

## Week 10

### Section 3: The Marine Environment

#### Functional aspects - Part 1

##### 1. The food chain concept

###### 1.1

The constituent parts of the marine system do not stand alone and must not be considered in isolation; they are interrelated through a complex of relationships not always easily understood even by those specialists who have worked for years on the marine environment.

**The food chain concept** provides a reasonably satisfactory model as a first approach to the functional aspects of the marine environment.



###### 1.1.1

**Some indispensable terminology, definitions and descriptions.**

###### 1.1.2

The **photosynthetic organisms**, also known as **primary producers**, use solar energy, nutrients and CO<sup>2</sup> to produce vegetal material and oxygen.

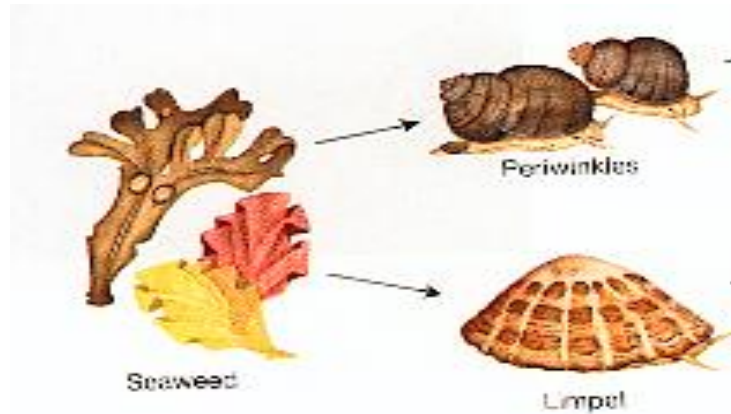
###### 1.1.3

**Herbivores** of various types and sizes, also known as **secondary producers or primary consumers**, make use of the production of the photosynthetic organisms to cover their energy needs.

###### 1.1.4

In exactly the same way, **first order carnivores, or tertiary producers**, feed on the biomass of herbivores until they in their turn are eaten by **higher carnivores, called quaternary producers**.

Biomass, that is to say, the weight of live body tissues, from each of these links in the food chain at any given time, is called standing crop; while the production to time ratio (i.e. the biomass produced in a time interval divided by the length of this time interval) is defined as productivity.



#### 1.1.5

**Productivity** is not the same in each link of the food chain and is very closely related to the general characteristics of the environment (nutrients concentration, temperature, solar radiation etc.), as well as on food availability and size. Since small organisms usually have high productivity, this should be seen as an important characteristic of the marine environment because the latter is based on the microscopic phytoplankton.

### 1.2 General rules in operation

#### 1.2.1

They utilise only part of the available standing crop of the previous trophic link; in other words, not all the vegetal production is consumed by herbivores, nor are herbivores consumed by carnivores, etc.

#### 1.2.2

Some of the energy consumed is used for body development, some for respiration and some for reproduction. Thus the higher an organism is located in the food chain, the higher the energy losses they have sustained and consequently there is less overall disposable energy.

#### 1.2.3

During their lifecycles, all organisms produce excretions, some of which can be and is utilised by other organisms as food, and all organisms produce carbon dioxide which can be utilised by plants for photosynthesis.

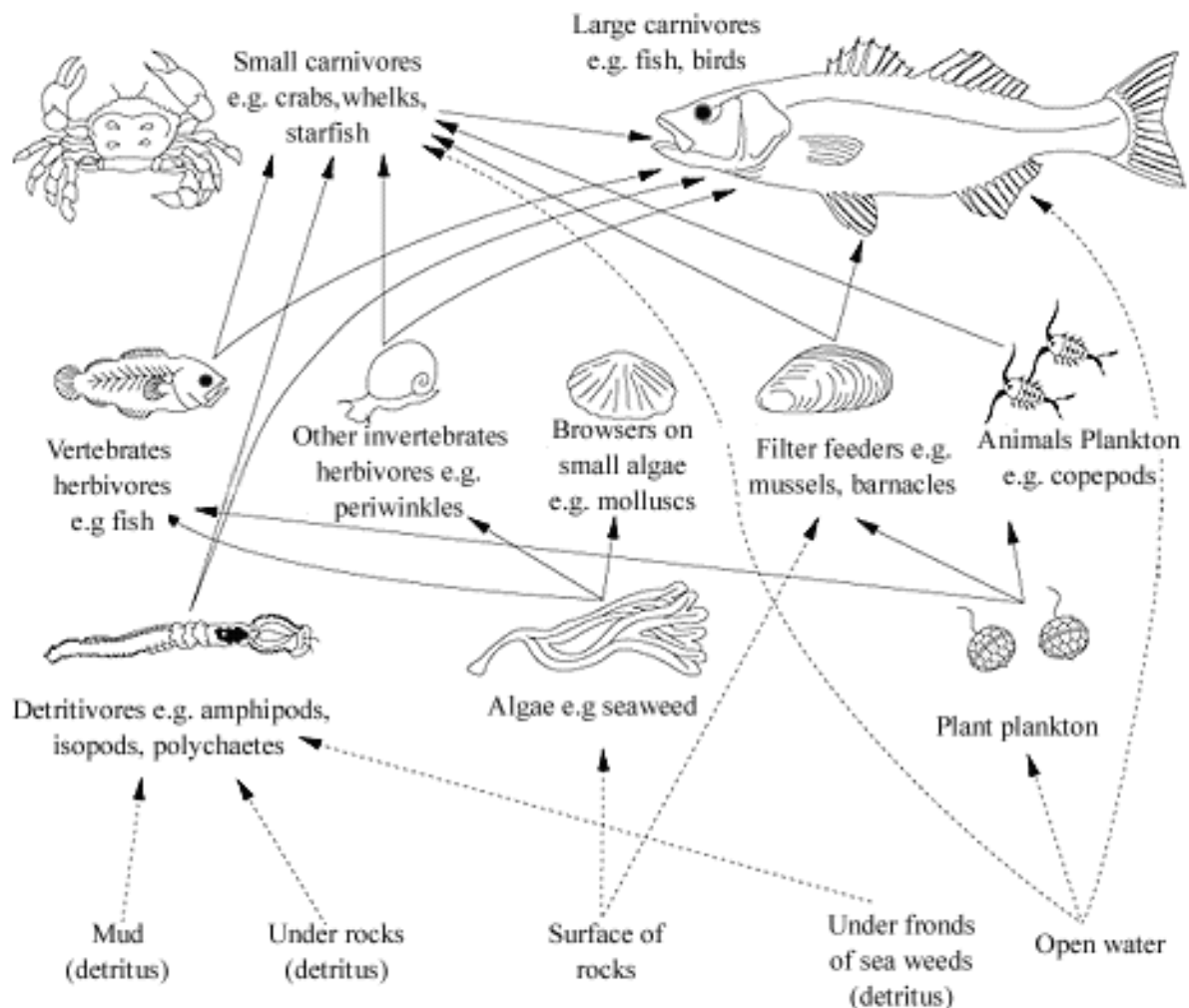
#### 1.2.4

The excretions as well as the dead bodies of the marine organisms, will sooner or later end in bacterial activity which through mineralization produces the raw / primary material for photosynthetic organisms.

### 1.3 Complexity of Concept

#### 1.3.1

All the above general rules have been simplified to some extent, without straying far from the truth. One of the problems of the food chain paradigm is that it can give the impression there is a one-to-one relation between successive links while in reality the relations are much more complex: many organisms adopt alternative feeding methods which correspond to food availability, and it is quite common for adults to belong to a different trophic link than the juvenile individuals of the same species. The contemporary concept is that of the food web, an example of which is given in **Figure 20** below.



**Figure 20.** Food web