

ECOSYSTEM SERVICES OF THE NORTHWESTERN BLACK SEA REGION: BRIEF OVERVIEW OF THE PROBLEM

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Marine and coastal ecosystems are negatively affected by population growth in coastal areas, overexploitation of marine resources, industrialization, climate change, introduction, pollution, eutrophication, acidification and other factors that negatively affect their condition and quality. This creates risks for sustainable activities and well-being, because the supply of the necessary natural resources, the quality of the natural components of the environment, climate change, conditions for recreational activities, etc. depends on the state of ecosystems. Human activity affects various ecosystems, including marine, continental, natural, semi-natural and artificial types.

Ecosystem services are usually understood as all the useful resources and benefits, that mankind can receive from nature, that is, material benefits that guarantee the abiotic and biogenic components of various natural ecosystems. The satisfaction of human needs for habitat and food, as well as the level and quality of life depends on ecosystem services.

The aim of the work is to review the current state of ecosystem services of the northwestern part of the Black Sea and the prospects for their use.

Resource (providing) services

Hydrobionts of the Black Sea are represented by 5600 species, including: phytoplankton – 2800, microalgae – 453, crustaceans – 390, fishes – 200, marine fungi – 175; there are four types of marine mammals: monk seal common (*Monachus*), bottlenose dolphin (*Tursiops truncatus*), focaena common (*Phocoena phocoena* L.) and a white-sided dolphin (*Delphinus delphis*); all of them are listed in the Red Book of Ukraine, however, their populations continue to decline as a result of entanglement in fishing nets.

In 2021, Ukrainian fishing in the Black Sea was 7669 tons, in the Black Sea limans (lagoons) – 107 tons, in the river mouths areas of the Danube – 504 tons, in the Dniester-Bug limans – 1157 tons. A significant source of animal protein is the development of aquaculture; 18570 tons of aquaculture products were received in 2020, a significant part of which comes from coastal ecosystems. The northwestern part of the sea basin is characterized by the unique resources of the Zernov's *Phyllophora* Field – the concentration of algae macrophyte, the dominant species among which are red algae of the *Phyllophoraceae* family (Fig. 1). As a result of more than half a century of intensive industrial mining of the layer-forming form of the species *Phyllophora crista* for the industrial production of agar-agar, as well as due to the anthropogenic impact on the marine environment of the NW Black Sea, a decrease in the genetic diversity of hydrobionts of the phyllophora field was recorded.

Regulating services

Wetlands, widespread in the coastal zone of the North-Western Black Sea region, regulate such processes as: accumulation and storage of fresh water, water filtration, absorption from the atmosphere and accumulation of carbon, return of oxygen to the atmosphere, regulation of surface runoff, stabilization of groundwater levels, participation in the formation of climatic conditions (precipitation, humidity and air temperature), prevention and containment of erosion processes, maintenance and preservation of biodiversity, formation of habitats for various species of plants and animals, including rare and species listed in the Red Book of Ukraine, as well as maintaining the maximum biological productivity of aquatic ecosystems. Discharge of sewage and other return waters from agricultural lands, industrial and urban agglomerations, maritime complexes and other sources of pollution provoke the processes of eutrophication and pollution of the marine environment, which negatively affects the state of abiotic and biogenic components of the marine ecosystem. An inefficient system of management and handling of municipal solid waste, uncontrolled recreational activities in the coastal strip have led to the formation of spontaneous dumps, which are the source of the formation of marine debris, which is transformed in the marine environment and negatively affects the biota. For example, waste plastic materials (macroplastics) that have entered the marine environment are gradually destroyed, generating a huge amount of microparticles that pose a danger to the state of the marine environment and biota (Safranov et al. 2020).

Cultural and social services

The marine and coastal ecosystems of the Northwestern Black Sea region play an important role in providing recreational services. In the coastal strip of the northwestern part of the Black Sea there are deposits of therapeutic mud (silt-sulfide peloids): Tuzly Liman (lagoon) (reserves 35 185 thousand m³), Budak Liman (lagoon) (4 190 thousand m³), Khadzhibey Liman (lagoon) (11 048 thousand m³), Kuyalnyk Liman (lagoon) (15 327 thousand m³); Tiligulskiy Liman (lagoon) (11 276 thousand m³), Berezanskyi Liman (lagoon) (10 910 thousand m³) etc. Only Kuyalnyk and some limans (lagoons) of the Odessa region are still used for mud therapy and obtaining medicines, although the potential of other North-Western Black Sea region limans is very high. The Danube and Black Sea Biosphere Reserves, "Tuzlovsky Limans", "Kuyalnitsky" and "Dzharylgatsky" National Natural Parks, regional landscape parks and other objects and territories of the nature reserve fund can provide educational services, as they are natural scientific laboratories in which carry out research activities in the field (Safranov et al. 2017, Poletaieva et al. 2019).

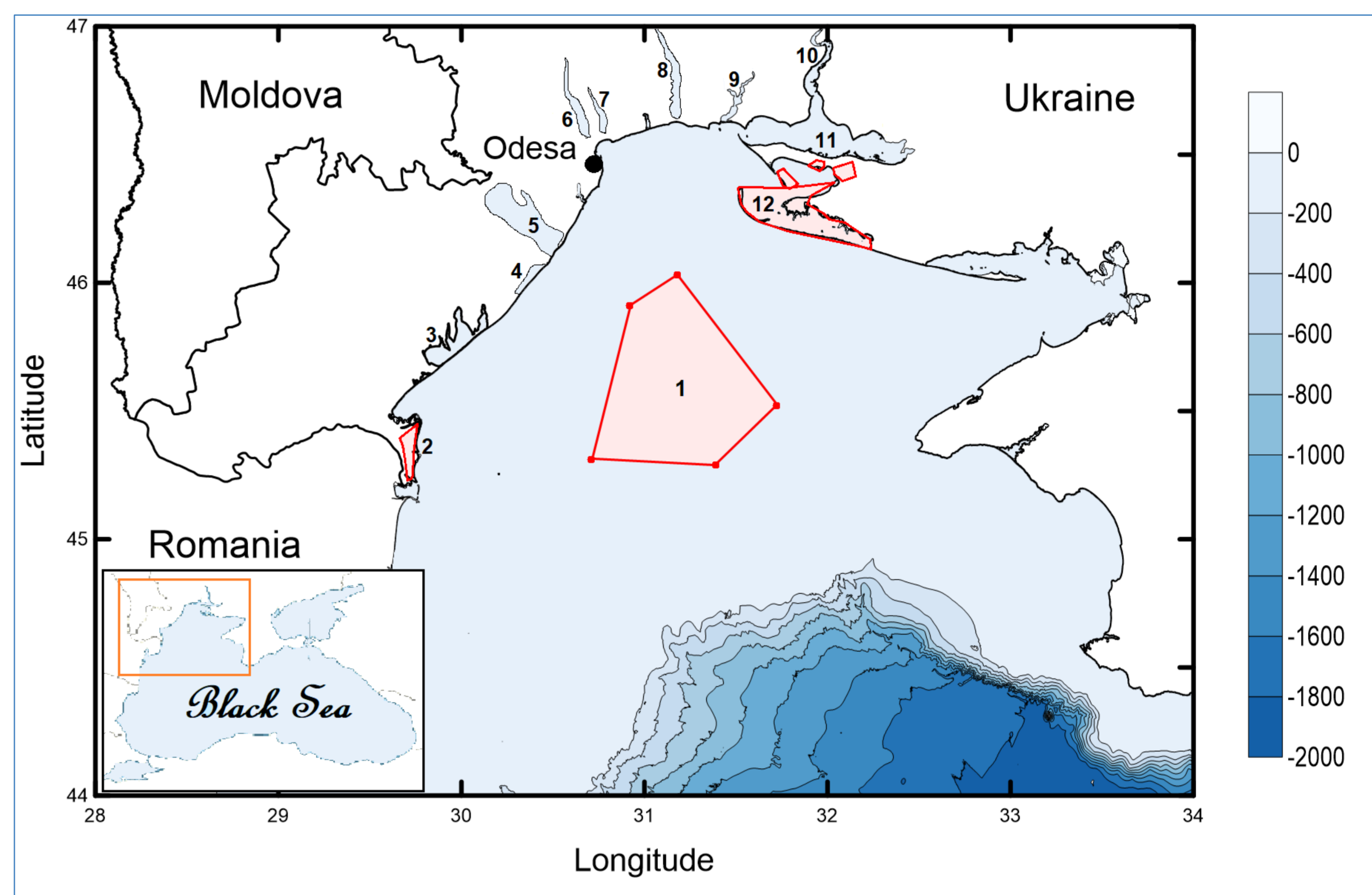


Fig. 1 Map of the northwestern part of the Black Sea: 1 – the boundaries of botanical reserve national significance "Zernov's Phyllophora Field", 2 – Danube Biosphere Reserve, 3 – Tuzly Limans, 4 – Budak Liman, 5 – Dniester Liman, 6 – Khadzhibey Liman, 7 – Kuyalnyk Liman, 8 – Tiligulskiy Liman, 9 – Berezanskyi Liman, 10 – Bug Liman, 11 – Dniester Liman, 12 – Black Sea Biosphere Reserve

Supporting services

The marine and coastal ecosystems of the Northwestern Black Sea region are the habitat and source of food for numerous organisms. The role of wetlands protected by the Ramsar Convention is especially important (Chilia branch, Sasyk Lagoon, Shahany-Alibei-Burnas lakes system, Northern area of the Dniester Liman, Tylihul Lagoon, Kuhurluy etc.), which are of great importance as a habitat for waterfowl and birds living in the coastal zone, and characterized by biodiversity. The most intensive cycle of biogenic (nutrient) substances occurs in the rivers mouths flowing into the Northwestern part of the Black Sea. At the same time, many resources are now depleted for a variety of reasons: overfishing, destructive fishing practices, negative impacts from aquaculture, pollution and eutrophication, climate change, and more.

CONCLUSIONS. Based on the fact that there is no information about the state of ecosystem services in the scale of the Black Sea, the primary task is to determine the needs of local communities for the use of ecosystem services, collect and summarize information on their state, harmonize methods for assessing services for a given region and doing this assessment. An innovative approach Blue Growth Accelerator will help in such management of marine resources, in which economic activities are carried out taking into account the specific needs of local / national communities, provides a number of opportunities based on the management of ecosystem services and is not currently used in the Black Sea basin.

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