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The City of Bender Museum

Академику Л.С. Бергу – 145 лет: Сборник научных статей

Academician Leo Berg – 145: Collection of Scientific Articles

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Current collection of scientific articles is published to commemorate 145 birth anniversary of the famous scientist Academician Leo Berg, born in the City of Bendery. The current publication includes research articles of scientists from Moldova, Ukraine, Russia, Belarus, Romania, Kazahstan, Kyrgyzstan, and Poland has the aim to demonstrate respect to outstanding personality born in Moldova. The publication is realized thanks to financial support of the "Environmental Platform" project supported by the UNDP-Moldova by the European Union funds, as well as Commemoration Conference, held in Bendery on March 12, 2021 in online format.

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METHODS OF BIODIVERSITY ASSESSMENT OF THE BLACK SEA MARINE ENVIRONMENT

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Introduction

Biodiversity is an important characteristic of the state of the marine environment as a whole and its biological component. A particularly great diversity of aquatic organisms is observed in the coastal areas at the shallow depths. The level of the ecosystem biodiversity reflects its ecological state. Biocenotic and general ecological approach to assessing the quality of marine ecosystems by biological methods takes into account the indicators of general biodiversity, taxonomic and species richness of pelagic and benthic biocenoses.

The sea waters of the Odessa region and, first of all, of the coastal waters are largely under the influence of the anthropogenic pressure caused by the activities of the ports, industrial enterprises, housing and communal services and agriculture. The most powerful sources of anthropogenic pollution are the river runoff and the coastal point sources, which primarily include wastewater discharges from the various economic entities located in the coastal zone, as well as the seaports. In addition, a wide range of natural factors (temperature, salinity, precipitation, wind, currents, etc.) determine the formation of the hydrochemical regime of the water and as a result affect the state of the marine biota.

Materials and methods

Algae-macrophytes play an important role in the aquatic biocenoses structure. They are actively involved in the circulation of the water body substances and energy, acting as the primary link in the food chain. A mixotrophic way of many algae species feeding contributes to the biological purification of the water bodies. However, the excessive development of algae with their subsequent extinction can cause the secondary pollution of the coastal waters. Most species of macrophyte algae in their life cycle lead an attached lifestyle and therefore are quite sensitive to the changes in the environment. It has long been observed that there is a relationship between the algae floristic composition, their productivity and the quality of the aquatic environment. As a rule algae are affected by a complex of factors – various types of pollution (oil, heavy metals, organochlorine compounds, detergents, etc.), desalination or, conversely, increased salinity, nutrients excess (eutrophication), temperature features, hydrodynamics, etc.. [1.11].

Quantitative development of phytoplankton and its taxonomic composition depend on the presence of nutrients in the water, the dynamics of their entering into the productive layer, climatic conditions and the intensity of its consumption by zooplankton. In general, phytoplankton is a complex that responds extremely quickly to any changes in the environment and is a good ecological indicator of the aquatic environment.

Zooplankton is the main resource in the trophic chain of the marine ecosystem. Zooplankton is conventionally divided into holoplankton (true plankton), which ontogenesis takes place exclusively in the water column, and meroplankton (temporary component of zooplankton), represented mainly by benthic animals larvae. The number of zooplankton species increases significantly during the meroplankton development, which is associated with the period of the benthic fauna reproduction.

Phytoplankton, as a component of the aquatic ecosystem, responds extremely quickly to any changes in the environment and is an effective indicator of the ecological state of the aquatic environment [1,5].

Results and its discussion

In 2016 when assessing the marine environment quality with the help of the biotesting and bioindication methods using the hydrobionts of the different systematic levels (mussels at the different stages of development and microfitobenthos algae) it was shown that the ecological properties of the environment of the open and coastal areas of the NWBS, different from the influence of the anthropogenic and natural factors on them, differed considerably [4,5].

The quality of the coastal marine environment of the most surveyed waters of the Odessa region improved during the year, but it was slightly worse for the development of the studied aquatic organisms than in 2015. The aquatic environment of the open areas of the NWBS as a whole had significantly better environmental properties for the biological objects development. The bottom environment of some of

these marine areas was much more eutrophicated (by indicators of the state of benthic microphytes vegetation) than in the coast of the Odessa region. The surface water masses from the mainland slope of the NWBS in summer had significantly better ecological properties for the test objects morphogenesis (early stage mussel larvae) than all the waters from coastal and open waters areas of this part of the sea studied for the last 9 years. In the spring and summer periods in 2016 in the waters of NWBS there was a development of 224 species of phytoplankton, which belonged to 8 departments (Fig. 1) [1, 5].

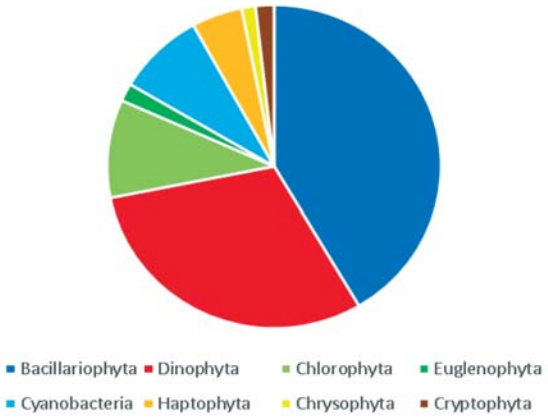

Fig. 1. Phytoplankton species diversity in the waters of the NWBS (May, 2016)

The most significant contribution to the species diversity was made by the representatives of diatoms (93 species) and dinophytes (68 species), the proportion of green algae (22 species), cyanobacteria (19 species) and haptophytovyh (11 species) was a bit less. Euglen (4 species), golden (3 species) and cryptophyte algae (4 species) were insignificant.

In the water area of the Odessa region there was a polydominant complex of phytoplankton species (212 microalgae species and varieties) with a predominance of diatom in both numbers and a biomass [1,5].

In the coastal areas the quantitative indicators of phytoplankton are higher than in the open shelf waters. High values of the quantitative indicators of phytoplankton in the coastal waters were caused by a flow of several large rivers especially the Danube River.

There are 28 taxa registered in the zooplankton of the Odessa region, which are representatives of freshwater, brackish water and marine complexes. The average biomass was 39.56 mg · m^{-3} ± 21.02 mg · m^{-3}. Changes in zooplankton biomass during the year are shown in Figure 2 [5].

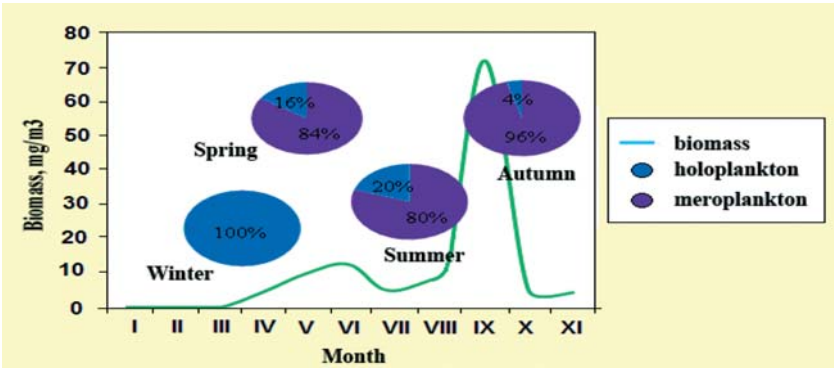

Fig. 2. An average biomass (mg m^{-3}) of zooplankton in the Odessa region in 2016

On average in the Odessa region in a seasonal zooplankton biomass two peaks – in summer and autumn – were noted: the first maximum of the biomass was at the end of June, the second was in September, and they were due to the development of the nauplial stages of crustaceans *Balanus (Cirripedia)*.

Conclusions

The methods of biotesting of a quality of the marine environment of the coastal areas of the NWBS using physiological and morphological indicators of the state of the adult Black Sea mussels and their larvae have revealed that a quality of the aquatic environment for the life of these hydrobionts had improved (as compared to a previous year) in the most studied water areas.

In 2016 in the spring-summer period in the NWBS area there was a development of 224 species of phytoplankton, which belonged to 8 departments. The representatives of diatomaceous and dinophytic microalgae made the most significant contribution to a species diversity. In the waters of the Odessa region there was a polydominant complex of phytoplankton (212 species and varities of microalgae) with a predominance of diatomaceous species both in numbers and in a biomass. In the coastal areas the quantitative indicators of phytoplankton are higher than in the open shelf waters.

High values of the quantitative indicators of phytoplankton in the coastal waters were caused by a flow of several large rivers especially the Danube River.

In 2016 105 macrozoobenthos taxons were detected in the studied zones of the Black Sea shelf of Ukraine. The largest variety was shown by the following groups – *Annelida, Crustacea* and *Mollusca.* A number of species varied from 9 to 44 by sampling. The Whitteker Beta Spread Diversity Index was 3.28. 30 taxons were registered within the macrozoobenthos of the Odessa region (up to 3 meters deep). An average number was 6,244 units/m^2, and a biomass was 145,12 g/m^2. The appearance of some types of crustaceans in the macrozoobenthos indicates an increase in a fish feed base. According to the obtained results it can be noted that in general the macrozoobenthos state is satisfactory and tends to improve both by variety and by the quantitative parameters.

In the coastal areas of the sea after the periodic changes in macrophytobenthos mesosappropriate algal species prevail and there is some stabilization of bottom phytocoenoses. Compared to previous years a species composition of macrophytobenthos changed significantly in the region of the NWBS. Some brown algae disappeared as the most sensitive to the anthropogenic pressure. But there is a massive development of filamentous green and red algae because of the excess of the pollutants.

Thus the adaptation of macrophytes to the changing environmental conditions occurs and it is expressed in a change of a structural organization and in a slight tendency to their restoration at the NWBS.

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