

## **The phenomenon of eutrophication**

The knowledge of the environment surrounding us has always represented one of the primary objectives of man since the time of the most ancient civilizations. Step by step, in the course of time, we have become aware that it is now necessary to carry out actions of control and monitoring on ecosystems in order to preserve natural resources.

Eutrophication is a phenomenon of enrichment in nutritional substances (above all phosphorus and nitrogen salts) occurring in aquatic ecosystems, which can modify the balance of the whole system, whose productivity is then no longer limited to the nutritional salts available. Obviously such phenomenon occurs in geologic times but it can be accelerated by human activities in coincidence with the re-introduction in the ecosphere of high quantities of nitrogen and phosphorus dug out of their geological reserves for agricultural (fertilizers) and industrial (waste) use.

There are various definitions of eutrophication. One of the first coined was by OCSE (Organizzazione per la Cooperazione e lo Sviluppo Economico = Organization for Cooperation and Economic Development) in the 70s: "eutrophication is the enrichment of waters in nutritional salts, which causes typical changes such as an increase in the production of algae and water plants, the impoverishment in fish resources, a general degradation of the quality of the water, and other effects that reduce and preclude its use".

At present new definitions are:

"an increase in the amount of organic substance supplied to an ecosystem". Scott W. Nixon (1995)

"a phenomenon of ecologic instability caused by a surplus in the supply of organic substance to an ecosystem." Izzo et al. (1998).

With regard to the phenomenon of "eutrophication", there is increasing awareness that it causes a series of direct and indirect effects on biological communities, according to the morphological and hydrodynamic characteristics of the aquatic ecosystem. The rapid increase of nutritional substances stimulates the growth rate of the autotrophic component (algae, water plants, phytoplankton) with consequent overloading on the mineralization processes of organic substance. This in turn causes a drastic decrease in the levels of oxygen, thus determining a condition of hypoxia and anoxia.

The initial effect of eutrophication, due to the decreased content of oxygen in the water, is the alteration of phytoplankton and benthos species; macrophytes only present an increase in epiphyte species and fish can present slight changes in their species, although these are not as accentuated as phytoplankton and benthos.

The second effect is a reduced distribution of macrophytes in deep waters, due to a reduction of light caused by the increased phytoplankton biomass that makes waters turbid. The change occurring in oxygen concentration, which tends to diminish because of the biomass of decomposing algae, induces a change also in the behaviour of fish, that move away changing their biotope.

The final effect is a massive growth of "opportunistic" algae (e.g. *ULVA RIGIDA*, *CLADOPHORA* sp), an increase in toxic phytoplankton species, the mortality of benthonic species and fish because of the reduced quantity of oxygen and consequent reduction of specific biodiversity.

The extreme effect is the production of H<sub>2</sub>S (sulphur hydrogen), as a result of the activity of sulphate-reduction, i.e. the anaerobic way to the mineralization of organic substance that leads to the death of all species.