INTRODUCTION TO THE MARINE ENVIRONMENT

E-AQUALEX COURSE

Introduction to the Marine Environment is a Level 6 (EQF) tutor-led course for B.Sc. undergraduates who wish to specialize in the marine sciences. The 12-week course introduces essential information about the abiotic and the living elements.

No prior knowledge required.

Aims of the course
* to provide basic knowledge on the marine environment for those entering this field of study for the first time
* to provide an overview of the marine environment for educators engaged in environmental studies at varying levels

Week 1

Section 1 Abiotic Elements

Part 1

1. Light

Light is an ecological factor of primary importance in the marine environment. As in all ecosystems, without light there can be no photosynthesis, nor can there be any primary production. Thus, primary production is influenced both by the quantity and the quality of solar radiation. The quantity of solar radiation reaching the marine environment and its temporal distribution is related to a series of factors such as:

a) **latitude** which determines the angle of incidence (which in turn determines the reflection percentage) and the temporal distribution of radiation

b) **season of the year** which is also related to the angle of incidence but also to the quantity of radiation which reaches the sea surface daily

c) **the cloud factor** which has a major influence on the amount of radiation reaching the sea surface

d) **the composition of the atmosphere**, containing ozone, carbon dioxide and dust, is also responsible for reducing the amount of the incident radiation

e) **the composition of sea water**, containing dissolved substances and suspended particles, significantly affects the amount of radiation reaching the deeper layers.

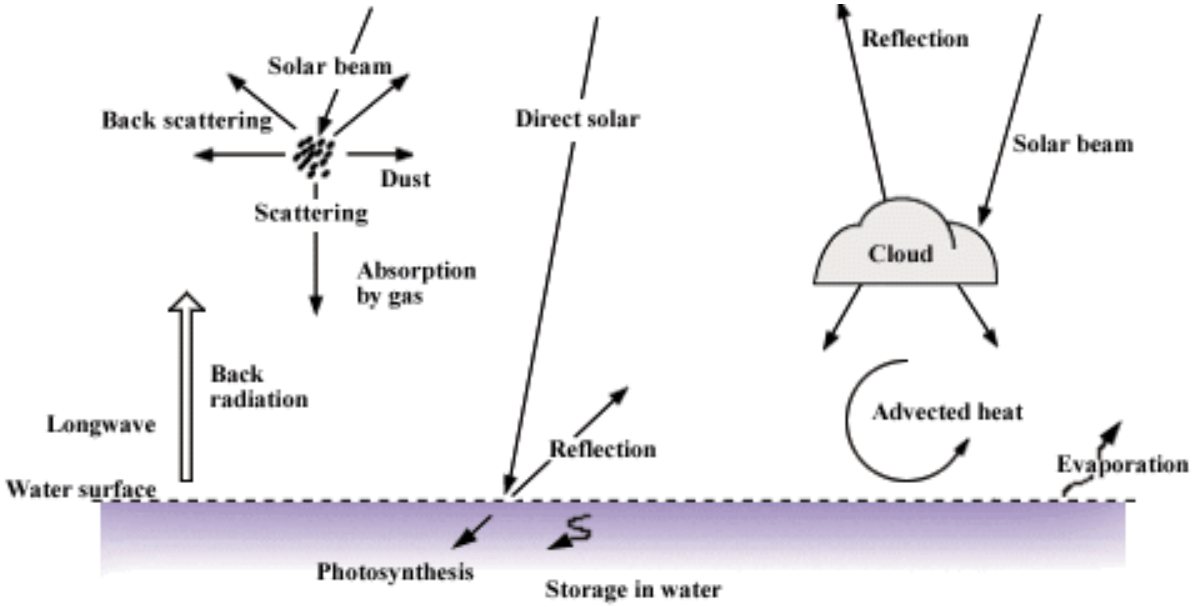

Figure 1. The energy balance of the surface.

The quality of **radiation**, i.e. the wavelength of the partial radiation, is affected by the density of the layers run by the light. In sea water both infra-red and ultra-violet radiation are absorbed in the surface layers while blue penetrates to the maximum depth.

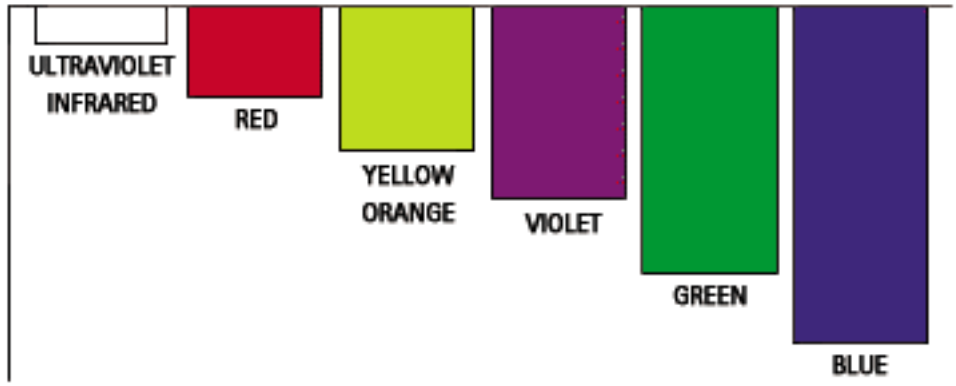

Figure 2. Relative penetration of different wavelengths of light through lake water.

Different categories of plants make use of different ranges of visual radiation for photosynthesis, and thus have the ability to colonize different depths of the water column. However, there is a depth beyond which photosynthesis will not be sufficient to cover the energy demands of the plants. This depth, known as **compensation depth**, is a very important limiting factor from the ecological point of view. Below that depth, organisms are completely dependent on the energy produced in the upper layers.

A problem related to eutrophication processes in coastal waters is the observed increase in light attenuation in surface waters that leads to shifts in distribution patterns of algae as revealed by historical comparisons in Swedish coastal waters.

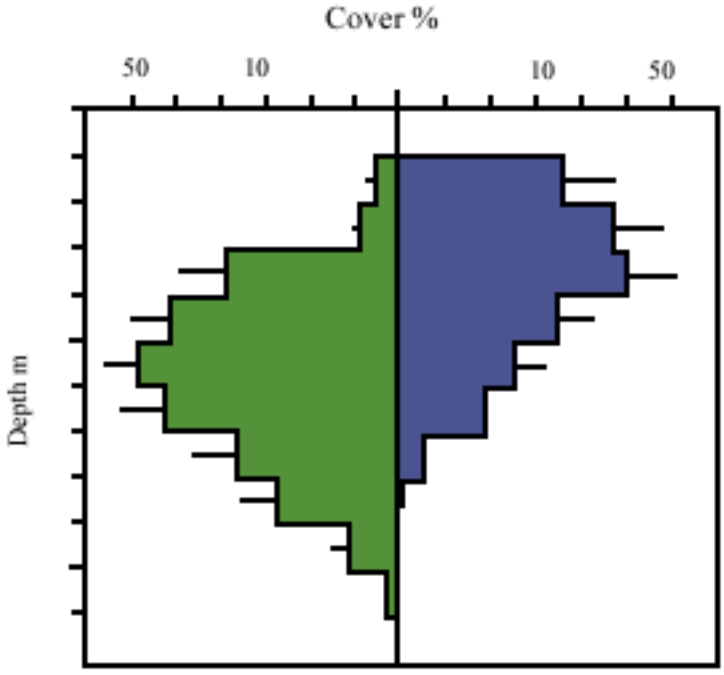

Figure 3. Kautsky plot vs 1986.

Another ecological aspect related to the drastic decrease in the radiation reaching deeper layers (reduced tenfold with almost every 75 m of depth) is the problem of vision. Those organisms living in **shallow water**s have to cope with problems such as:

i) avoiding predators during the day

ii) finding and identifying food items

iii) recognising individuals of the opposite sex for mating.

In the **deeper layers**, reduced radiation leads to specific adaptations, such as:

i) enlarged eyes (although there are also species with degenerated eyes)

ii) increased sensitivity pigments

iii) over-development of other senses

iv) the bioluminescence phenomenon.

The latter has been detected in representatives of various animal groups and has obviously occurred through different evolutionary paths. Bioluminescence functions are not completely understood except for some obvious ones (attraction of the opposite sex, and of prey etc.).