1871
ИнБЮМ – IBSS

Морской биологический журнал
Marine Biological Journal
2024, vol. 9, no. 3, pp. 118–120
https://marine-biology.ru

REVIEWS

CYSTOSEIRA PHYTOCENOSIS AS A BIOLOGICAL BARRIER FOR HEAVY METALS AND ORGANOCHLORINE COMPOUNDS IN THE SPNA CAPE MARTYAN MARINE AREA (THE BLACK SEA): REVIEW OF THE ARTICLE

The article "*Cystoseira* phytocenosis as a biological barrier for heavy metals and organochlorine compounds in the SPNA Cape Martyan marine area (the Black Sea)" published by V. Egorov and co-authors in the prestigious journal "Regional Studies in Marine Science" is focused on the genus *Cystoseira* and one of its numerous ecological communities [Egorov et al., 2021]. *Cystoseira*, brown algae of the order Fucales, comprise fucoids; those contain antherozoids without stigmata, few antheridial branches, trichothallic hairs in conceptacles, large ovoid oospheres, and eggs remaining attached to the surface of receptacles *via* mucilaginous stalks until after fertilization [*Cystoseira*, 2024].

Cystoseira species are currently thought to occur in the Mediterranean and Black seas and Northeast Atlantic. Species from the Indian and Pacific oceans are now classified within different genera. *Cystoseira* representatives are important habitat-forming species in coastal waters of the Mediterranean Sea and Northeast Atlantic. They require good water quality and can be used as bioindicators of pollution levels.

In addition to *Cystoseira barbata*[*] and *Cystoseira boshorica*[*] reported for the Black Sea, 19 more species are listed in [*Cystoseira*, 2024]. Many of them are poorly studied and require validation. *C. barbata* and *C. bosphorica* form significant populations along the Romanian Black Sea coast in the southern sector between Constanța and Vama Veche – with its hard substrate and rocky bottom – and dominate in the supra-, mid-, and infralittoral zones [Black Sea Biological Diversity, 1997; Exotic Species, 2001]. Their biomass measurably (up to 80%) decreased after severe frosts in the winter of 1970–1971 [Bologa et al., 1996]. Now, they seem to be recovering.

The study [Egorov et al., 2021] was aimed at assessing the role of a *Cystoseira* phytocenosis as a biological barrier in seawater purification in the specially protected natural area (hereinafter SPNA) Cape Martyan from pollution by heavy metals (V, Fe, Co, Ni, Cu, Zn, Hg, Mo, Ag, Cd, Sb, and Pb) and organochlorine compounds (DDT, DDE, DDD, ∑DDT, PCB 28, PCB 52, PCB 101, PCB 138, PCB 153, and PCB 180).

The "Introduction" section provides a description of Cape Martyan. The "Material and Methods" section presents data of hydrobotanical observations, methods for analyzing pollutants, and the concept of flows. The results of hydrobotanical studies are given, as well as information on flows of pollutants: heavy metals and organochlorine compounds (hereinafter HMs and OCs, respectively).

[*]Note from the Scientific Editor:
1. *Cystoseira barbata* is unaccepted; the synonym is *Gongolaria barbata* (Stackhouse) Kuntze, 1891.
2. *Cystoseira bosphorica* is unaccepted; the synonym is *Ericaria bosphorica* (Sauvageau) D. Serio & G. Furnari, 2021.

Based on the results of the research, the following key conclusions were drawn:

1. The parameters of a *Cystoseira* biotope in the SPNA Cape Martyan marine area were determined: area of 309,000 m^2, algae reserve of 1,425.6 tons, and production of 3,136.3 tons *per* year.
2. For most of the trace elements studied (Co, Cu, Zn, Pb, Sb, Mo, Cd, Ag, Ni, V, and Hg), concentrations in the SPNA Cape Martyan marine area did not reach international reference values established for both acute and chronic effects. In general, this evidenced for a favorable environmental status of the water area in terms of its pollution by HMs.
3. In the *Cystoseira* biotope, the deposition of 9÷99% HMs and 55÷96% OCs is governed by its high specific biomass (4.6 $kg \cdot m^{-2}$) and the ability to concentrate pollutants characterized by accumulation factors within the ranges from $n \times 10^2$ to $n \times 10^5$ for HMs and from $n \times 10^2$ to $n \times 10^3$ for OCs.
4. Localization of *Cystoseira* phytocenoses in recreational zones is the key biological factor in seawater self-purification from HMs and OCs. As a result of production processes in the *Cystoseira* phytocenosis in the SPNA Cape Martyan marine area, the extraction of HMs is 0.1÷967.6 $kg \cdot year^{-1}$, and the extraction of OCs is 0.044÷8.360 $g \cdot year^{-1}$. In the biotope, the turnover of HMs and OCs varies mainly from daily one to seasonal.
5. An equation is proposed for assessing the maximum capacity of the *Cystoseira* phytocenosis to purify water from HMs and OCs. Preservation of *Cystoseira* phytocenoses in coastal areas and measures to increase their reserve and productivity are among optimal mechanisms for high-quality management of recreational zones, with the factor of pollution of the marine environment taken into account.

The work concludes with 54 references, 19 of which are related to the Black Sea. Some other literature sources could be added, for example, the following paper: Celan M. Notes sur la flore algologique du littoral roumain de la mer Noire. I. Sur les *Cystoseira*. *Bulletin de la Section Scientifique de l'Académie Roumaine*, 1935, vol. 17, pp. 81–94.

Thus, the publication by D. Sc. V. Egorov and his colleagues is a valuable scientific contribution to the study of the Black Sea macrophytobenthos based on an original approach, new concept and methodology. This once again confirms the ecological significance of a *Cystoseira* community in the marine benthic ecosystem.

A. Ș. Bologa
Academy of Romanian Scientists, Section of Biological Sciences,
Bucharest/Constanța, Romania

REFERENCES

1. *Black Sea Biological Diversity* : *Romania* / A. Petranu (Comp.). New York : United Nations Publ., 1997, 314 p. (Black Sea Environmental Series ; vol. 4).
2. Bologa A. S., Bodeanu N., Petranu A., Țigănuș V., Zaitsev Yu. P. Major modifications of the Black Sea benthic and planktonic biota in the last three decades. In: *Les mers tributaires de Méditerranée* / F. Briand (Éd.). Monaco : Musée océanographique, 1995, pp. 85–110. (Bulletin de l'Institut oceanographique, Monaco, n° special 15 ; CIESM, Science Series no. 1).
3. *Cystoseira*. In: *Wikipedia. The Free Encyclopedia* : [site]. URL: https://en.wikipedia.org/wiki/Cystoseira [accessed: 20.05.2024].
4. Egorov V. N., Gorbunov R. V., Plugatar Yu. V.,

Malakhova L. V., Sadogurskiy S. E., Artemov Yu. G., Proskurnin V. Yu., Mirzoyeva N. Yu., Marchenko Yu. G., Belich T. V., Sadogurskaya S. A. *Cystoseira* phytocenosis as a biological barrier for heavy metals and organochlorine compounds in the SPNA Cape Martyan marine area (the Black Sea). *Regional Studies in Marine Science*, 2021, vol. 41, art. no. 101572 (10 p.). https://doi.org/10.1016/j.rsma.2020.101572

5. *Exotic Species in the Aegean, Marmara, Black, Azov and Caspian Seas* / Yu. P. Zaitsev, B. Öztürk (Eds). Istanbul : Turkish Marine Research Foundation, 2001, 267 p.

ОБЗОР СТАТЬИ *CYSTOSEIRA* PHYTOCENOSIS AS A BIOLOGICAL BARRIER FOR HEAVY METALS AND ORGANOCHLORINE COMPOUNDS IN THE SPNA CAPE MARTYAN MARINE AREA (THE BLACK SEA)

Проанализирована статья академика РАН В. Н. Егорова и соавторов, посвящённая исследованию роли видов *Cystoseira* как биологического барьера для потоков загрязняющих веществ — тяжёлых металлов и хлорорганических соединений — в акватории особо охраняемой природной территории «Мыс Мартьян».