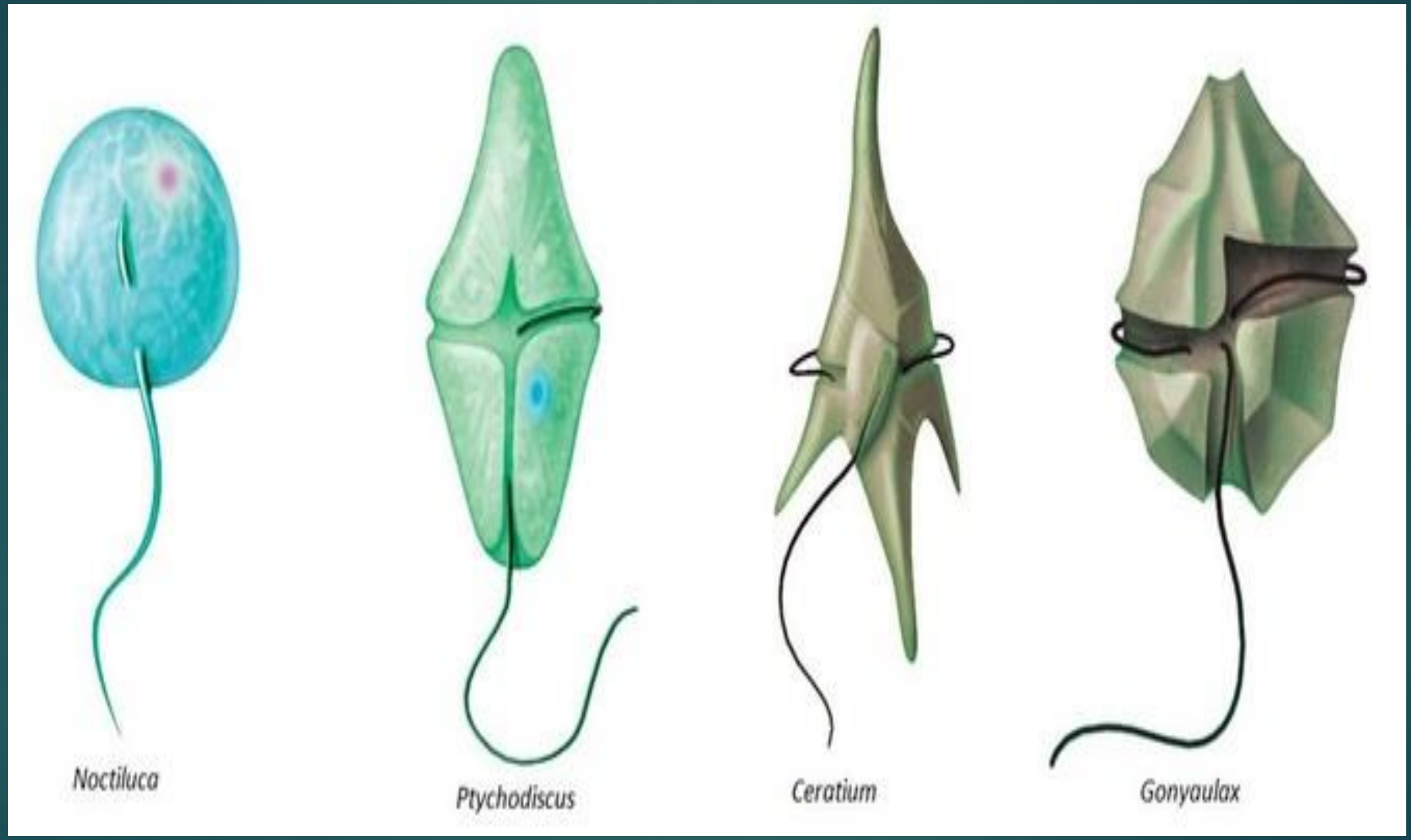


Fig. 3.100 : Different forms of Diatom : A. *Licmophora flabellata*, B. *Biddulphia pulchella*, C. *Achnanthes linearis*, D. *Triceratium planoconcavum*, E. *Cascinodiscus excentricus*, F. *Eunotia* sp., G. *Cocconeis placentula*, and H. *Bacillaria paradoxa*

- **Dinoflagellates:-**
- Dinoflagellates may be better-adapted to low-nutrient conditions than diatoms.
- The dinofl agellates (division, or phylum, Dinophyta) make up another large group of planktonic, unicellular organisms.
- Their most outstanding characteristic is the possession of two fl agella, one wrapped around a groove along the middle of the cell and one trailing free . These fl agella direct movement in any direction.
- Most dinofl agellates have a cell wall armored with plates made of cellulose,
- Though most dinofl agellates photosynthesize, many can also ingest food particles. A few .have a light-sensitive pigment spot that acts as a crude eye


Noctiluca
Ptychodiscus
Ceratium
Gonyaulax

seaweeds

- Seaweeds show a wide range of growth forms and complexity of structures.
- Seaweeds lack the true leaves, stems, and roots of plants. The complete body is known as the thallus (plural, thalli) whether it is a fi lament, a thin leafy sheet, or a giant kelp, Known as **blade**.
- The leaf-like, fl attened portions of the **thallus** of many seaweeds are known as blades . They have a large surface area and are the main photosynthetic regions, though all portions of the thallus are able to photosynthesize in light as long as they have chlorophyll.
- Gas-fi lled bladders known as **pneumatocysts** sometimes keep the blades close to the sea surface, thereby maximizing their exposure to the sunlight.
- Some seaweeds have a distinct, stem-like structure to provide support, **the stipe** , from which blades originate. And root like structure known as **holdfast.**

Types:-

- There are three types of seaweeds: the green, brown, and red algae.
- Most multicellular green algae have a simple thallus compared to the other two groups of seaweeds. Their pigments and food reserve are the same as those in plants.
- Brown Algae The color of the brown algae (division, or phylum, Phaeophyta), which actually varies from olive green to dark brown, is due to a preponderance of yellow-brown pigments, particularly fucoxanthin, over chlorophyll.
- Red Algae There are more species of marine red algae (division, or phylum, Rhodophyta) than of marine green and brown algae combined. Among other features, they have red pigments called phycobilins, which mask chlorophyll .
- Most species actually are red, though some may have different colors depending on their daily exposure to light

Brown algae

- The simplest brown algae have a finely fi lamentous thallus, as in the widely distributed Ectocarpus. The thallus is fl at and branched in Dictyota and fan-shaped and lightly calcifi ed in Padina .
- Both are tropical and subtropical. The thallus of most species of Desmarestia is branched in many ways. Desmarestia is found in cold waters. It ranges from the Antarctic, where it is one of the dominant species, to temperate shores elsewhere.
- The kelps are the most complex and largest of all brown algae. Most kelps are found below the low tide level in temperate and subpolar latitudes. In these environments they can occur in great abundance, providing food and shelter for many other organisms.
- Kelp beds are harvested by chopping off the tops for the extraction of several natural products.

Green algae

- Certain species dominate in environments with wide variations in salinity, such as bays and estuaries and isolated tide pools on rocky coasts.
- Filamentous green algae may be common on rocks in shallow water and other seaweeds, as well as in rocky shore tide pools.
- Several other green algae consist of thin fi laments or tubes (siphons) formed by a single giant cell with many nuclei. Such is the case in Caulerpa, which is restricted to the tropics and subtropics.
- Halimeda, a calcareous green alga, consists of numerous segments with deposits of calcium carbonate . The accumulation of its dead, calcifi ed segments plays an. important role in the formation of coral reef

Red algae

- The structure of the thallus of red algae does not show the wide variation in complexity and size seen in brown algae. Some reds have become greatly simplified, at least in their structure, by becoming parasites of other seaweeds.
- The coralline algae are red algae that deposit calcium carbonate within their cell walls. They are important in several marine environments. The calcified thallus takes a variety of shapes: thin disks growing over other seaweeds, branches with many joints (Corallina; Fig. 6.10), smooth or rough encrusting growths on rocks.
- Red algae inhabit most shallow-water marine environments. Some are harvested for food and for the extraction of various products.

SEAWEEDS

1. Fucus. 2. Nitella. 3. Phyllophora. 4. Codium. 5. Macrocystis. 6. Delesseria. 7. Laminaria. 8. Caulerpa. 9. Rhodymenia.

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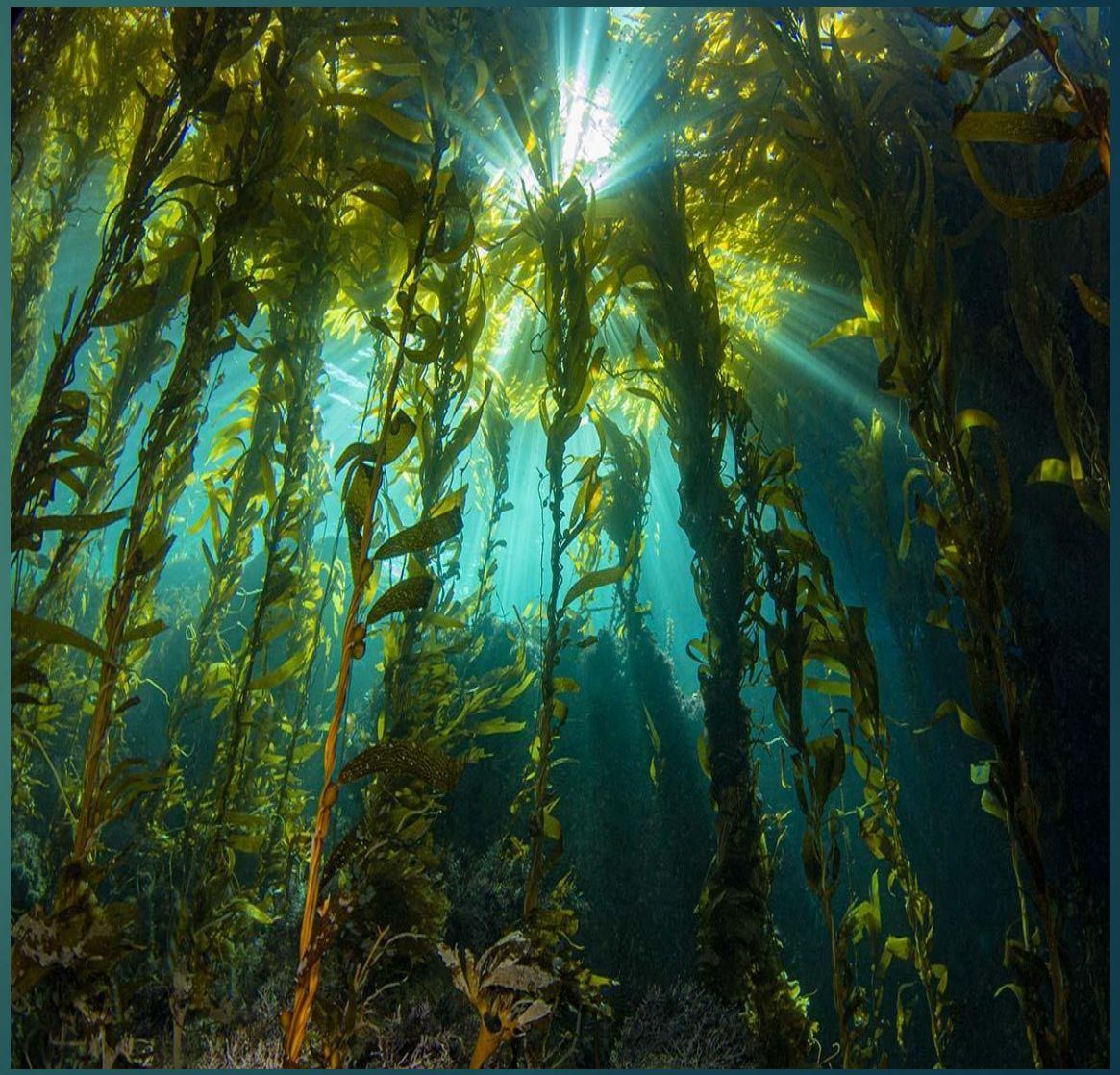
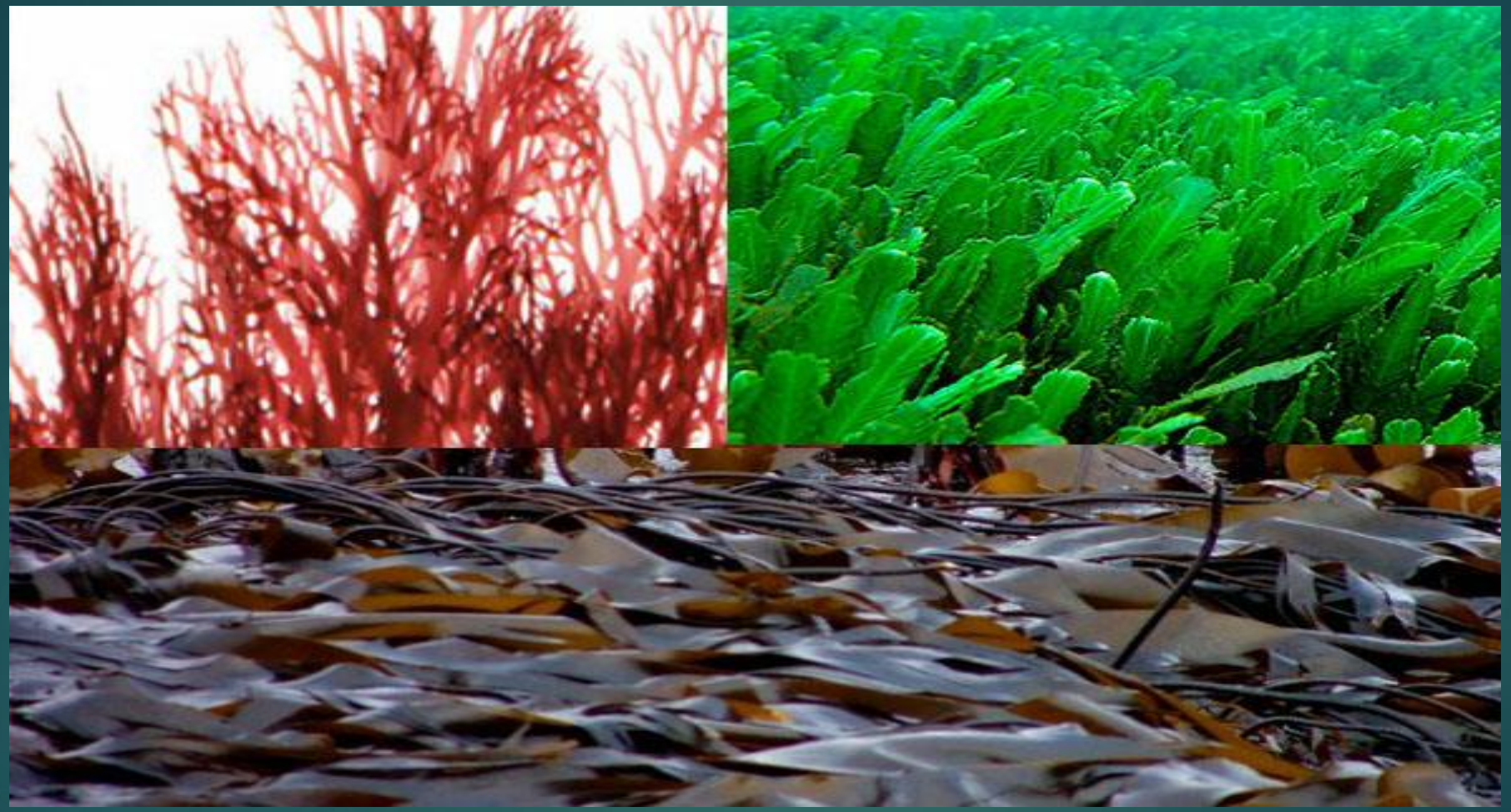
Kelp forests in underwater



Monterey Bay kelp forest

- The rocky nearshore environment of the Monterey Bay National Marine Sanctuary (MBNMS), like the rest of central California, is characterized by dense forests of kelp growing at depths from 2 m to more than 30 m (Foster and Schiel 1985).
- The giant kelp *Macrocystis pyrifera* and the bull kelp *Nereocystis luetkeana* are the dominant canopy-forming kelps in this region, and make up the major forests within the MBNMS.
- The Kelp Forest is one of the tallest aquarium exhibits in the world. You'll get a diver's-eye view of sardines, leopard sharks, wolf-eels and a host of other fishes as they weave through swaying fronds of kelp, just like they do in the wild.



Sea grasses

- Seagrasses superfi cially resemble grass but actually are not grasses at all. The closest relatives of certain seagrasses seem to be members of the lily family, so we know that seagrasses evolved from land plants.
- They have horizontal stems called rhizomes that commonly grow beneath the sediment. Roots and erect shoots grow from the stems . Seagrass flowers are typically very small and inconspicuous because there is no need to attract insects for pollination.
- These flowering plants, grass-like in appearance but unrelated to true grasses, have become established in the marine environment.
- Typical seagrass beds in this region consist of several species of seagrasses living together. Among the most common are turtle grass (Thalassia), paddle grass (Halophila), strapweed (Amphibolis), and ribbonweed (Posidonia).

Types Of Sea Grasses And Their Location

widgeon grass

Johnson's grass

star grass

manatee grass

shoal grass

Turtle grass

Paddle grass

Seagrass meadows

Smithsonian ocean

Shark Bay, Australia

Gulf of Mannar, Indian Ocean

Mangroves

- Mangroves are trees and shrubs adapted to live along tropical and subtropical shores around the world. They are essentially land plants that can tolerate salt. Luxuriant and very productive mangrove forests flourish along muddy or sandy shores protected from waves.
- Adaptations become more crucial in mangroves living right on the shore, such as species of the red mangrove (Rhizophora) , which are found throughout the tropics and subtropics.
- Different adaptations have evolved in some estuarine plants. Cordgrasses (Spartina), other salt-marsh plants, and some mangroves actually excrete excess salts by way of salt glands in their leaves.
- mangroves, develops pneumatophores, conspicuous, unbranched extensions of the shallow roots that grow upward from the oxygen-poor mud to help aerate the plant tissues.

Pichavaram, Mangroove forest

Sundarbans

Pneumatophores in coastal Tanzania

THANK YOU