DISTRIBUTION OF PHYTOPLANKTON AT FISH POND PREVLAKA (BARDAČA)

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DISTRIBUCIJA FITOPLANKTONA U RIBNJAČKOM JEZERU PREVLAKA (BARDAČA)

Apstrakt

Područje Bardače je smješteno na krajnjem sjeveroistoku Lijevča polja, oko 50 km sjeverno od Banjaluke. Od 2007. godine je uvršteno u svjetsku listu zaštićenih močvarnih područja (tzv. „Ramsarsko područje"). Područje ribnjaka se sastoji od 11 bazena od kojih je bazen Prevlaka sa površinom od oko 160 hektara drugi po veličini. Šaran čini 95% ukupnog nasada ribe, dok su sa po 2% zastupljeni sivi tolstolobik i amur, a 1% nasada čine som i smuđ. Ribnjaci generalno trpe znatno veći antropogeni uticaj nego bilo koji drugi tip kopnenih voda. U šaranskim ribnjacima se odvijaju posebno komplikovani fizičko-hemijski i biološki procesi budući da je neophodno osigurati optimalnu sredinu za život riba i pritom racionalno iskoristiti biološko kruženje materije u vodi. Biološka produktivnost ribnjaka je uslovljena prije svega prisustvom biogenih elemenata u vodi, dinamikom njihove potrošnje i dodavanja u obliku stajskih ili mineralnih đubriva. Najjeftiniji način proizvodnje ribljeg mesa je iz prirodne hrane čiji razvoj se pospješuje đubrenjem. Jedan od efekata đubrenja jeste i povećavanje razvoja primarnih producenata, tj. fitoplanktona i makrofita. Planktonske alge najčešće pripadaju razdjelima Euglenophyta, Pyrrophyta i Chrysophyta, dok se predstavnici Cyanobacteria, Chlorophyta i Bacillariophyta mogu podjednako naći i u planktonu i u bentosu. Svaka vrsta pritom ima svoje posebno kretanje u toku godine, poseban životni ciklus, tempo razmnožavanja i specifične reakcije na spoljašnje uticaje. Unošenje nutrijenata u ribnjake dovodi do narušavanja homeostaze ekosistema. Prirodna sukcesija biocenoza u ribnjacima se narušava krajem uzgojne sezone kada se vrši ispuštanje vode. Tokom 2011. godine je praćen kvantitativni i kvalitativni sastav fitoplanktona u vodi bazena Prevlaka. Analize su pokazale da se bazen Prevlaka odlikuje znatnim diverzitetom

ove grupe organizama, ali i visokom organskom produkcijom. Tokom 2011. godine u vodi je konstatovano prisustvo 85 taksona iz 7 razdjela fitoplanktona, uključujući i cijanobakterije. Kvalitativno je bilo najviše predstavnika razdjela Chlorophyta koje su bile zastupljene sa 31 taksonom. Sledeće po zastupljenosti su bile Bacillariophyta-e, Euglenophyta-e i Cyanobacteria-e. Krečenje vode, koje se provodi od aprila do jula, dovelo je do pomjeranja ili potpunog izostanka proljetnog maksimuma razvoja fitoplanktona. Znatno višu brojnost fitoplankton je dostigao u drugom, tzv. ljetno/jesenjem cvjetanju algi. Zbog konstantno visokog sadržaja organske materije u vodi izostala je faza čiste vode. I pored provedenih agrotehničkih mjera u vodi su bile brojne nepoželjne vrste cijanobakterija, dok su poželjne zelene alge u ljetnom periodu bile zastupljene u znatno manjem broju. U cilju poboljšanja ribnjačke proizvodnje trebalo bi vršiti kontinuiran monitoring fitoplanktona i u skladu sa njegovim razvojem provoditi odgovarajuće agrotehničke mjere.

Ključne riječi: Bardača, fitoplankton, ribnjak
Keywords: Bardaca, phytoplankton, fish pond

INTRODUCTION

Area of Bardača is located in the northeast part of the field Lijevče polje (Republic of Srpska, BiH), about 50 km north of Banja Luka. Since 2007 Bardača has been in the world's list of protected wetland areas (known as „Ramsar Site"). It is a fish farm consisting of 11 ponds and among them pond Prevlaka, with a surface area of about 160 hectares, as the second-largest (Gašić i Dujaković, 2009). Carp comprise up to 95% of the total of fish composition, while 2% consists of bighead carp and grass carp, and 1% of catfish and perch. Fish ponds are generally exposed to significantly higher anthropogenic impacts than any other type of inland waters (Bojčić, 1982). In carp fishponds, particularly complex physical, chemical and biological processes occur since it is necessary to provide the optimal environmental conditions and rational usage of cycling of matter in the water. Biological productivity of ponds is primarily conditioned by the presence of biogenic elements in water, whose concentrations depend on their introduction from manure or mineral fertilizers, and on their consumption by primary producers. The cheapest way of producing fish meat is from natural food whose growth can be increased by fertilization. One of the effects of fertilization is increased growth of primary producers, i. e. phytoplankton and macrophytes. The change of qualitative and quantitative composition of phytoplankton during the year is called seasonal variation of phytoplankton. Planktonic algae usually belong to phylums: *Euglenophyta*, *Pyrrophyta* and *Chrysophyta*, while representatives from phylums *Cyanobacteria*, *Chlorophyta* and *Bacillariophyta* can be found in plankton and benthos (Kvet *et al.,* 2002). Most planktonic algae are called holoplanktonic species. During the largest part of the annual cycle they are present in the water column. On the other hand, meroplanktonic algae are present in the water column only in a certain part of the year, while during the largest part of the annual cycle they are dormant in the sediment (Sigee, 2004). Each species has its particular dynamics during the year, a specific life cycle, reproduction processes and specific reactions to external influences. External introduction of nutrients in the pond leads to the disruption of the ecosystem's homeostasis. Natural succession of biocenoses in ponds is interrupted at the end of the growing season when water is drained out of the fish ponds due to the fish harvest.

MATERIAL AND METHODS

Samples for analysis of phytoplankton of pond Prevlaka were collected once a month from January to October 2011. In November and December the pool was drained due to fish harvest. Samples were collected from a boat, at least 10 meters from the lakeshore. Depending on the time of year, 5 to 20 liters of water was filtered through the plankton net with pore diameter of 20 microns. Filtered samples were then fixed with acidic Lugol's iodine solution. Identification of algae was performed using the following keys: Blaženčić and Cvijan (1996), Hindak (1978, 2005 and 2008), John et al (2005), Krammer & Lange-Bertalot, (1988a and 1988b), Lazar (1960) and www.algaebase.org. For analysis was used Leica DM 1000 microscope with the corresponding camera Leica DSF245.

RESULTS AND DISCUSSION

Presence of 85 different taxa of phytoplankton within 7 phylums, including cyanobacteria, was identified in the pond Prevlaka during 2011. Qualitatively, the largest number of taxa was from phylum *Chlorophyta*, which were represented by 20 genera and 31 species. The next most numerous phylums were *Bacillariophyta* with 23 taxa, *Euglenophyta* with 15 and *Cyanobacteria* with 13 taxa. Phylums *Chrysophyta, Pyrrophyta* and *Xanthophyta* were present with one species. In the sample from March only 19 taxa were identified, while in the sample collected in September highest number of algae, both, in qualitative and quantitative terms were found. There were 15.62 x 10^6 individuals per liter within 42 different taxa. In January and February 2011 siliceous algae were dominant. Quantitatively, the most numerous representatives in the sample from January were from genera *Melosira* and *Synedra*, and in February were algae of the genus *Navicula*. After extremely cold weather in February, there has been an intensive growth of golden algae *Dinobryon divergens* which accounted for 50.6% of total phytoplankton in sample from March (Chart 1). With the further increase of water temperature and increase of the duration of days, green algae developed in large numbers. Among them, genus *Pediastrum* was the dominant representative. These algae were prevailing until June, when the most abundant become cyanobacteria *Merismopedia tenuissima*.

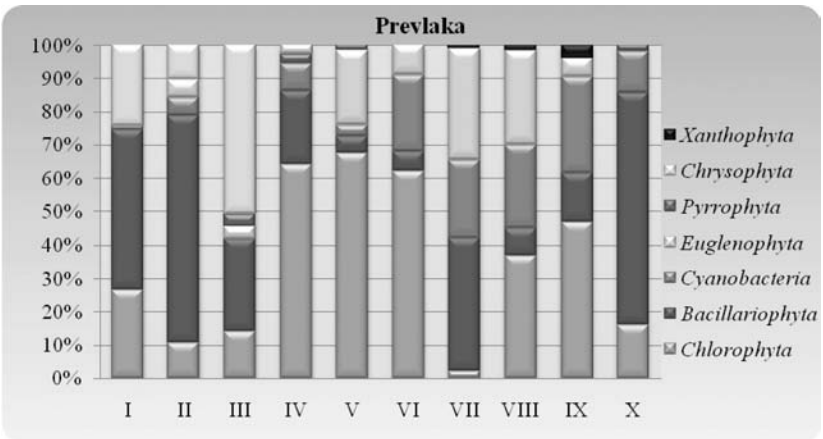

Chart 1. Quantitative distribution of phytoplankton in fish pond Prevlaka

The other species of cyanobacteria developed in great numbers in July, especially representatives of the genus *Microcystis*, as well as *Euglenophyta* from genus *Phacus*. *Euglenophyta* were qualitatively dominant, while in the entire sample only one green algae *Selenastrum bibraianum*, was identified. The absence of the green algae from genera *Pediastrum* and *Scenedesmus* was unusual. This may be caused by the introduction of some of agrotehnical measures and due to predation by zooplankton which was highly abundant in this period. The most abundant algae in August were *Microcystis aeruginosa* and *Pandorina morum*. In the sample from September there were large numbers of *Microcystis* and *Oscillatoria*, and different species from genus *Pediastrum* that developed again. In the sample from October, there were still large numbers of cyanobacteria of the genera *Microcystis* and *Oscillatoria*. Beside them, with the disturbance of mud due to water drainage, there were large numbers of diatoms, especially of species *Nitzschia acicularis*.

During the summer in the fish pond Prevlaka cyanobacteria *Cylindrospermopsis raciborskii* was present. This algae has never been isolated before at the area of Bardača. It is invasive species that produces toxins cilindrospermopsin and saxitoxin. Saxitoxin belongs to neurotoxins and it is dangerous for humans, while cilindrospermopsin mainly causes skin irritation, but can also seriously damage the liver (Simeunović, 2009). Stević found this species in the Danube in the area of Kopački rit in 2011. It is possible that birds brought this alga at the area of Bardača.

Bojčić et al (1982) reported that in fishponds during the summer period green algae and cyanobacteria generally dominate. However, at Bardača, the presence of diatoms cannot be ignored, since they were present in the water column in substantial numbers throughout the year. Also, Sigee (2004) reported that the genus *Melosira* is present in the plankton during colder periods of the year, while in summer it moves to the bottom, while the genus *Microcystis* goes opposite, i.e. in summer it is present in the plankton, and in winter it sinks to the bottom. Analysis of phytoplankton in 2011 showed that *Melosira* was present in significant numbers in all samples throughout the year, while *Microcystis* could be found in low numbers in samples collected in January. In water of Kopački Rit dominant species during the winter was *Chrysophyta Synura uvella* (Stević, 2011). At the fish pond Prevlaka this alga was not very abundant. In summer in Kopački Rit cyanobacteria dominated, and in autumn the dominant was *Pyrrophyta* from genus *Peridinium*. In the fish pond Zobnatica (Serbia) *Pyrrophyta Peridiniopsis cunningtonii* also dominated in autumn (Matavulj i sar., 2007). This algae was present in pond Prevlaka throughout the year, but has never prevailed in the total phytoplankton. In the fish pond Zobnatica very abundant were green algae from genera *Pediastrum* and *Scenedesmus, Euglenophyta* from genera *Euglena* and *Phacus*, and cyanobacteria from genera *Anabaena* and *Microcystis* were, like at Bardača. Dominant siliceous algae at Zobnatica were: *Amphora*, *Cymbella, Fragilaria*, *Navicula* and *Cyclotella*, while in the fish pond Prevlaka dominating genera were: *Melosira*, *Cyclotella, Navicula, Nitzschia, Synedra* and *Gyrosigma*. Genera *Amphora*, *Cymbella* and *Fragilaria* were present only sporadically or in low numbers.

CONCLUSIONS

According to the analysis of qualitative and quantitative distribution of phytoplankton it can be concluded that the fish pond Prevlaka is characterized by considerable diversity of phytoplankton, but also with high organic production. During 2011 presence of 85 different

taxa of phytoplankton within 7 phylums, including cyanobacteria, was determined. Qualitatively, the highest number of taxa was from phylum *Chlorophyta*, which were represented by 31 taxa. The next most numerous phylums were *Bacillariophyta*, *Euglenophyta* and *Cyanobacteria*. Draining of fishponds for harvest and application of agrotechnical measures disturb normal seasonal dynamics of phytoplankton. Introduction of lime into the water, which is carried out between April and July, leads to a shift or complete absence of the spring phytoplankton maximum development. Significantly higher abundance of phytoplankton is reaches in the second, summer/autumn algal bloom. Due to the constant high level of organic matter in the water caused by fertilization, clear water phase was absent. Despite implemented agrotechnical measures numerous undesirable species of cyanobacteria were present, while the desirable green algae in the summer period were represented in lownumber. Agrotechnical measures significantly affected the phytoplankton at fish pond Prevlaka, providing differences in their distribution compared to fish ponds in the region. Continuous monitoring of phytoplankton should be carried out in order to improve the fish production, and in accordance with results appropriate agrotechnical measures should be implemented.

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