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The macrozoobenthic fauna of the Biosphere reserve Srebarna Lake in North-Eastern Bulgaria

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With 1 Table

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The paper represents the results of two years regular observations on the species diversity of the benthic invertebrate communities of the Srebarna Lake - a Biosphere Reserve, World Natural Heritage Site and Ramsar Site of International Importance, located on the Danube bank in North-Eastern Bulgaria. All available faunistic information about the species content is associated with the data obtained in 1997-1999 as a part of a large monitoring program in developing a management plan of the reserve. In total 170 benthic taxa have been historically recorded, of them 35 have been identified firstly and other 41 confirmed during the last period of investigations.

1 Introduction

The Lake of Srebarna is located on the right Danube bank in North-Eastern Bulgaria, close to the district town of Silistra. Perhaps, this lake is the most prominent Bulgarian protected area a biosphere reserve, registered in the UNESCO's list, World Natural Heritage Site, a Ramsar Site of International Importance, Important Bird Area, recognized by WetLands International, etc.

During its long history as a protected area (nature reserve status was declared in 1948), the lake has been subjected by many negative factors, the most catastrophic ones have been the diking of the bank and cutting off the connection with the Danube River, which used to provide the lake with fresh waters during the annual spring floods. To this end, and together with the imputs of nutrients from the surrounding arable lands and wastewaters from the neighbouring village, in early nineties the ecological situation has been estimated as a disaster. Only after the construction of the connecting canal in 1994, the exchange of water with the Danube was made possible, the water level arised up to the 2,5 m and some processes of ecosystem rehabilitation have had place recently.

Concerning the macrozoobenthos of the Srebarna Lake, it should be emphasized that the community has been never a subject of systematic benthological investigations by now. The available faunistic data were summarized by in the book "Biodiversity of the Srebarna Biosphere Reserve. Checklist and Bibliogra-

phy" (MICHEV & al. 1998) and they concerned the registration of species from various taxonomic groups, some of them being a component of bottom communities, and thus contributing to the better knowledge of the species diversity of the reserve as whole.

The most of the available data concern findings during episodic visits of the lake and/or some additional samplings, obtained mainly from phytophilic biocenoses (reed-ring) around the bank. Amongst other, the molluscs seem to be better known with 29 Gastropoda and 13 Bivalvia species reported (DRENSKY 1946-1947, FRANK, JUNGBLUTH & RICHNOVSKY1990, ANGELOV in press). There are several contributions on Oligocheta (GENOV 1971, RUSSEV 1979, UZUNOV & KAPUSTINA 1993, UZUNOV 1998) with 26 species recorded, of them 9 earthworms. STOICHEV (1996a) reported 9 nematode species for the lake fauna. After BULGURKOV (1961) and ANDREEV (1998), the crustaceans are known with 6 represented species. The insect fauna of the reserve has been studied mostly on imago; there are few data on larvae of the bottom invertebrate communities. The larvae of Chironomidae (Diptera) look the most investigated group in the lake (DIMITROV 1966, MICHAILOVA 1979, 1989, 1998, STOICHEV 1996b). There are data about only two dragon-flies larvae of 35 species as reported by BESHOVSKY & MARINOV (1993) for the faunistic inventory of Odonata for the reserve. Amongst very rich list of the beetles (more than 300 species Coleoptera reported for the reserve), there are only two aquatic ones (MICHEV & al. 1998). There is complete lack of information about water inhabitants from other families and genera of Diptera, Heteroptera, Coleoptera, some Lepidoptera, etc. In general, one may assume that there are 136 species registered in the faunistic inventory of the reserve, which are of could be a component of bottom communities.

The first cenological investigations have been undertaken by Stanoy Kovachev, Hydrobiological Department, Biological Faculty, Sofia, during the period of 1994-1995, when first effects of the newly constructed canal between the Danube River and the Srebarna Lake have been expected. Unfortunately, in this period the results have been completely negative: there has not been macrozoobenthos at all. According to Kovachev's personal opinion, the lake ecosystem could be described as a full ecological regress (concerning the benthic communities, at least), where the bio-degradation of the incoming organic matter was not possible, and thus microaerobic, even anaerobic, conditions have predominated close to the lake bottom.

The prediction about some future restoration of the macrozoobenthos in next period of regular inflow of fresh water masses from the Danube and maintenance of relatively high water levels in the Srebarna Lake was examined during the period of 1997-1999. The present paper represents the results of two years regular observations on the species diversity of the benthic invertebrate commu-

nities of the Srebarna Lake, which have been carried out in 1998-1999 as a part of a large monitoring program in developing a management plan of the reserve, according to the requirements of the national nature protection legislation.

2 Material and methods

Some preliminary qualitative observations were performed in August-September 1997 and in August-October 1998 (totally 18 samples). Quantitative bottom samples have been collected by Eckmann's dredge of 225 cm^2 surface range monthly since May till November in 1998 and between March and July in 1999 respectively from 5 permanent points (see I-V on the Table) of the open lake surface (totally 60 samples). After relevant processing of the materials obtained, the biomass was measured as "soft" one (excluding molluscs); all quantitative data were represented as for 1 m^2.

3 Actual state of the macrozoobenthos species diversity

A full inventory of the species found in the bottom invertebrate communities by now is presented on the Table 1. The results of the present study are associated with the data known from different sources (see R on the Table) as summarised by MICHEV & al. (1998). Some unpublished yet data on Oligochaeta (Uzunov, personal communication) have been associated also to the list.

As a result of the present investigation, some 35 species were found as first record for the bottom fauna of the lake, the finding of other 41 species was confirmed. Thus the number of the registered bottom invertebrate taxa was found to be 170. A matter of interest is to point out that the number of species found along the banks (53 taxa in total) was higher than of those found in the lake bottom (45 taxa in total) under the open lake surface.

During the present investigation, *Segmentina nitida* (Gastropoda) was the only globally threatened species found in the lake. Other ones with the same conservation status, like *Hirudo medicinalis* (Hirudinea) and larvae of *Gomphus flavipes* (Odonata) were not found during the present study. *Brachytron pratense* and *Leucorrhinia pectoralis* (Odonata), also globally threatened species, have not been found since late sixties (BESHOVSKY & MARINOV 1993).

Special attention should be paid to the fact that, even poor in its species number, the macrozoobenthos has been presented permanently during the whole biological season in the lake. This is a sign for some stability of the lake environment when comparing with the period before 1995. Important characteristics of the restoration is participation of secondary aquatic insects, among them the main dominant is *Chaoborus crystallinus*, together with several representatives of Chironomidae and other Diptera larvae. The participation of primarily aquatic species (like worms, molluscs, crustaceans etc.) is still minimum in density. Most common are the molluscs *Acroloxus lacustris, Bithynia tentaculata,*

Valvata piscinalis, Planorbarius corneus, Dreissena polymorpha, and the oligochets *Limnodrilus claparedeanus, L. hoffmeisteri, Potamothrix bavaricus.*

In quantitative terms, the density is not very high: average 190 ind./m² (averaged for two years of the study), with a maximum at station V in June 1999 (1188 ind./m²). The "soft" biomass was averaged at 0.903 g/m² for two years of the study (with a maximum of 14.741 g/m² at station V in April 1999) - significantly low, when comparing with other native wetlands in that country (see KOVACHEV & UZUNOV 1981)

Tab. 1: Invertebrate fauna of the Srebarna Lake as found as recorded in the references (R) and in the sampling sites I-V during the 1997-1999 study, Q = qualitative samples

Taxon	R	I	II	III	IV	V	Q
NEMATODA							
Dorylaimus stagnalis DUJARDIN							
Laimidorus flavomaculatus (LINSTOW)							
Monhystera stagnalis BASTIAN							
Mononchus truncatus BASTIAN							
Paractinolaimus macrolaimus (DeMAN)							
Paradorylaimus filiformis (BASTIAN)							
Prodesmodora circulata (MICOLETZKY)							
Punctodora ratzenburgensis (LINSTOW)							
Tripyla glomerans BASTIAN							
OLIGOCHAETA							
Aeolosoma hemprichi EHRENBERG							
Allolobophora calliginosa (SAVIGNY)							
Amphichaeta leydigi TAUBER							
Aulophorus furcatus (O. F. MUELLER)							
Bimastus tenius (EISEN)							
Branchiura sowerbyi BEDDARD							
Chaetogaster limnaei BAER							
Criodrilus lacuum HOFFMEISTER							
Dero digitata (O. F. MUELLER)							
Eisenia rosea (SAVIGNY)							
Eisenia foetida (SAVIGNY)							
Eiseniella tetraedra (SAVIGNY)							
Homochaeta naidina BRETSCHER							
Isochaetides michaelseni (LASTOCHKIN)							
Limnodrilus claparedeanus RATZEL							
Limnodrilus hoffmesteri CLAPAREDE							
Limnodrilus udekemianus CLAPAREDE							
Lumbricus rubellus (HOFFMEISTER)							
Nais barbata O. F. MUELLER							
Nais simplex PIGUET							
Nais pardalis PIGUET							
Nais variabilis PIGUET							
Octolasion complanatum (DUGES)							
Octolasion lacteum (OERLY)							
Octolasion transpadanum (ROSA)							
Ophidonais serpentina O. F. MUELLER							
Potamothrix bavaricus (OESCHMANN)							

Taxon	R	I	II	III	IV	V	Q
Potamothrix hammoniensis (MICHALESEN)	*		*	*		*	*
Potamothrix vejdovskyi (HRABE)							
Psammoryctides albicola (MICHAELSEN)							
Slavina appendiculata (d'UDEKEM)							
Stylaria lacustris (LINNAEUS)							
Tubifex tubifex (O. F. MUELLER)							
Vejdovskyella comata (VEJDOVSKY)							
HIRUDINEA (Det. Dr. I. Yaneva)							
Glossiphonia complanata (LINNAEUS)							
Glossiphonia heteroclita (LINNAEUS)							
Haementeria costata (O. F. MUELLER)							
Hirudo medicinalis LINNAEUS							
GASTROPODA (Det. Mg. I. Dedov)							
Acroloxus lacustris (LINNAEUS)							
Anisus leucostomus (MILLET)							
Anysus septemgyratus (ROSSMAESSLER)							
Anisus spirorbis (LINNAEUS)							
Anisus vortex (LINNAEUS)							
Anisus vorticulus (TROSCHEL)							
Bithynia tentaculata (O.F. MUELLER)							
Galba truncatula (O. F. MUELLER)							
Gyraulus albus (O. F. MUELLER)							
Gyraulus crista (LINNAEUS)							
Gyraulus laevis (ALDER)							
Hippeutis complanatus (LINNAEUS)							
Lithoglyphus naticoides PFEIFFER							
Lymnaea stagnalis (LINNAEUS)							
Physa acuta (LINNAEUS)							
Physa fontinalis (DRAPARNAUD)							
Planorbarius corneus (LINNAEUS)							
Planorbis carinatus O. F. MUELLER							
Planorbis planorbis (LINNAEUS)							
Radix auricularia (LINNAEUS)							
Radix ovata (DRAPARNAUD)							
Radix peregra (O. F. MUELLER)							
Segmentina nitida (O. F. MUELLER)							
Stagnicola corvus (GMELIN)							
Stagnicola palustris (O. F. MUELLER)							
Valvata cristata (O. F. MUELLER)							
Valvata piscinalis (O. F. MUELLER)							
Viviparus acerosus (BOURGUIGNAT)							
Viviparus contectus (MILLET)							
Viviparus viviparus (LINNAEUS)							
BIVALVIA (Det. Mg. I. Dedov)							
Anodonta anatina (LINNAEUS)							
Anodonta cygnaea (LINNAEUS)							
Dreissena polymorpha (PALLAS)							
Pisidium casertanum (POLI)							
Pisidium personatum MALM							
Pisidium pseudosphaerium SCHLESCH							
Pseudanodonta complanata (ROSSMAESSLER)							

Taxon	R	I	II	III	IV	V	Q
Sphaerium cornem (LINNAEUS)	*			*			
Unio crassus RETZIUS							
Unio pictorum (LINNAEUS)							
Unio tumidus PHILIPSSON							
MYSIDACEA							
Limnomysis benedeni CZERNIAVSKY							
AMPHIPODA							
Gammarus arduus KARAMAN							
Gammarus sp.							
Niphargus sp.							
ISOPODA							
Asellus aquaticus (LINNAEUS)							
DECAPODA							
Astacus leptodactylus ESCHSCHOLTZ							
EPHEMEROPTERA (Det. Dr. I. Yaneva)							
Caenis horaria (LINNAEUS)							
Caenis robusta EATON							
Cloeon dipterum (LINNAEUS)							
TRICHOPTERA (Det. Dr. K. Kumanski)							
Ecnomus tenellus (RAMBUR)							
Leptocerus cf. tinneiformis CURTIS							
ODONATA							
Aeshna affinis (LINDEN)							
Aeshna mixta LATREILLE							
Aeshna isosceles (O. F. MUELLER)							
Anax imperator LEACH							
Calopteryx splendens (HARRIS)							
Chalcolestes viridis (LINDEN)							
Coenagrion ornatum (SELYS)							
Coenagrion puella (LINNAEUS)							
Coenagrion pulchellum (LINDEN)							
Cordulia aenea (LINNAEUS)							
Crocothemis erythraea (BRUILLE)							
Erythromma najas (HANSEMANN)							
Erythromma viridulum (CHARPENTIER)							
Hemianax ephippiger (BURMEISTER)							
Gomphus flavipes (CHARPENTIER)							
Ischnura elegans (LINDEN)							
Iscnura pumilio (CHARPENTIER)							
Lestes barbatus (FABRICIUS)							
Lestes virens (CHARPENTIER)							
Lestes sponsa (HANSEMANN)							
Lestes dryas KIRBY							
Libellula depressa LINNAEUS							
Orthetrum albistylum (SELES)							
Orthetrum anceps (SCHNEIDER)							
Orthetrum brunneum (FONSCOLOMBE)							
Orthetrum cancellatum (LINNAEUS)							
Orthetrum coerulescens (FABRICIUS)							
Platycnemis pennipes (PALLAS)							
Somatochlora metallica (LINDEN)							

Taxon	R	I	II	III	IV	V	Q
Sympecma fusca (LINDEN)	*						
Sympetrum depressiusculum (SELYS)							
Sympetrum fonscolombei (SELYS)							
Sympetrum meridionale (SELIS)							
Sympetrum pedemontanum (ALLIONI)							
Sympetrum sanguineum (O.F. MUELLER)							
Sympetrum striolatum (CHARPENTIER)							
Sympetrum vulgatum (LINNAEUS)							
COLEOPTERA							
Dytiscus marginalis LINNAEUS							
Gyrinus distinctus LINNAEUS							
Haliplus sp.							
Ilybius sp.							
Laccobius sp.							
HETEROPTERA							
Ilyocoris cimicoides (LINNAEUS)							
Plea minutissima LEACH							
Ranatra linearis (LINNAEUS)							
Sigara falleni (FIEBER)							
DIPTERA: CERATOPOGONIDAE							
Bezzia sp.							
Culicoides sp.							
DIPTERA: CHAOBORIDAE							
Chaoborus crystallinus (FABRICIUS)							
CHIRONOMIDAE (Det. Dr. S. Stoychev)							
Camptochironomus sp.							
Chironomus annularius MEIGEN							
Chironomus plumosus (LINNAEUS)							
Corynoneura sp.							
Cricotopus algarum (KIEFFER)							
Cricotopus trifascia EDWARDS							
Cricotopus ornatus (MEIGEN)							
Cricotopus sylvestris (FABRICIUS)							
Cryptochironomus defectus KIEFFER							
Endochironomus sp.							
Eukiefferiella cf. similis GOETGHEBUER							
Glyptotendipes glaucus (MEIGEN)							
Glyptotendipes pallens (MEIGEN)							
Glyptotendipes gripenkoveni KIEFFER							
Parakiefferiella bathophila (KIEFFER)							
Psesctrocladius isthimicus TSCHERNOVSKY							
LIMONIIDAE							
Helobia sp. Larva							
Wiedemannia sp. Larva							
MUSCIDAE g. sp. Larva							
PSYCHODIDAE g. sp. Larva							
STRATYOMYIDAE g. sp. Larva							
TABANIDAE g. sp. Larva							*
TOTAL	136	13	25	15	14	16	53

Following the procedures after Russev (1978) and based on the averaged "soft" biomass only, some preliminary estimation of the annual benthic producion shows figures near 5.148 g/m², or 6.5 t/year having approximately 120 ha open water of the lake. If the fish populations may utilize one third of this production (about 2.2 t/year), the expected growth of the fish mass is only 310 kg/year, or 4.8 % of the annual production of the macrozoobenthos. These estimations are actually lower than real ones, when one takes into considerations the share of the molluscs in the fish diet, and the trophic opportunities provided by the invertebrates in the reed-ring around the lake's bank as well.

4 Conclusions

It could be concluded, that after the construction of the connecting canal, since 1995 the bottom invertebrate community of the Srebarna Lake is restoring its species diversity and the macrozoobethos could be registered permanently during the whole vegetation period. During this initial steps of the community's restoration, in the species content, there are mostly representatives of the secondary aquatic (insect-larvae and/or air-breathing imago), rather than primarily aquatic species like worms, molluscs, crustaceans, etc. The historical species list looks longer than the species content really found within the period of the reported investigation. Perhaps, the trend of future enrichment of the species diversity will be contitued together with maintainance of the relatively high water levels and elimination of human impacts on this protected area.

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