E-AQUALEX
Aquatic Sciences
e-learning Toolset

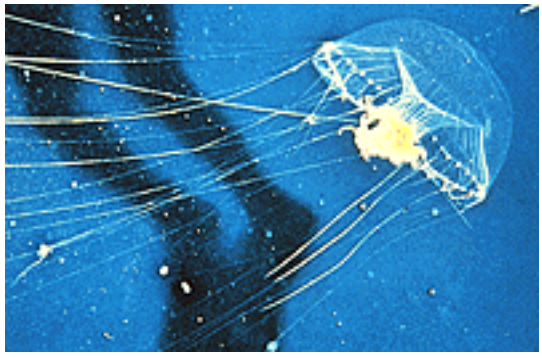
Section 2 Week 5

The Living Element Part 1

Pelagic fauna

1.1

Life first made its appearance in the oceans and it was there that it evolved into the main taxonomic categories. That is why all the higher taxonomic categories are present in the marine environment, even though there are far fewer marine species than terrestrial ones. On land, the conditions of heterogeneity in space and time caused a higher speciation rate (or biodiversity) and that is why today the vast majority of living species is terrestrial.



The oceans and the seas are nevertheless inhabited by many species, differing greatly in appearance but differing even more in function. The aim of this section is to give a brief overview of this variability and to describe the adaptations which marine organisms have developed in order to cope with different situations (and their intrinsic problems) in the marine environment.

1.2

Plankton

The term plankton is used to denote those organisms which live suspended in the water column and are unable to move against water currents.

Planktonic organisms are somewhat tentatively divided into two categories: phytoplankton (organisms that acquire energy through photosynthesis) and zooplankton (the animal component). In **Figure 12** a systematic list of the main plankton groups is presented.

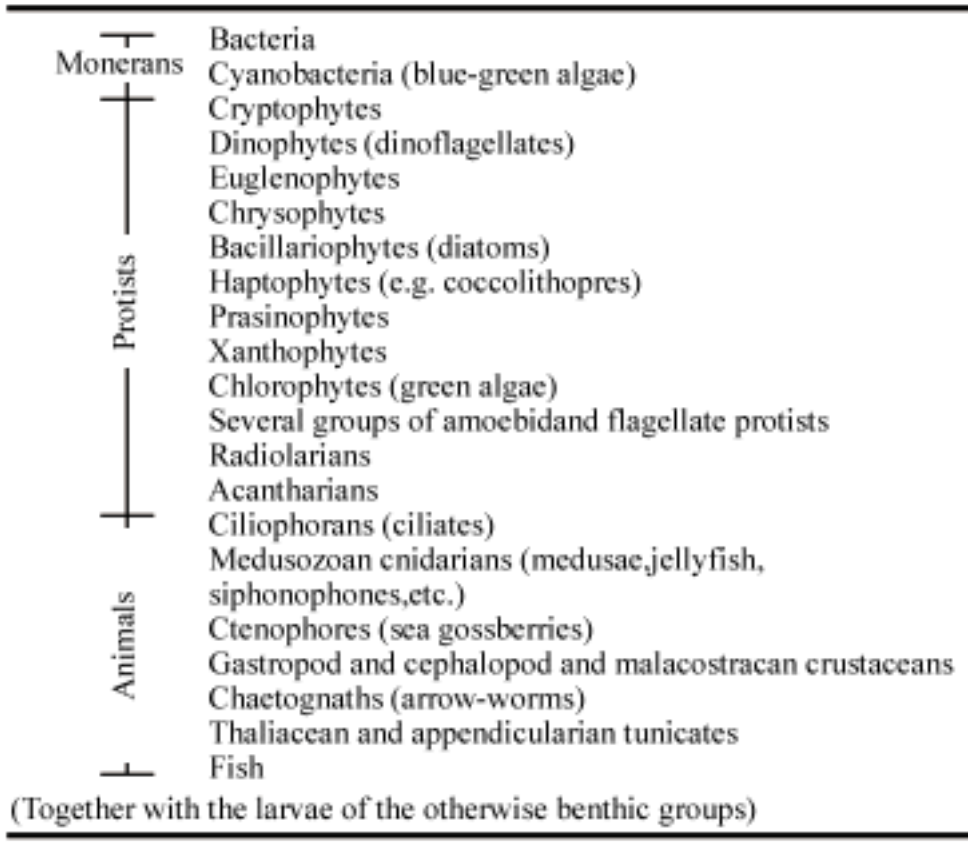


Figure 12. Systematic list of the main groups of planktonic organisms (parasites excluded)

1.3

Phytoplankton

Phytoplankton organisms are usually very small unicellular organisms that, in some species, form filaments or undifferentiated sets of cells (thallus).

Phytoplankton is the main food source and as such, provides energy to the entire marine ecosystem. Phytoplankton grows by means of nutrients such as inorganic salts, nitrates and phosphates, solar energy and carbon dioxide (CO^2). Photosynthesis can only take place in the depth layer that has enough light to run this process. This zone is called the euphotic zone. In temperate areas, the optimal doses of the first two of these factors occur in spring and autumn, frequently resulting in a population explosion (sometimes termed bloom), i.e., a rapid increase of the amounts of phytoplankton organisms in sea water. This bloom is very important for a wide range of organisms which try to synchronize their egg-hatching period to it so that their newly hatched offspring (larvae) will have enough food for the first stages of growth.

However, when extremely high concentrations of phytoplankton occur in conjunction with other factors, for instance limited water circulation, there is a possibility of an excessive production of secondary metabolites (toxins) which will lead to a subsequent poisoning of a wide range of marine organisms over an extensive area. These large temporary concentrations dominate the community and this can result in discoloured water which has given rise to the term"red tides".

1.4

Zooplankton

In this category are included many animal species, usually very small in size, some of which remain planktonic organisms (holoplankton) throughout their entire life cycle; some pass through as young larval individuals which belong to larger species. After the hatching-out stage, the latter spend one stage of the life cycle as planktonic organisms (meroplankton), and after metamorphosis, they adopt a completely different life mode and are incorporated into nekton or benthos. Zooplankton organisms feed on phytoplankton or detritus.

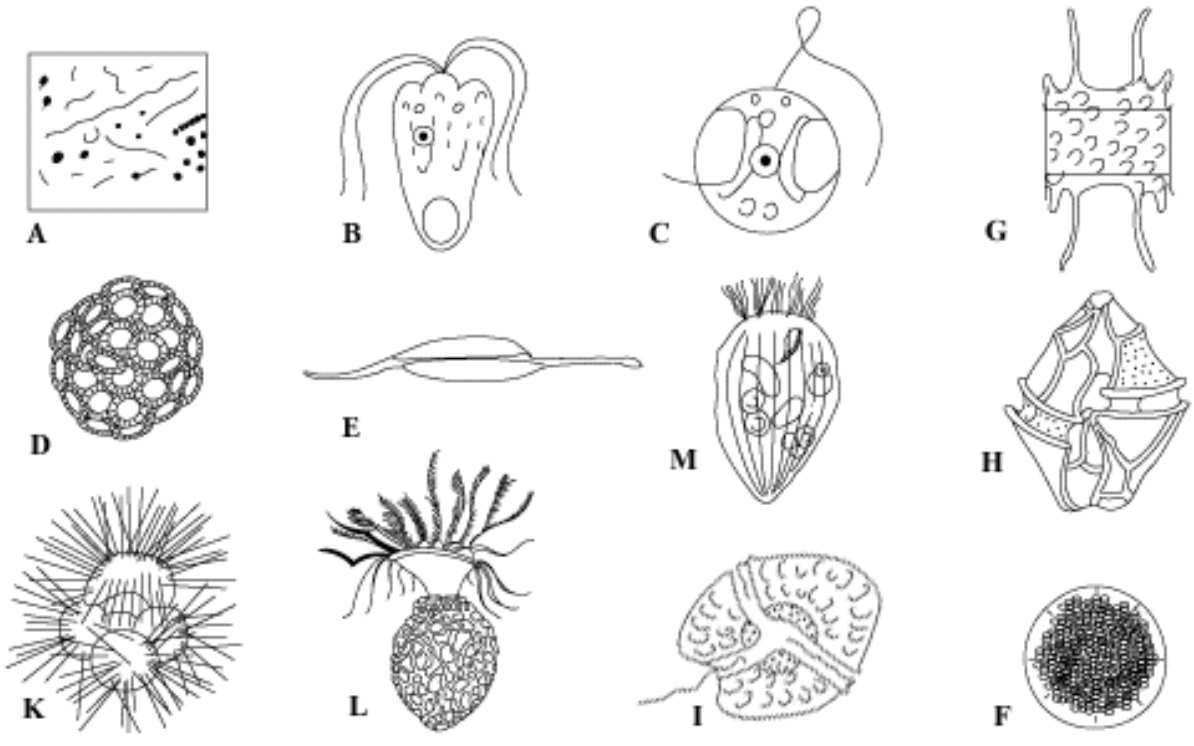


Figure 13. Representative members of the ultra-, nano-, and microplankton: A.bacteria: B,C.flagellates; D,coccolithophores; E,G.diatoms; H,I.dinoflagellates; J.foraminiferan; K.ciliate; and L.tintinnid.

Because of their limited mobility, both phyto- and zooplankton organisms have to deal with the problem of sinking. It is therefore necessary for these to have a specific body weight as close as possible to that of sea water. Since cytoplasm (the fluid in the interior of cells) is a just a little heavier than sea water, it must be counterbalanced by the formation of oil (or fat) droplets. This is also why they have developed long thin appendices along with a very small body so that the ratio body surface/body volume becomes maximal since friction which slows down sinking is proportional to that ratio. Other relevant adaptations that have taken place are the minimization of the weight of the skeletal parts, and the excretion of gas retained in various compartments which act like floats.