THE SEASONAL DYNAMICS OF PHYTOPLANKTON AND WATER QUALITY IN THE PRUT RIVER LOWER SECTOR

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Abstract. The article presents the results on qualitative and quantitative indicators of phytoplankton of the Prut River lower sector within the Republic of Moldova in 2018-2020. In phytoplankton compositions 72 species were identified. Seasonal and long-term patterns of phytoplankton development have been established in Prut River lower sector. The numbers of phytoplankton changed within the limits 1,06 to 20,32 mln. cell/l, with biomass 1,23-21,64 g/m³. The values of saprobic indexes, estimated on the basis of species-indicators (52 species) from phytoplankton composition, which are in proportion of 58% typically β -mezosaprobic, confirm the following: the water quality of lower Prut River sector in the period 2018-2020 was satisfactory for the development of phytoplankton and was attributed mainly to II-III (good-moderately polluted) quality classes.

Introduction

The Prut River is the second longest and the last major tributary of the Danube, with its confluence located just upstream of the Danube Delta [7]. The study of phytoplankton development and water quality of lower Prut river sector are of particular importance in terms of eutrophication and continuous pollution. Photoautotrophic plankton is the major primary producer of organic carbon in the waters. Phytoplankton composition and biomass provides an integrated view on water-quality conditions, an indication of eutrophication. Reaction of the phytoplankton to the natural and anthropogenic factors is closely connected with changes in algae abundance, biomass and species composition and it is a reliable indicator of the aquatic ecosystems [4, 5].

Material and methods

Researches of phytoplankton were carried out seasonal during 2018-2020 from lower Prut River sector (Cahul, Caslita-Prut and Giurgiulesti sampling points) in the research of the Laboratory of Hydrobiology and Ecotoxicology of the Institute of Zoology. Algae species identification was performed using the microscope MIKMED-2 (LOMO) and identifying keys [2]. To estimate the trophic dynamics seasonal and annual values of biomass were used. Sampling and analysis of phytoplankton was carried out by conventional hydrobiological methods [1-3,6].

Results and discussion

In phytoplankton compositions of the lower Prut River sector during 2018-2020, 72 species were identified, and represented by 5 taxonomical groups: *Cyanophyta*–8, *Bacillariophyta*–38, *Chrysophyta*–2, *Euglenophyta*–8, *Chlorophyta*–16 (*Chlorococcophyceae*–14, *Volvocineae*–1, *Desmidiaceae*–1). It was found that the phytoplankton species of the following groups predominated: *Cyanophyta*, *Bacillariophyta* and *Chlorophyta*. (Tab.1.). The basis of the floristic diversity of lower Prut River sector consists of such species as: *Aphanizomenon flos-aquae* (L.)

Ralfs, *Oscillatoria lacustris* (Kleb.), from blue-green algae, *Cyclotella kuetzingiana* Thw., *Navicula cryptocephala* Kutz., *Synedra acus* Kutz., *Synedra ulna* (Nitz.) from diatoms algae, *Monoraphidium Komarkovae* (Nyg.), *Monoraphidium contortum* Thur. and *Scenedesmus quadricauda* Turp. from green algae. The quantitative parameters of phytoplankton vary widely in seasonal and annual aspect.

Table 1. The number of planktonic algae found in the lower Prut river sector during 2018-2020

Algal groups	Cahul	Caslita-Prut	Giurgiulesti
<i>Cyanophyta</i> (<i>Cyanobacteria</i>)	3	4	7
<i>Bacillariophyta</i>	27	26	34
<i>Chrysophyta</i>	-	2	1
<i>Euglenophyta</i>	2	7	4
<i>Chlorophyta</i> :			
<i>Chlorococcophyceae</i>	7	11	9
<i>Volvocineae</i>	-	1	-
<i>Desmidiaceae</i>	-	1	-
Total	39	52	55

The number of phytoplankton species in lower Prut River sector was in limits 1,06- 20,32 mln. cell/l, and biomass 1-21,94 g/m³ in spring, 1,61-18,68 mln. cell/l, with biomass 1,9-10,36 g/m³ in the summer, 1,36-6,88 mln. cell/l, and biomass 1,23-6,44 g/m³ during autumn (Fig.1.).

Figure 1. Dynamics of quantity (N-mln cell/l) and biomass (B-g/m³) of phytoplankton in the lower Prut river sector (C-Cahul, C-P - Caslita-Prut and G-Giurgiulesti sampling points) during 2018-2020.

The highest values of phytoplankton species number and their biomass were attested at Caslita-Prut and Giurgiulesti during spring 2018 and at Caslita -Prut sampling points during summer time 2020. In lower sector the preponderance of *Cyanophyta*, *Bacillariophyta* and *Chlorophyta* in the forming of the number of algae species was attested. Species of algae which are growing in large quantities were represented by: *Aphanizomenon flos-aquae* (L.) Ralfs, *Os-*

cillatoria planctonica (Wolocz.), *Oscillatoria lacustris* (Kleb.), *Synechocystis aquatilis* (Sanv.), *Asterionella formosa* Hass., *Nitzschia acicularis* W.Sm., *Monoraphidium contortum* Thur., *Scenedesmus falcatus* Chod.

The main part in the formation of phytoplankton biomass was *Bacillariophyta* algae: *Cocconeis placentula* (Ehr.), *Cymatopleura solea* (Breb.) W.Sm., *Cyclotella Kuetzingiana* Thw., *Nitzschia sigmaidea* (Ehr.) W.Sm., *Gyrosigma acuminatum* (Kutz.), *Rhoicosphenia curvata* (Kutz.), *Synedra ulna* (Nitzh.) Ehr., *Surirella robusta* Ehr. v. *splendida* and mostly in summer time presented by *Euglenophyta* species: *Trachelomonas hispida* (Perty) Stein., *Euglena polymorpha* Dang., *Lepocinclis fusiformis* (Lemm), *Phacus pleuronectes* (Mull.).

For the estimation of trophicity of lower Prut river sector, according to the criteria of classification and trophicity categories of continental aquatic ecosystems [2], were used the seasonal and multiannual values of phytoplankton biomass. Thus, according to the values of phytoplankton biomass, which in 2018-2020 varied within the limits of 1,00-21,64 g / m³, the lower Prut River sector was attributed to the category of “eutrophic” trophicity, periodically “polytrophic” (Fig.1.).

Figure 2. Distribution of phytoplankton indicator types according to the zone of saprobity in lower Prut river sector 2018-2020

From whole number of species of algae, identified in Prut river lower sector (72 species and varieties of phytoplankton) 52 were indicators of water saprobity, the most frequently met, were the following: *Aphanizomenon flos-aquae* (L.) Ralfs, *Asterionella formosa* Hass., *Cyclotella Kuetzingiana* Thw., *Gomphonema olivaceum* (Lyngb.), *Hantzschia amphioxys* (Grun.), *Navicula gracilis* (Ehr.), *Navicula cryptocephala* (Kutz.), *Surirella robusta* (Ehr.), *Euglena polymorpha* (Dang.), *Trachelomonas hispida* (Perty) Stein., *Scenedesmus quadricauda* Turp. more than 58 % of them were β-mesosaprobe species. α -mesosaprobe species made 13 %, the most frequent of which were: *Nitzschia acicularis* W.Sm., *Nitzschia palea* (Kutz.), *Euglena polymorpha* Dang., *Closterium acerosum* (Ehr.); O-β mesosaprobe species were 11 %, the most frequent of which were the species: *Anabaena spiroides* (Lemm.), *Epithemia ze-*

bra (Ehr.), *Fragilaria capucina* (Desm.), *Melosira italica* (Ehr.); species β - α -mesosaprobic (8%) were represented by: *Merismopedia tenuissima* (Lemm), *Cymatopleura solea* (Breb.), *Navicula cincta* (Pant.), *Navicula hungarica* v. *capitata* (Grun.); species α -oligosaprobic (4%) were presented by: *Dinobryon sertularia* (Ehr.), *Ophiocitium capitatum* (Woll.); and species: β -O-mesosaprobic were accounting for 6% (*Navicula gracilis* (Ehr.)), α - β mesosaprobic (*Cyclotella meneghiniana* (Kutz)), ρ - α - mesosaprobic (*Chlorella vulgaris* (Beier.)). (Fig.2.). Species with preference to the χ - xenosaprobe zone have not attested in Prut river lower sector, these however being met in the previous years [4, 5].

The saprobic index values were established within the limits 1,98-2,3 in spring time, 1,92-2,34 in summer and 1,9-2,3 at lower Prut river sector, with high values at Cahul sampling point. According to saprobic value indices, the water quality of lower Prut river sector was satisfactory for the development of phytoplankton and was attributed mainly to II-III (good-moderately polluted) quality classes.

Conclusions

The basis of the floristic diversity of the lower Prut river sector consists of groups: *Bacillariophyta*, *Cyanophyta*, *Chlorophyta*, *Euglenophyta* and *Chrysophyta*.

Higher values of quantitative phytoplankton parameters were recorded during the spring and summer periods. In most cases the phytoplankton biomass values referred to the trophic category “eutrophic” sometimes “polytrophic”.

According to saprobic index values indices, the water quality of lower Prut river sector was satisfactory for the development of phytoplankton and was attributed mainly to II-III (good-moderately polluted) quality classes.

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