Week 11

Section 3: The Marine Environment

Functional aspects - Part 1

1. The food chain concept Part 2

Food chains

Food chains or nets can be of different length or complexity. An example for a short food chain may be found in Antarctic waters from primary producers (diatoms) over krill (herbivorous crustaceans) to baleen whales that filter the krill out of the water. Much longer food chains may be found in tropical waters where 5-7 steps lead to the top predator.

1.4 Competition

1.4.1

The complexity of these trophic relationships is linked to the concepts of competition and stability. There is competition between two species when both have the same preferences for a single limited natural resource. This concept has immense repercussions because it obviously covers all the life parameters of any given species.

1.4.2

As far as food is concerned, however, it is easily understandable. In Figure 20 it can be seen that herring juveniles and sand eel have to a large extent overlapping feeding preferences. Some decades after this Figure was produced, the herring population of the North sea fell drastically, and almost reached extinction levels, because of over-fishing. One of the consequences of this extreme drop in population was a correspondingly drastic increase in the sand eel population in the area (normally preyed on by herring).

1.5 Stability of the ecosystems

1.5.1

The stability of the ecosystems has attracted the attention of many marine ecologists. In **Figure . 21** the two main concepts related to this aspect are presented.

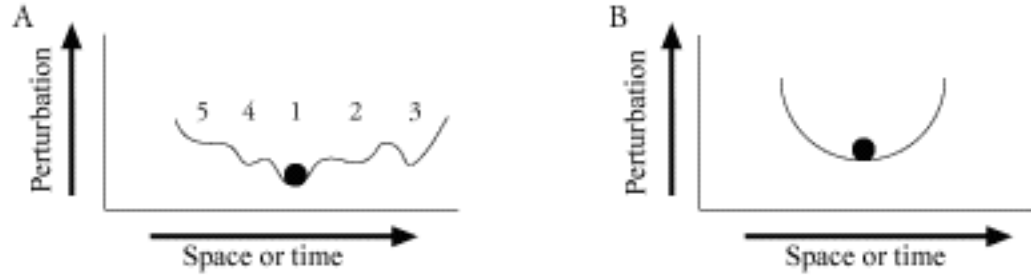

Figure 21. Models of the stability of communities. The ball represents the community, which can be perturbed from stable equilibrium. A, In neighbourhood stability there are

1.5.2 **The global stability concept**

According to this, the disturbance of an ecosystem (caused by a pollution event or incident, or an ecological catastrophe) may alter its faunal and floral composition, but sooner or later it will recover and come back to its initial regime, once the activity of the disturbing factor has ceased.

1.5.3 **The multiple stable states equilibrium concept**

According to this, the restoration to the initial state will occur only if the disturbance is relatively small, otherwise various alternative states may occur, and some of these may be quite different from the original.

1.5.4

The latter concept has gained ground over the last few years, because human activities now have in their turn the potential to cause large scale and high intensity disturbance. Of course anthropogenically induced intense disturbance is directly related to pollution and, in particular, is related to the depletion and loss of natural resources. For instance, when a natural population dies out in a certain area because of overfishing the species composition is altered. New species combinations are established and these may inhibit the re-establishment of the local population which has died out. Serious problems will still arise even if the population has not totally disappeared, but is only severely depleted.

1.5.5

This is the concept of the **critical population size** below which reproduction fails, while the random (stochastic) variation of mortality can wipe out an entire population. Critical population size is a theoretical concept which has a practical meaning mainly in the case of K-strategy species i.e. relatively large size species with few offspring. These species are much more susceptible to environment disturbance and the decrease of their population. Perhaps this is the reason why conservation movements usually organise campaigns to save large size animals (seals, dolphins, whales) which give birth to only one youngster. No efforts are ever made to save polychaetes, worms or small crustaceans which lay thousands of eggs, although it could be argued that both categories have a similar right to survive. In addition, it cannot be asserted that either category is of lesser importance to an ecosystem. One step towards this goal is the formulation of red lists of endangered species or habitats.