PRELIMINARY QUANTITATIVE MACROFAUNAL INVESTIGATIONS ON CHARACTERISTIC BIOTOPES OF LAKE FERTŐ/HUNGARY

by

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Introduction and objective

The most characteristic representants of shallow lakes of large extension in Europe can be found in Hungary. These waters are interesting for the regional limnology because of the shallowness, casually the greater salt concentration both from the point of view of the theoretical regional limnology as well as utilization.

The hydrobiological investigation of the Central-European shallow salinic and sodic lakes is according to Naumann (1932) also traditionally in first line the task of the Hungarian hydrobiologists.

In contrary to the above statement of one creator of the classic limnology we still do not know enough from Lake Fertő as a limnological object in spite that our internationally famed limnologist-zoologist Varga – uncovered many basic attainments.

In the past years as a result of the planned researches the special literature concerning the Austrian part of Lake Fertő increased considerably. We mention only some: Dokulil 1975 a, b, c, Donner 1968, Farahat – Nopp 1966, 1967, Imhof 1966, 1973, Löffler 1974, 1979 etc.

The complex development of Lake Fertő (what it concerns of course the southern Hungarian part) – as a region of recreational area is ordained by a Government Decree. In 1968 the Fertő-Region Committee of the Hungarian Academy of Sciences has been called to being which gave a new impulse by its fact-finding investigations and data collections to the here evolving Hungarian hydrobiological investigations.

In connection with the revealing the living organisms of the lake we may face with many white spots in the fields both of the botany and zoology. We are still far away to may speak on the hydrobiological revealing of the lake. The hydrobiological researches to be perfected urgently on the Hungarian part of Lake Fertő may yet create the possibility of the prevention and efficient protection of nature as well as landscape.

On Lake Fertő and in waters similar to her even as the consequence

of the shallowness – in contrary to the deep (namely the „real") lakes, the macrovegetation has outstanding importance in the entity of the matter circulation. I concentrated consequently my researches in the beginning – considering my narrower field of specialization – to the cognition of the zoocenoses of the macrovegetations, to the revealing of the connections between biotope and zoocenosis (Andrikovics 1973, 1978, 1979).

The principal results of these initial approaching-quantitative macrofaunal collectings and ecological investigations can be summarized in the following.

As a concequence of the wind-effect on Lake Fertő – especially on the open- water parts – only slight mosaicity may develop. In the open-water tanglies especially species-poor zoocenosis may settle.

The tangle stands of the smaller-larger ponds in the reedy zone are populated by a zoocenosis quantitatively as well as qualitatively richer than previous. The macrofauna of the *Utricularia vulgaris* stands was found especially rich.

The orientational investigations indicated the monotonous and poorish character of the macrofauna in the reeds and in the mud both in quantitative and qualitative aspect. The above summarized results concern the 1971–72 vegetational period. In the second part of the seventies a change of large extent occurred in the expansion of the macrovegetation. The repression of the open-water tanglies, the *Utricularia vulgaris* stands respectively the progression of the emergent macrovegetation and of the *Najas marina* stands caused a great faunal pauperization by the changing into unfavorable living conditions.

Since the approaching-quantitative investigations elucidated in first line quantitative differences thus it seemed as essential to compare more accurately quantitatively the faunal communities of the different biotopes. In my present paper I give an account on these results.

Location, date and method of the investigations

I carried out systematical quantitative collectings from reeds standing in water, from bulrushes and from *Potamogeton pectinatus* and *Najas marina* patches among the tanglies. As a comparison I took also sediment samples. Ad hoc quantitative samples were taken also from the sedges of the Kis-Herlakni pond and Hidegség pond and on the Austrian lake part from the opern-water *Potamogeton pectinatus* stands too.

Before the beginning of my investigations I had first to confront with several methodical difficulties. We do not know yet a reliable collecting method both in tanglies as well as in reeds. I could not adapt the flotation or other run for the exploitation of the zooolgical material only from the detrital sample got by quantitative collecting. It was a further problem that in comparison to the vegetational period of the 1971–72 years a regression of the tangle stands occurred.

I carried out systematical quantitative sampling from May, 1975 to May, 1976 by a monthly frequency.

My collecting method was: after heaving into the water a prism of 50 by 50 cm ground space, depending from the water depth covered by a nylon net (No. 25 mesh) being generally 100 cm high, on the limiting surface of the mud/water, a frogman reaching in from the outside cut the plant stems with a strong lawn-shear. Sediment samples were taken by a metal prism of the same basic groundface as the Eckman-Birge mud-gripper, 25 cm high, opern at the bottom and of sharpened edge which we pressed into the sediment swimming directly over the mud surface, followingly we closed the bottom with a metal plate and cautiously we lifted it. At every occasion I took 4 parallel mud samples later on I handled the entire material together.

Results of the investigations and their evaluation

We investigated systematically from the reeds standing in water the dense reed stands of the eastern bank of the Fertőrákos Bay and Hidegség pond. From the reeds I could demonstrate totally 44 taxons. The total individual number altered between 280 – 1704 individua/m^2. The most frequently reached individual number was around 600 – 800 ind/m^2.

The most characteristic organisms of the reed stands are the Chironomids. The most frequent species are: *Glyptotendipes gripekoweni*, an *Orthocladius* species, *Orthocladius rivulorum* and other species classified to the *Orthocladiinae* and *Chironominae* subfamilies. *Asellus aquaticus* was found in every collecting, its individual number altered between 20 – 260 ind/m^2. Casually the *Gastropoda*, *Hirudinea* and *Trichoptera* species live also in large individual number in the reed stands (Table I).

From the bulrush stands in turn there were found only 33 taxons. The individual number altered between 776 – 1748 ind/m^2. The means exceed in most of the cases the thousand magnitude order. In the macrofaunal composition I could not demonstrate any significant difference between the bulrush and the reed (Table I and II).

On the 27th of June 1975 we carried out investigations on three spots namely in the open-waters of Kis – Herlakni pond, Hidegség pond and Fertőrákos Bay in the stands of *Schoenoplectus litoralis* (Table III). From these biotopes we demostrated 23 macrofaunal taxons. The individual numbers by squaremeters altered here between the marginal values of 568 – 2168. The species composition within the singular orders and families were formed similarly to the previous, corresponding with the isolated tanglies (A n d r i k o v i c s 1973) on these biotopes too the macrofaunae of the open-water stands appears to be the poorest (Table III).

Among the submergent stands we effected the systematical investigations of the *Potamogeton pectinatus* and the *Najas marina* fields. In 1975 we investigated in the months of June – October the macrofauna living in the *Potamogeton pectinatus* stands of Herlakni pond. In course of the

Results of the quantitative zoological investigations of the

Species \ Months	1975					
	IV.		V.		VI.	
	i/m²	D%	i/m²	D%	i/m²	D%
Hirudinoidea						
Piscicola geometra L.						
Glossiphonia heteroclita L.	32	6.50				
Helobdella stagnalis L.			28	3.07	60	9.49
Erpobdella octoculata L.					8	1.26
Thermyzon tessolatum O. F. Müll.						
Gastropoda						
Gyraulus albus Müll.			12	1.31		
Armiger crista L.					20	3.16
Bithynia tentaculata L.						
Physa fontinalis L.						
Lymnaea peregra Müll.						
Isopoda						
Asellus aquaticus L.	20	4.06	260	28.57	160	25.31
Ephemeroptera						
Cloeon dipterum L.			20	2.19	4	0.63
Caenis robusta Etn.			24	2.63	12	1.89
Odonata						
Ischnura elegans Linden.						
Enallagma cyathigerum Charp.						
Coenagrion sp. jnv.	24	4.87				
Trichoptera						
Ecnomus tenellus Ramb.	68	13.82				
Holocentropus picicornis Steph.	28	5.69	4	0.43		
Agraylea multipunctata Curt.	8	1.62				
Oxyethira sp.						
Orthotrichia costalis Curt						
Phryganeidae sp. juv.					8	1.26
Limnephilidae sp. juv.					4	0.63

Table I

Phragmites communis stands at Fertőrákos (Lake Fertő) Hungary

1975						1976					
VII.		VIII.		IX.		III		IV.		V.	
i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%
						4	1.42				
		4	0.33			8	2.85	4	1.26		
4	0.55	8	0.66								
4	0.55										
		72	6.00			12	4.28				
120	16.57					24	8.57	4	1.26		
32	4.41	16	1.33								
12	1.65			16	2.15			4	1.16		
		4	0.33			4	1.42				
152	20.99	20	1.66	56	7.52	60	21.42	60	18.98	14	0.82
4	0.55	40	3.33	44	5.91	8	2.85	4	1.26	8	0.47
								4	1.26		
						8	2.85				
				8	1-07					32	1.88
		4	0.33	60	8.06			4	1.26	180	10.57
						4	1.42			16	0.94
										8	0.47
						8	2.85	4	1.26		
										40	2.35
8	1.10	56	4.66			24	8.57			4	0.23

Species \ Months	1975					
	IV.		V.		VI.	
	i/m²	D%	i/m²	D%	i/m²	D%
Lepidoptera						
Parapoynx stratiotata L.						
Nymphula stagnata Don.						
Coleoptera						
Guignotus pussillus F.			4	0.43		
Noterus crassicornis Müll.			4	0.43		
Laccophilus variegatus Germ.					4	0.63
Enochrus maritimus Thoms.	4	0.81			4	0.63
Dytiscidae lárva	4	0.81	4	0.43	4	0.63
Hydrophilidae larvae					4	0.63
Heteroptera						
Cymatia coleoptrata Fabr.			20	2.19		
Sigara striata L.			72	7.91		
Corixidae sp. juv.					12	1.89
Diptera						
Chironomidae	292	59.34	270	29.67	300	47.46
Tabanidae	4	0.81	40	4.39	4	0.63
Stratiomyiidae			32	3.51		
Ceratopogonidae	4	0.81	28	3.07	12	1.89
Chaoboridae						
Hydracarina						
Eylais sp.			40	4.39	4	0.63
Hydrachna globosa Geer			48	5.27		
Arrenurus sp.	4	0.81				
Limnesia fulgida Koch.					4	0.63
Unionicola crassipes Müll.					4	0.63
Totally: 44	492	99.95	910	99.89	632	99.91

Table I (cont.)

1975						1976					
VII.		VIII.		IX.		III.		IV.		V.	
i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%
4	0.55										
4	0.55										
		4	0.33								
		4	0.33	12	1.61						
						4	1.42	8	2.53		
372	51.38	852	71.00	548	73.65	100	35.71	200	63.29	1396	82.02
4	0.55	104	8.66			12	4.28	4	1.26		
4	0.55	12	1.00							4	0.23
								16	5.06		
724	99.95	1200	99.95	744	99.97	280	99.91	316	99.94	1702	99.98

Results of the quantitative macrofaunal investigations of

Taxons \ Months	1975					
	V.		VI.		VII.	
	i/m²	D%	i/m²	D%	i/m²	D%
Hirudinoidea						
Glossiphonia heteroclita L.			64	4.96	8	1.03
Helobdella stagnalis L.	28	2.96	72	5.59	24	3.09
Piscicola geometra L.						
Gastropoda						
Lymnaea peregra Müll.						
Gyraulus albus Müll.						
Bithynia tentaculata L.	4	0.42			48	6.18
Armiger crista L.			64	4.96		
Planorbis planorbis L.						
Physa fontinalis L.						
Isopoda						
Asellus aquaticus L.	40	4.23	196	15.21	100	12.88
Ephemeroptera						
Cloeon dipterum L.			4	0.31		
Caenis robusta Etn.	20	2.11	4	0.31		
Odonata						
Coenagrion puella L.	4	0.42	4	0.31		
Coenagrionidae jnv.						
Trichoptera						
Holocentropus picicornis Steph.					8	1.03
Ecnomus tenellus Ramb.						
Orthotrichia costalis Curt			32	2.48	36	4.63
Agraylea multipunctata Curt.			56	4.34	8	1.03
Oecetis furva Ramb			8	0.62		
Lepidoptera						
Nymphula stagnata Don.						

Table II

bulrush stands/Fertőrákos (Lake Fertő/Hungary)

1975						1976			
VIII.		IX.		X.		V.		VI.	
i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%
56	6.08	4	0.08	4	0.23				
16	1.73	16	0.32	80	4.70	4	0.22		
4	0.43			40	2.35				
48	5.21	16	0.32	40	2.35	8	0.45	8	0.83
4	0.43	16	0.32	124	7.29			8	0.83
								4	0.41
						4	0.22	8	0.83
								8	0.83
		88	1.80	56	3.29	20	1.14	120	12.55
		12	0.24	72	4.23	60	3.43	24	2.51
		32	0.65					12	1.25
		4	0.08						

Taxons \ Months	1975					
	V.		VI.		VII.	
	i/m²	D%	i/m²	D%	i/m²	D%
Coleoptera						
Noterus crassicornis Müll.	4	0.42			4	0.51
Enochrus maritimus Thoms.					4	0.51
Hygrobia tarda Hrbst.			12	0.93		
Dytiscidae larvae			12	0.93	4	0.51
Hydrophilidae larvae						
Heteroptea						
Cymatia coleoptrata Fabr.	4	0.42			4	0.51
Sigara striata L.			8	0.62	8	1.03
Corixidae larvae			40	3.10	8	1.03
Diptera						
Chironomidae	840	88.98	696	54.03	312	65.97
Ceratopognonidae			8	0.62		
Tabanidae			4	0.31		
Stratiomyiidae			4	0.31		
Chaoboridae						
Totally 33	944	99.96	1288	99.94	576	99.94

investigations we found individua of 31 taxons. The individual number altered between 3691 – 9972 ind/m² (Table IV).

The macrofauna consisted in 80,69 – 94,47 procent of Chironomids. The *Asellus aquaticus* turned up only sporadically in small individual numbers. Characteristic organisms found in the hundred magnitude order of the *Potamogeton pectinatus* fields are the *Cloeon dipterum* and the *Holocentropus picicornis*.

Concerning the detailed species composition the quantitative investigations enforced entirely the results of the previous quasi-quantitative collectings. As a comparison at one single occasion we collected on the Austrian lake part from the open-water *Potamogeton pectinatus* fields (Neusiedl am See; the 7th August, 1976). The total individual numbers were 4842 ind/m² in the field closer to the coastal reedy zone while in the further tangle spots as the average of 4 – 4 measurings they were 3576 ind/m².

Table II (cont.)

1975						1976			
VIII.		IX.		X.		V.		VI.	
i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%
12	1.30								
8	0.86	4	0.08						
4	0.43	4	0.90						
16	1.73			4	0.23				
680	73.91	652	95.17	1240	72.94	1644	94.05	764	79.91
72	7.82					8	0.45		
				40	2.35				
920	99.93	848	99.96	1700	99.96	1748	99.96	956	99.95

In the second half of the seventies – as mentioned above – the repression of the tangle stands was escorted only with the transitional progression of one single tangle species namely the *Najas marina*. But from the zoocenosis living on this tangle species the approaching quantitative investigations already detected that it is extremely poorish. This fact is also supported by the results of the quantitative collectings. From the *Najas marina* stands we identified only 24 taxons. The individual numbers compared to the usual great values of the tanglies were in general small, they altered between 272–676 ind/m² (Table V).

The next large biotope type of Lake Fertő is the sediment. The quantitative collectings effected both in open-waters as well as below the tanglies resulted extremely monotonous and often poor mudfauna (Table VI). The macrofauna of the open-water mud consisted almost entirely of *Chironomidae* species in first line the *Tanypus punctipennis* and the *Procladius* sp. The individual numbers altered between 0–840 ind/m² (Table

Table III

Results of the quantitative macrofaunal investigations of sedge stands Fertőrákos (Lake Fertő) Hungarys 27*th* June, 1975

Species \ Collectiong spots	Kis – Herlakni Pond		Hidegség Pond		Open-water of Fertőrákos	
	i/m²	D%	i/m²	D%	im/²	D%
Hirudinoidea						
Helobdella stagnalis L.	100	4.61			4	0.70
Isopoda						
Asellus aquaticus L.	168	7.74	8	1.04		
Ephemeroptera						
Cloeon dipterum L.	8	0.36	8	1.04		
Caenis robusta Etn.			8	1.04		
Odonata						
Coenagrion puella L.					4	0.70
Coenagrionidae larvae					8	1.40
Trichoptera						
Agraylea multipunctata Curt.	80	3.69	8	1.04	60	10.56
Oxyethira sp.			24	3.12	40	7.04
Holocentropus picicornis Steph.			260	33.85	152	26.76
Cyrnus sp.			8	1.04	16	2.81
Oecetis furva Ramb.			52	6.77	8	1.40
Leptoceridae			8	1.04		
Ecnomus tenellus Ramb.					16	2.81
Phryganeidae juv. indet.					12	2.11
Coleoptera						
Noterus crassicornis Müll. ...	28	1.29				
Hydrophilidae larvae	8	0.36				
Heteroptera						
Cymatia coleoptrata Fabr.	152	7.01				
Sigara striata L.	24	1.10	8	1.04		
Naucoris cimicoides L.	80	3.69				
Corixidae juv.			8	1.04	20	3.52
Diptera						
Chironomidae	1520	70.11	364	47.39	216	38.02
Hydracarina						
Eylais sp.					12	2.11
Piona coccinea Koch.			4	0.52		
Totally 23	2168	99.96	768	99.97	568	99.94

VI). Especially the sediment rich in organic matter of the macrovegetational areas was found totally empty in several cases.

If we compare the faunae of the different biotopes we may state that the reed fringe standing from the open-water side yet in the water has among the emerging macrovegetations the most manifold but in individual number the poorest fauna.

The fauna of the bulrushes is already poorer but the individual number is in most of the cases larger.

The submerging macrovegetation – especially the *Potamogeton pectinatus* assures a biotope to a manifold zoocenosis being of far the greatest individual number. In contrary to this the macrofauna of the *Najas marina* stands is remarkable poor. The most monotonous and poorest fauna however was found in the sediment of Lake Fertő. The macrofauna of the sediment rich in organic matter is often entirely empty.

Summary

The author demonstrated in course of his quantitative investigations all together 44 taxons from the reed stands of Lake Fertő. The total individual number of the macrofauna oscillated between 280 – 1704 ind/m^2. The most common total indicidual number was found 6 – 800 ind/m^2.

The bulrush *(Typha angustifolia)* stands rendered individua of 33 taxons with marginal values of between 776 – 1748 ind/m^2. The individual number data mostly closed to the thousand magnitude order. We investigated systematically among the submerging stands the *Potamogeton pectinatus* fields of Herlakni pond. We determined here 31 taxons in 3775 – 9972 ind/m^2 individual numbers. The most common were the values of above 4500 individua.

As a comparison we investigated the *Najas marina* stands of Herlakni pond. Here we found individual numbers between 272 – 676 ind/m^2 and the number of the identified taxons was also less; only 24. On basis of the sediment investigations the macrofauna living in the mud is poorish, the mudgripping results are often empty. The results of the quantitative investigations have shown that the open-water tanglies were repressed in the second half of the seventies respectively the emerging macrovegetation and the *Najas marina* spots progressed thus the turning to more unfavorable of the living conditions caused a faunal pauperization of great extent.

Expression of thanks

I render thanks for the determination of the *Chironomidae* mass-species to Dr. G. Kulcsár, for the assistance and the performance of the sampling to the HVDSZ Triton frogman group.

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Table IV

Results of the quantitative zoological investigations of submerging stands (Potamogen pectinatus) of Herlakni Pond

Taxons \ Months	1975									
	VI.		VII.		VIII.		IX.		X.	
	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%
Hirudinoidea										
Helobdella stagnalis L.	27	0.71	40	0.40			16	0.34		
Piscicola geometra L.									4	0.08
Gastropoda										
Gyraulus albus Müll.					148	2.60	196	4.25	16	0.32
Gyraulus sp.			8	0.08						
Physa fontinalis L.										
Isopoda										
Asellus aquaticus L.	12	0.31					8	0.17	16	0.32
Ephemeroptera										
Cloeon dipterum L.					112	1.96	132	2.86	16	0.32
Caenis robusta Etn.			40	0.40						
Caenis sp.							8	0.17		
Odonata										
Ischnura pumilio Charp.					4	0.07	8	0.17		
Coenagrion puella L.							12	0.26		
Coenagrion sp. juv.			16	0.16	40	0.70	24	0.52		
Trichoptera										
Agraylea multipunctata Curt.	20	0.52			8	0.14			32	0.65
Orthotrichia costalis Curt.									12	0.24

Holocentropus picicornis Steph.	24	0.63	112	1.12	118	2.07	364	7.90		
Cyrnus sp.					32	0.56				
Ecnomus tenellus Ramb.			48	0.48	24	0.42			88	1.80
Oecetis furva Ramb.	8	0.21			20	0.35	12	0.26		
Oecetis ochracea Curt.					4	0.07				
Lepidoptera										
Nymphula stagnata Don.			56	0.56	24	0.42	56	1.21	4	0.08
Coleoptera										
Dytiscidae larvae	4	0.10								
Heteroptera										
Micronecta pusilla Horv.	32	0.84	560	5.61	16	0.28				
Cymatia coleoptrata Fabr.									4	0.08
Sigara striata L.							4	0.08	44	0.90
Corixidae larvae					8	0.14	16	0.34		
Diptera										
Chironomidae	3640	96.42	9088	91.13	5116	89.91	3712	80.62	4652	95.17
Chaoboridae							8	0.17		
Hydracarina										
Eylais sp.					12	0.21	8	0.17		
Limnesia fulgida Koch.			4	0.04						
Limnesia maculata Müll.							8	0.17		
Arrenurus cuspidifer Piers.					4	0.07	4	0.08		
Arrenurus sp.	8	0.21					8	0.17		
Totally: 31	3775	99.95	9972	99.98	5690	99.97	4604	99.91	4888	99.96

Table V

Results of the quantitative zoological investigations of Najas marina stands (Herlakni Pond)

(e. h. = emty houses)

Species \ Months	1975 29th July		1975 29th August		1975 24th September	
	i/m²	D%	i/m²	D%	i/m²	D%
Hirudinoidea						
Helobdella stagnalis L.					48	7.10
Gastropoda						
Gyraulus laevis Müll.	e. h.				16	2.36
Gyraulus sp.			16	5.88		
Bithynia tentaculata L.	e. h.				4	0.59
Lymnaea peregra Müll.						
Isopoda						
Asellus aquaticus L.					16	2.36
Ephemeroptera						
Cloeon dipterum L.			12	4.41	64	9.46
Caenis sp.			8	2.94		
Odonata						
Coenagrion sp.				24	8.82	
Trichoptera						
Agraylea sp.			8	2.94		
Orthotrichia costalis Curt.			20	7.35		
Holocentropus picicornis Steph.	60	9.40	20	8.35		
Oecetis furva Eamb.			8	2.94		
Oecetis ochracea Curt.					28	4.14
Oecetis sp.			8	2.94		
Ecnomus tenellus Ramb.	30	4.70				
Lepidoptera						
Nymphula stagnata Don.			4	1.47		
Heteroptera						
Micronecta pusilla Horv.					4	0.59
Cymatia coleoptrata Fabr.					40	5.91
Sigara striata L.			24	8.82	16	2.36
Corixidae larvae juv. indet			120	44.11	440	65.08
Diptera						
Chironomidae	540	84.63				
Hydracarina						
Eylais sp.	4	0.62				
Arrenurus fimbriatus Koen.	4	0.62				
Totally: 24	638	99.97	272	99.97	676	99.95

Table VI

Individual number and dominance values of macroorganisms found in open-water mud (Fertőrákos)

(e. h. = empty houses)

Species \ Months	1975												1976			
	V.		VI.		VII.		VIII.		IX.		X.		II.		III.	
	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%	i/m²	D%
Hirudinoidea																
Helobdella stagnalis L.					30	5.88										
Gastropoda																
Lymnaea (Radix) peregra Müll.		e. h.	150	29.41												
Trichoptera																
Oecetis ochracea Curt.			e. h.		30	5.88			30	5.88						
Diptera																
Chironomidae			360	70.58	450	88.23	270	81.81	480	94.11	750	100.0	840	100.0	720	100.0
Ceratopogonidae							30	9.09								
Chaoboridae							30	9.09								
Totally: 6	0.0	0.0	510	99.99	510	99.99	330	99.99	510	99.99	750	100,0	840	100.0	720	100.0

REFERENCES

Andrikovics, S. 1973. Hidroökológiai és zoológiai vizsgálatok a Fertő hínárosaiban. (Hydroecological and zoological investigations in the tanglies of Lake Fertő/Hungary.) – Állatt. Közlem. **60**: 39–50.

Andrikovics, S. 1978. Series of hydroecological data to the zoological evaluation of the pondweed fields of Lake Fertő. – Opusc. Zool. Budapest, **15**: 23–29.

Andrikovics, S. 1979. Contribution to the knowledge on the invertebrate macrofauna living in the pondweed fields of Lake Fertő. – Opusc. Zool. Budapest, **16**: 59–65.

Dokulil, M. 1975a. Planktonic primary and bacterial productivity of shallow waters within a large Phragmites community (Neusiedlersee, Austria). – Verh. Internat. Verein Limnol. **19**: 1295–1304.

Dokulil, M. 1975b. Horizontal- und Vertikalgradienten in einem Flachsee (Neusiedlersee, Österreich). – Verhndl. Ges. f. Ökologie, Wien: 177–187.

Dokulil, M. 1975c. Bacteria in the water and mud of Neusiedler See (Austria). – Symp. Biol. Hung. **15**: 135–140.

Donner, I. 1968. Zwei neue Schlamm-Rotatorien aus dem Neusiedlersee; Paradicranophorus Indzukii und Paradicranophorus sordidus. – Anz. math.-naturw. Kl. Österr. Akad. Wiss. **10**: 224–232.

Farahat, A. Z. – Nopp, M. 1966. Über die Bodenatmung im Schilfgürtel des Neusiedlersees. – Sitz. Ber. Österr. Akad. Wiss. Math. – nat. Kl. Abt. 1. **175**: 238–255.

Farahat, A. Z. – Nopp, M. 1967. Jahreszeitliche Aenderungen der Bodenatmung im Schilfgürtel des Neusiedlersees. – Anz. meth.-naturw. Kl. Österr. Akad. Wiss. **9**: 220–223.

Imhof, G. 1966. Ökologische Gliederung des Schilfgürtels am Neusiedlersee und Übersicht über die Bodenfauna unter produtions-biologischem Aspekt. – Sitz. Ber. Österr. Akad. Wiss. Math.-nat. Kl. Abt. 1. **175**: 219–235.

Imhof, G. 1973. Aspect of ernegy by different food chains in a Reed-Bed, – Pol. Arch. Hydrobiol. **20**: 165–168.

Löffler, M. 1974. Der Neusiedler See. Naturgeschichte eines Steppen Sees. – Wien – München – Zürich: 175 p.

Löffler, H. ed. 1979. Neusiedlersee: The limnology of a shallow lake in Central Europe. – Monographiae Biologicae, **37**. Hague – Boston – London, 559 p.

Naumann, E. 1932. Grundzüge der regionalen Limnologie. – Binnengewässer, Stuttgart, **11**: 176 p.

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