

**Major modifications of the Black Sea benthic and planktonic biota
in the last decades**

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Increasing eutrophication as well as other man-made activities have considerably changed the structure and functioning of the Black Sea ecosystems, mainly in its NW corner, affecting both the qualitative and the quantitative state of the benthic and planktonic phyto- and zoo-communities.

We attribute this change to the more rapid acceleration of changing interrelationships between anthropogenic influence and biota in this nearly enclosed basin during the last three decades.

The marked decline of the ecological health has induced marked changes especially in the structure of littoral ecosystems.

The **macrophytobenthos** has shown a gradual, but continuous, decline approximately since 1945-1950 due to both natural (e.g. occasional massive frosts) and anthropogenic factors (siltation of the rocky bottom, increased turbidity, diminution of light penetration).

The previously large belts of *Cystoseira barbata*, a perennial brown alga, along the western coast have practically disappeared as have numerous other associated and/or epiphytic algal and animal species.

The present algal flora, which displays a reduced species diversity, is uniform. Generally it is dominated by *Enteromorpha intestinalis*, *E. linza*, *Ceramium elegans* and *C. arborescens*. These newly dominant species with short and nearly seasonal life cycles show considerable production but, nevertheless, they do not reach the levels attained by *Cystoseira* during previous decades.

The evolution of **zoobenthos** communities is marked by a qualitative impoverishment, expressed by the reduction of species number by 50-60% at the present in comparison with the 1960 period, as well as by the numerical reduction of numerous species which formerly were omnipresent in the communities.

The qualitative structure of the communities was altered by the diminution of those species which were prevailing and characteristic formerly (*Spio filicornis*, *Corbula mediterranea*, *Syndesmia fragilis*, *Spirula subtruncata*, *Mytilus galloprovincialis*) and by the proliferation and autoacclimation of some opportunistic species (*Neanthes succinea*, *Polydora limicola*, *Mellina palmata*, *Mya arenaria*, *Scapharca inaequivalvis*).

Increases in populations of opportunistic species did not compensate for the reduction of general biomass and density, which are lower by 35-84 % than those measured 25 years ago. The zoobenthic communities become more and more homogenous as a result of mass proliferation of a few species. Their community structure is unstable owing to permanent disturbance generated by blooms and related benthic mass mortalities.

Following the more intense eutrophication, the biomass of the **phytoplankton** surpasses that of the past. Some essential structural changes have occurred and new quantitative and qualitative characteristics have been recorded.

The increase in the amplitude and frequency of algal blooms is a significant ecological consequence of the accumulation of nutrients in sea water. Since 1970, blooms are no longer exceptional phenomena. For example, in the 1980's alone, 46 blooms due to 15 algal species were recorded in the Romanian littoral waters.

Besides the species producing the blooms, other numerous mass species are remarkably developed. During the 1980's, 79 species reached densities of more than 100,000 cells/l, as compared to 57 species in the 1970's and only 38 species in the 1960's.

From the 1960's up to the 1980's, the proportion of nondiatoms in the numerical density of the phytoplankton increased from below 8% of the total, up to 62% with a corresponding decrease of the diatoms. The changes of the quantitative proportions of the main algal groups are due to the changes in the nutritive basis. These changes include :

(1) the reduction of the ratios Si : N and Si : P (which is detrimental to diatoms), and (2) the increase of organic matter (which favors the phytoplankters with mixotrophic affinities belonging to Dinoflagellata, Euglenida, and Chrysochyta).

Between 1983 and 1990 the average biomass of phytoplankton in Romanian littoral waters was more than 8 times higher than that assessed between 1959 and 1963.

The evolution of the **zooplankton** communities was marked by simplification of structure and decline of the species diversity, especially in the shore areas. Besides the total disappearance of some species (three species of the copepods belonging to the family Pontellidae), the populations of some holoplanktonic species have diminished greatly, as for example *Centropages Kroyeri*, *Penelia avirostris*, *Evadne tergestina* and *E. spinifera*.

The population of the meroplanktonic component of the zooplankton (the planktonic larval stages of benthic biota) have also diminished as a consequence of the mortalities produced in the benthic fauna.

In contrast the density of a small number of opportunistic species (e.g. *Acartia clausi* and *Pleopis polyphenoides*) increased, the species becoming dominant in the communities.

Another characteristic feature is the explosive development of *Noctiluca scintillans*, especially during the summer, following a significant algal bloom (in the summer of 1986 and 1987, this species represented 91-99% of the entire zooplankton biomass). Massive accumulation of the jellyfish *Aurelia aurita* has also been recorded.

Between 1980 and 1987 the total zooplankton increased in mean values of density and biomass of up to 10 times as compared to the mean values in the decade 1960-1970, because of large populations of *Noctiluca* in the summer.

The trophic zooplankton has experienced a substantial decline of the population (especially during 1990-1991) and a decrease of the planktonophagous fish catches concomitantly with the appearance in the Black Sea waters of *Mnemiopsis leidyi* (a big consumer of plankton and fish juveniles). For the ecosystem components of the Black Sea as a whole, the inseparable relationship between the dynamics of community structure with space and time, as well as the variable character of dynamic processes at the community level, have become particularly obvious during the last thirty years.