ECOLOGICAL STUDY OF ZOOBENTHOS COMMUNITIES FROM THE MATITA AND MERHEI LAKES (DANUBE DELTA)

STUDIU ECOLOGIC AL COMUNITATILOR ZOOBENTALE DIN LACURILE MATITA SI MERHEI (DELTA DUNARII)

Gabriela-Mihaela PARASCHIV*, Verginica SCHRODER, Manuela-Diana SAMARGIU*, Daciana SAVA***

**University Ovidius, Constanta, Romania*
***Dobrogea-Litoral Romanian Waters Direction, Constanta, Romania*
Corresponding author: Gabriela-Mihaela PARASCHIV, e-mail:gmparaschiv@gmail.com

Abstract: *The study on the benthal fauna in Matita and Merhei lakes is based on a number of 172 qualitative and quantitative samples collected in two stages (June and September) from different regions of the two lakes and from different substrates; the processing of the biological samples permitted the identification of a number of 58 species from 18 supraspecific taxonomical groups: Hydrozoa, Spongia, Turbellaria, Nematoda, Nematomorpha, Polychaeta, Oligochaeta, Hirudinea, Gastropoda, Bivalvia, Acarina, Ostracoda, Copepoda, Amphipoda, Cumacea, Mysidacea, Isopoda and Insecta. The invertebrate associations are structured into two major communities: the community of sedimentophile species and that of phytophile species. A relatively low number of species is cited as present in both basins, especially among the sedimentophile ones. However, the phytophile fauna is abundant in Matita, which is explained by the rich submersed vegetation.*

Rezumat: *Studiul asupra faunei bentale din lacurile Matita si Merhei se bazează pe un număr de 172 probe (calitative si cantitative) colectate in doua etape (iunie si septembrie) din diferite regiuni ale celor doua lacuri, de pe substraturi diferite; prelucrarea probelor biologice au permis identificarea unui număr de 58 de specii din 18 grupe taxonomice supraspecifice: Hydrozoa, Spongia, Turbellaria, Nematoda, Nematomorpha, Polychaeta, Oligochaeta, Hirudinea, Gastropoda, Bivalvia, Acarina, Ostracoda, Copepoda, Amphipoda, Cumacea, Mysidacea, Isopoda si Insecta. Asociațiile de nevertebrate sunt structurate in doua comunitati majore: comunitatea speciilor sedimentofile si cea a speciilor fitofile; un număr relative redus de specii sunt citate ca prezente in ambele bazine mai ales dintre cele sedimentofile in timp ce fauna fitofila abunda in Matita, fapt explicat prin vegetația submersa foarte abundenta.*

Key words**:** *zoobenthos, sedimentary and phytal fauna*
Cuvinte cheie: *zoobentos, fauna sedimentofila si fauna fitofila*

INTRODUCTION

Our study, extended over 1999-2003, was part of a research program oriented towards the zoobenthal communities in different biotopes of lakes from the Danube Delta which are or are not directly influenced by the Danube or marine waters; a part of the biological samples was collected within campaigns of the research programs of the National Institute for Geological and Marine Geoecological Research and Development Bucuresti. Another part was collected within campaigns realized by the authors. Lakes Matita and Merhei are localized in the fluvial delta, in the Matita-Merhei depression (Radan et.al., 1997). They have a maximum depth of 3.5-4 meters and, at their level, there are no citations of direct influences from the Danube or marine waters; over the entire study period, the basin of lake Matita was covered by abundant submersed vegetation (unlike lake Merhei) – the dominant species being *Myriophyllum* and *Potamogeton*.

MATERIAL AND METHODS

For the drawing of the biological samples from Lake Matita, four situs were established near the border vegetation and eight situs were positioned at different distances from the shore. In Lake Merhei, the shore and 5 placed 3 situs in the central area of the lake (Table 1). The qualitative samples were obtained through dredging or by collecting submersed vegetation and separating the biological material on sieves (sieve net size: 1 mm and 0.25 mm); the quantitative samples were taken by means of the Van Veen bodengreifer. The statistical analysis of the data and the calculation of the ecological indexes were calculated by using the EstimateS, program. The results obtained consequently to laboratory processing of the biological samples confirmed our thesis, according to which the zoobenthal communities in the analyzed lakes are associated according to the type of substrate – based on a positive tropism, but also according to the feeding regime, which made us continue the analysis of the results obtained based on the same thesis.

Table 1

The location and number of biological samples collected from Matita and Merhei Lakes during the analyzed period

Lake	Sample Type	Shore Vegetation	Different distances from the shore
MATITA	Qualitative	8 Phytal	16 Phytal+Sedim. substr.
	Quantitative	14	22 Phytal substr. and 32 Sedim. substr.
MERHEI	Qualitative	12 Phytal	10 Phytal+Sedim.substr.
	Quantitative	26	12 Phytal substr. and 20 Sedim. substr.

RESULTS AND DISCUSSION

Among the 58 species from 18 supraspecific taxonomical groups (Annex 1), the maximum number of species recorded belongs to the Crustacea group: 13 Amphipoda species, 5 Cumacea, 3 Mysidacea, 2 Isopoda, (we mention that within the Ostracoda and Copepoda groups, the quantitative determinations were realized at group level), followed by Mollusca, 10 species and Insecta, 8 species; crustaceans dominate as densities as well: *Echinogammarus warpachowsky* (Rk_D 1), Ostracoda (Rk_D 4), *Pterocuma pectinata* (Rk_D 5) and *Pontogammarus robustoides* (Rk_D 8), followed by Oligochaeta (Rk_D 2) and Chironomidae larvae (Rk_D 3). In what regards the biomass, the first position is occupied by Oligochaeta, followed by the crustaceans *Echinogammarus warpachowsky* (Rk_B 2) and *Asellus aquaticus* (Rk_B 3) and the bivalve *Unio pictorum* (Rk_B 4).

We report the presence in these lakes of a number of 13 species endemic to the Poto-Caspian basin. They belong to the Amphipoda group – Echinogammaridae, the Cumaceans group – *Pterocuma pectinata danubialis, Schizorhynchus scabriusculus* v. *danubialis* and to all the Mysida (Serban, 2004).

Following the variation of the number of species in the associations from the two substrate types, we observe that a bigger number of species is recorded in the phytal associations and this is more obvious in lake Matita (Figure 1 a and b), where the submersed vegetation is abundant over the entire surface of the bottom and, in some regions, it developed up to the water surface (Serban et. al., 2000, 2001). The phytal substrate in both lakes is dominated by crustaceans that are caught in vegetation (these having affinity to harder substrates, Bacescu, 1954, 1969), but we also report the presence of species that use this type of substrate to attach themselves, such as *Hydra* individuals, sponge species and bryozoans or Gasteropoda species that also use this substrate as food resource (Bacescu et.al., 1971).

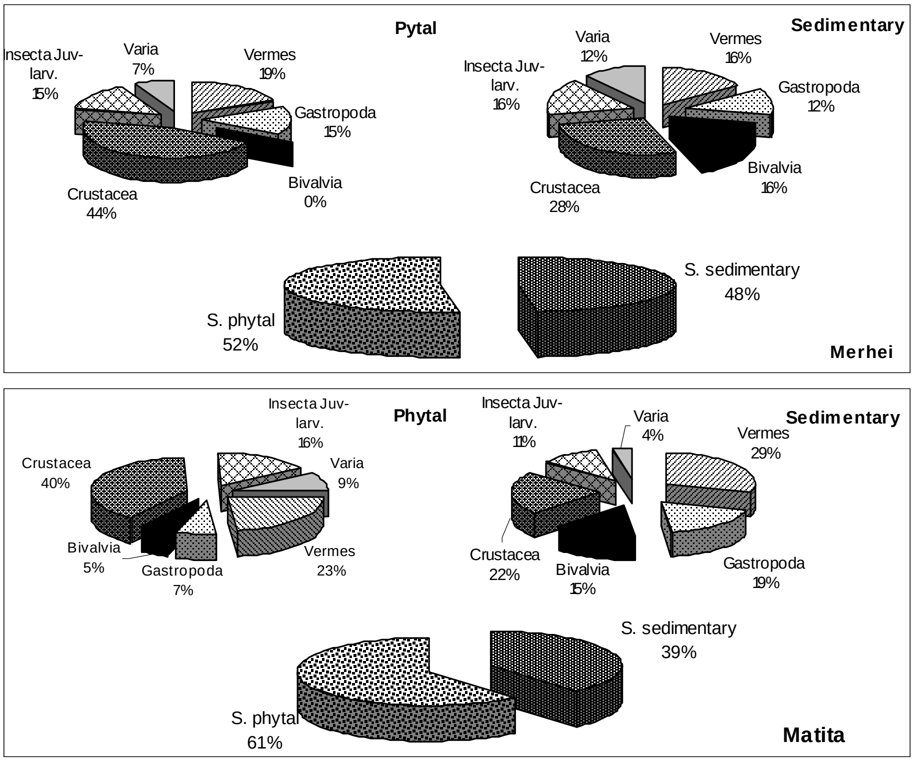

Figure 1 Species number variation within the zoobenthal communities in Matita (a) and Merhei (b) Lakes

Within the associations from the sedimentary substrate, a different situation is registered in the two lakes. In Lake Matita, the mollusks and worms are those that have a greater number of species. This was attributed to the existence of a column of sediment, mostly dominated by a considerably high layer of vegetal detritus with a fluid consistence and having a narrow, compact layer only at the basis. In Lake Merhei, where the substratum has a sandy matrix, it is more compact along the entire sediment column and it is considered a better support for the epifauna, crustaceans are the most numerous; in this context, we report the presence of Corophiidae, which are mostly sedimentophile (they build tubes out of sediment particles, in which they take refuge, Carausu et.al., 1955) and of the bivalve *Unio pictorum*. The presence of large quantities of vegetal detritus in lake Matita explains the faster development of detritivorous populations (sedimentophage – mostly Oligochaeta, and straining – bivalve mollusks: *Dreissena polymorpha* and *Anodonta*) and of strongly sedimentophile species in lake Merhei, among which the Cumacea (Bacescu, 1951) species: *Schizorhynchus eudorelloides*, *Schizorhynchus scabriusculus*.

In the case of the associations from the phytal and sedimentary substrata as well, the species reported only in one of the lakes is relatively more frequent. They are represented by a reduced average number of individuals per sample – up to 10 individuals, especially in the case of Peracarida crustaceans and of certain Gasteropoda species (Figure 2 a and b). A better representation is observed in the case of the populations of species reported in both lakes, as over 20 individuals were frequently recorded per sample. The highest number of common species was registered in the associations of the sedimentary substrate.

The careful analysis of the crustacean species that occur in the sedimentary benthos, as well as the phytal one, shows that most species from the Gammaridae group have an omnivorous feeding regime. (Barnard, 1983) They collect particles from the water mass (vegetables, detritic animals) with the help of setae palps. Their presence in both communities is explained, on the one hand, by their movement possibilities, but also by their non-selective omnivorous-detritivorous feeding regime.

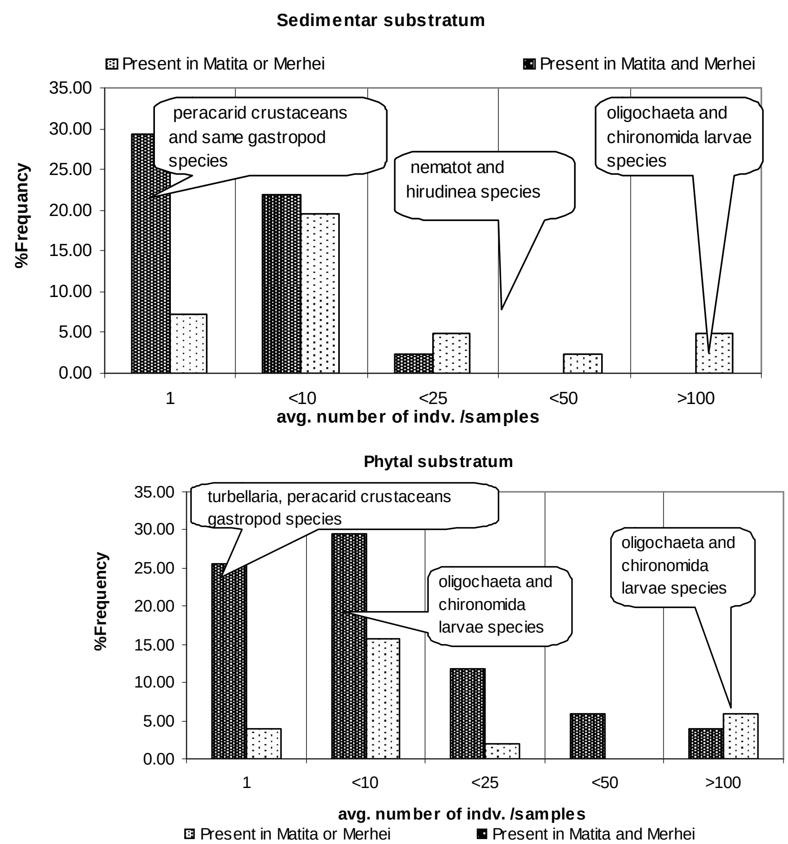

Figure 2. The variation of species occurrence frequency within the benthal communities on the sedimentary substratum (a) and phytal substratum (b)

Even though the number of taxa from the associations of the phytal substratum is bigger, if we analyze the values of the diversity indexes (Table 2) of different groups of zoobenthal organisms from the associations of these two categories of substratum, we observe that the H index value (Shannon-Winner) is closer to the theoretical value of the diversity index (Hmax) in the case of densities for the sedimentophil crustaceans, of insect biomass and, to a lesser extent, of crustaceans on the phytal substratum. However, from a density point of view, the variation of the equitability index shows a better division of resources in the case of the associations from the phytal substratum, while from a biomass point of view, the situation is reversed. This can also be explained by the much bigger size of sedimentophil forms.

Table 2

Diversity indexes: Sedimentary and Phytal Substrate

	D	**Vermes**	**Mollusca**	**Crustacea**	**Insecta**	**Varia**
H	**1.788459**	0.65263	0.90593	2.30504	0.233193	0.699843
Hmax	**5.285402**	3.16993	3.16993	3.45943	2.321928	1.584963
E	**0.499177**	0.80131	0.56378	0.22834	0.945897	0.7600
H/Hmax	**0.338377**	0.20588	0.28579	0.66631	0.100431	0.441552
	B	**Vermes**	**Mollusca**	**Crustacea**	**Insecta**	**Varia**
H	**0.629102**	0.017551	1.919226	1.2747816	0.575191	0.033184
Hmax	**5.392317**	3.321928	3.459432	3.8073549	2.321928	1.0000
E	**0.83684**	0.997383	0.296345	0.5427465	0.818752	0.993125
H/Hmax	**0.116666**	0.005283	0.554781	0.3348208	0.247721	0.033184

Phytal Substratum

	D	**Vermes**	**Mollusca**	**Crustacea**	**Insecta**	**Varia**
H	**1.647796**	0.58481	0.83376	0.58812	0.545646	1.573011
Hmax	**5.643856**	3.32193	2.80735	4.32193	2.807355	2.0000
E	**0.544032**	0.82086	0.61073	0.82876	0.854939	0.379372
H/Hmax	**0.291963**	0.17604	0.29699	0.13608	0.194363	0.786505
	B	**Vermes**	**Mollusca**	**Crustacea**	**Insecta**	**Varia**
H	**1.621886**	0.040559	1.10097	1.1185639	1.291305	1.006294
Hmax	**5.584963**	3.321928	3.0000	4.2479275	2.807355	2.0000
E	**0.410637**	0.993221	0.623464	0.5227812	0.457405	0.506671
H/Hmax	**0.290402**	0.01221	0.36699	0.2633199	0.459972	0.503147

CONCLUSIONS

- Out of the total number of species identified in the zoobenthos of the two lakes, 63.8% were determined on phytal substratum, among which, the mites and a large part of crustaceans and insect larvae were encountered exclusively on this substrate. There are no major differences to report between the two lakes in what regards the qualitative and quantitative structure of the analyzed communities.
- Most mollusk species, the species of Polychaeta (**Annelida**) *Hypania invalida* and *Schizorhynchus eudorelloides*, *Schizorhynchus scabriusculus*, *Pterocuma rostrata* among the Cumaceans, were identified by us in the sedimentary biotopes from the benthos of Lake Merhei.
- The qualitative and quantitative structure of the zoobenthal communities on the sedimentary substrate is considerably different from one lake to the other. These structural differences of the sedimentophile associations from the two lakes are owed to the major substrata differences: abundant vegetal detritus, the superior stratum rich in detritus and fluid in Lake Matita constitutes a more selective habitat

for the epibiont species, even Chironomidae species. The presence of the sandy matrix in the sediments of Lake Merhei constitutes a better habitat for both the epi- and infauna. This is why we report the presence of 34% of the sedimentophil species in this lake alone.

LITERATURE

1.BARNARD, C.M. & Y.L., "*Freshwater Amphipoda of the World*", Ed.Hayfield Associates, SUA, 1983.

2.BACESCU, M., "*Cumacea, Crustacea*", Fauna RSR, IV/ 1 Ed. Academiei RSR 1951.

3.BACESCU, M., "*Mysidacea, Crustacea*", Fauna RSR, IV/ 3, Ed. Academiei RSR 1954.

4.BACESCU, M., "*Mysidacea. Öpredeliteli fauna Cernogo Azovskoi morei*" II, Ed. Naukova Dumka, Kiev,1969, pg 363-381.

5.BACESCU, M., MULLER G.I., GOMOIU M.-T., "*Cercetari de ecologie bentala in Marea Neagra*", Ecologie marina IV, Acad. RSR, Buc, 1971.

6.CARAUSU, S., DOBREANU, E., MANOLACHE, C., "*Amphipoda forme salmastre si de apa dulce*", Fauna RSR, IV/ 1955, pg.41-407.

7.RADAN,S., STRECHIE, CLAUDIA, GANCIU, A., GYONGYI, RUZSA, RADAN, C.S., RADAN, MARIA, "*EROS 2000 Danube program: State of ecosystems within the Danube delta in 1995*", GEO-ECO-MARINA 2/1997, pg. 163-178.

8.ŞERBAN, VERGINICA, PARASCHIV, GABRIELA, GOMOIU, M-T., "*The population structure analysis of Ponto-Caspian Mysids (Crustacea-Peracarida) from the Romanian coastal waters*" Ann. Univ. "Ovidius" Constanța, Series Biology-Ecology, 4/2000, pg.37-42.

9.ŞERBAN, VERGINICA, GOMOIU, M-T, PARASCHIV, GABRIELA, LEPADATU, ANCA, CRISTINA, NEGREANU-PARJOL, TICUTA, " *Recent Studies Concerning Relict Ponto-Caspian Amphipods and Mysidacean (**Crustacea**) from Romanian Paramarine Lakes and Danube Delta*"- 3rd International Conference of PhD students; Miskolc Ungaria, 3 / 2001, pg. 124-132.

10.SCHRODER, VERGINICA, "Taxonomia, raspandirea si ecologia peracaridelor relicte ponto-caspice din Dobrogea"-teza doctorat2004.

Anexa Species List and Ecological Index (Average Density Ddavg and DBavg by biomass, Ecological Density Ddeco and DB eco by biomass, DD% / DB% Dominant index by density and biomass, WD-Ecological semnification index by density and WB biomass, Rank by Density –RkD and biomass-RkB)

Nr.gr.	Nr.sp.	Taxa	Ecological Index by Density and Biomass									
			DD.avg	**DD.eco**	**DD%**	**WD**	**RkD**	**DBavg**	**DBeco**	**DB%**	**WB**	**RkD**
1	**Tubellaria**											
	1	*Dugesia gonocephala*	43.5	174.0	0.0	0.7	38	0.152	0.609	0.009	0.469	30
	2	*Mesostoma* sp	21.8	87.0	0.0	0.5	47	0.076	0.305	0.004	0.332	35
	3	*Turbellaria varia*	174.0	232.0	0.1	2.3	21	0.104	0.139	0.006	0.673	26
2	**Nematoda**		2349.0	2349.0	1.0	**9.8**	**6**	0.016	0.016	0.001	0.306	36
3	**Nematomorpha**		195.8	783.0	0.1	1.4	31	0.000	0.000	0.000	0.009	62
4	**Polychaeta**											
	4	*Hypania invalida*	21.8	87.0	0.0	0.5	48	0.015	0.062	0.001	0.150	49
5	**Oligochaeta**		36453.0	36453.0	14.8	**38.5**	**2**	1202.949	1202.949	69.647	**83.455**	**1**
6	**Hirudinea**											
	5	*Batrachobdella sp.*	152.3	609.0	0.1	1.2	32	0.381	1.523	0.022	0.742	24
	6	*Erpobdella octoculata*	130.5	261.0	0.1	1.6	27	1.214	2.427	0.070	1.874	13
	7	*Erpobdella stagnalis*	43.5	87.0	0.0	0.9	35	0.392	0.783	0.023	1.065	20
	8	*Hellobdella* sp.	435.0	1740.0	0.2	2.1	24	0.218	0.870	0.013	0.561	28
	9	*Glossiphonia* sp.	478.5	478.5	0.2	4.4	10	0.239	0.239	0.014	1.177	19
	10	*Piscicola geometra*	108.8	217.5	0.0	1.5	30	0.054	0.109	0.003	0.397	32
7	**Gastopoda**											
	11	*Acroloxus lacustris*	21.8	87.0	0.0	0.5	49	0.000	0.000	0.000	0.005	63
	12	*Bithinya leachi*	21.8	87.0	0.0	0.5	50	0.002	0.009	0.000	0.057	56
	13	*Bithinya tentaculata*	130.5	130.5	0.1	2.3	22	0.014	0.014	0.001	0.286	38

Nr.gr.	Nr.sp.	Taxa	Ecological Index by Density and Biomass									
			DD.avg	DD.eco	DD%	WD	RkD	DBavg	DBeco	DB%	WB	RkD
	14	*Hydrobia* sp.	21.8	87.0	0.0	0.5	51	0.001	0.003	0.000	0.030	58
	15	*Lithoglyphus naticoides*	43.5	174.0	0.0	0.7	39	0.000	0.000	0.000	0.012	60
	16	*Radix ovata*	43.5	174.0	0.0	0.7	40	0.000	0.000	0.000	0.012	61
	17	*Viviparus viviparus*	43.5	87.0	0.0	0.9	36	1.025	2.050	0.059	1.723	15
	18	*Sphaerium* sp.	21.8	87.0	0.0	0.5	52	0.005	0.018	0.000	0.081	54
	19	*Gastropoda varia*	391.5	522.0	0.2	3.5	14	0.761	1.014	0.044	1.817	14
8	**Bivalvia**											
	20	*Dreissena polymorpha*	239.3	319.0	0.1	2.7	18	3.930	5.240	0.228	**4.131**	**7**
	21	*Unio pictorum*	152.3	304.5	0.1	1.8	25	11.612	23.225	0.672	**5.798**	**4**
	22	*Anodonta cygnaea*	65.3	130.5	0.0	1.2	33	2.243	4.485	0.130	2.548	11
	23	*Valvata* sp.	152.3	203.0	0.1	2.2	23	0.003	0.004	0.000	0.111	52
9	**Ostracoda**		5829.0	7772.0	2.4	**13.3**	**4**	0.379	0.505	0.022	1.283	17
10	**Copepoda**		391.5	783.0	0.2	2.8	17	0.008	0.016	0.000	0.151	48
11	**Amphipoda**											
	24	*Corophium volutator*	119.6	239.3	0.0	1.6	28	0.132	0.263	0.008	0.617	27
	25	*Corophium nobile*	43.5	174.0	0.0	0.7	41	0.002	0.007	0.000	0.050	57
	26	*Dikerogammarus villosus*	239.3	957.0	0.1	1.6	29	0.479	1.914	0.028	0.832	23
	27	*Dikerogammarus haemobaphes*	21.8	87.0	0.0	0.5	53	0.052	0.209	0.003	0.275	39
	28	*Echinogammarus warpachowsky*	158253.0	211004.0	64.5	**69.5**	**1**	316.506	422.008	18.325	**37.072**	**2**
	29	*Echinogammarus major*	21.8	87.0	0.0	0.5	54	0.044	0.174	0.003	0.251	40
	30	*Echinogammarus behningi*	43.5	174.0	0.0	0.7	42	0.087	0.348	0.005	0.355	33

	31	*Gammarus aequicauda*	21.8	87.0	0.0	0.5	55	0.005	0.020	0.000	0.085	53
	32	*Niphargus valachicus*	21.8	87.0	0.0	0.5	56	0.041	0.165	0.002	0.245	44
	33	*Orchestia cavimana*	21.8	87.0	0.0	0.5	57	0.044	0.174	0.003	0.251	41
	34	*Obesogammarus crassus*	21.8	87.0	0.0	0.5	58	0.019	0.077	0.001	0.166	46
	35	*Pontogammarus robustoides*	1587.8	1587.8	0.6	**8.0**	**8**	1.429	1.429	0.083	2.876	9
	36	*Synurella ambulans*	21.8	87.0	0.0	0.5	59	0.044	0.174	0.003	0.251	42
12	**Cumacea**											
	37	*Pterocuma rostrata* Sars	7808.3	15616.5	3.2	**12.6**	**5**	4.685	9.370	0.271	**3.683**	**8**
	38	*Pterocuma pectinata danubialis*	152.3	304.5	0.1	1.8	26	0.091	0.183	0.005	0.514	29
	39	*Schizorhynchus eudorelloides*	43.5	87.0	0.0	0.9	37	0.017	0.035	0.001	0.224	45
	40	*Schizorhynchus scabriusculus*	21.8	87.0	0.0	0.5	60	0.009	0.035	0.001	0.112	51
	41	*Schizorhynchus scabriusculus* v. *danubialis*	108.8	435.0	0.0	1.1	34	0.044	0.174	0.003	0.251	43
13	**Mysidacea**											
	42	*Limnomysis benedeni*	282.8	377.0	0.1	2.9	16	4.241	5.655	0.246	**4.291**	**6**
	43	*Katamysis warpachowsky*	43.5	174.0	0.0	0.7	43	0.653	2.610	0.038	0.972	21
	44	*Paramysis lacustris*	21.8	87.0	0.0	0.5	61	0.326	1.305	0.019	0.687	25
Nr.gr.	**Nr.sp.**	**Taxa**	**Ecological Index by Density and Biomass**									
			DD.avg	**DD.eco**	**DD%**	**WD**	**RkD**	**DBavg**	**DBeco**	**DB%**	**WB**	**RkD**
14	**Isopoda**											
	45	*Asellus aquaticus*	1696.5	1696.5	0.7	**8.3**	**7**	161.168	161.168	9.331	30.547	**3**
	46	*Jaera sarsi*	21.8	87.0	0.0	0.5	62	0.544	2.175	0.031	0.887	22
15	**Insecta-larvae**											
	47	Ephemeroptera	456.8	609.0	0.2	3.7	12	4.568	6.090	0.264	**4.453**	**5**

	48	Odonata	21.8	87.0	0.0	0.5	63	3.915	15.660	0.227	2.380	12
	49	Trichoptera	195.8	261.0	0.1	2.4	20	0.027	0.037	0.002	0.345	34
	50	Coleoptera	43.5	174.0	0.0	0.7	44	0.017	0.070	0.001	0.159	47
	51	Heteroptera	609.0	2436.0	0.2	2.5	19	0.061	0.244	0.004	0.297	37
	52	Corixidae	32.6	130.5	0.0	0.6	46	0.003	0.013	0.000	0.069	55
	53	Chironomida larv.	23245.3	23245.3	9.5	**30.8**	**3**	0.372	0.372	0.022	1.467	16
	54	Chironomida pup+imag	299.1	299.1	0.1	3.5	13	0.030	0.030	0.002	0.416	31
16	**Varia**											
	55	*Hydra* sp.	478.5	478.5	0.2	4.4	11	1.244	1.244	0.072	2.684	10
	56	*Spongilla* sp.	522.0	1044.0	0.2	3.3	15	0.522	1.044	0.030	1.229	18
	57	*Plumatella* sp.	43.5	174.0	0.0	0.7	45	0.000	0.002	0.000	0.025	59
	58	*Acarina*	739.5	986.0	0.3	4.8	9	0.004	0.005	0.000	0.127	50