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SEASONAL DYNAMICS OF PELAGIC CLADOCERANS OF LAKES PEIPSI-PIHKVA AND VÕRTSJÄRV

The area of Lake Võrtsjärv is 270 sq. km and that of Lake Peipsi-Pihkva 3,550 sq. km. The latter consists of three different parts: the northern part Lake Peipsi (2,670 sq. km in area), the southern part Lake Pihkva (710 sq. km) and narrow Lake Lämmijärv (170 sq. km) connecting the two larger parts.

Hydrobiologically, the lakes investigated belong to moderately eutrophic water bodies. The most eutrophic one is L. Võrtsjärv, being followed by L. Pihkva, L. Lämmijärv and L. Peipsi in this sense. L. Peipsi has preserved some characteristics of mesotrophic lakes.

The article is based on 1,003 quantitative samples of zooplankton taken from the pelagic part of L. Peipsi-Pihkva and L. Võrtsjärv in 1965 and 1966, the whole year round.

The samples taken from the pelagic zones of L. Peipsi-Pihkva and L. Võrtsjärv contain a total of 42 species and subspecies of cladocerans (Table 1). In addition, there are several hybrids of the subspecies of *Bosmina coregoni*. The number of taxons found is 40 for L. Peipsi-Pihkva and 27 for L. Võrtsjärv. The number of taxons of cladocerans occurring in L. Peipsi equals 26, in L. Lämmijärv — 33 and 26 in L. Pihkva. The number of taxons in L. Lämmijärv is somewhat higher due to the fact that very many littoral and benthic forms happened to be in the samples taken from the narrowest and deepest part of L. Peipsi-Pihkva.

The greatest number of species occurs in July (31), September (28) and October (27) follow. The number is smallest in March (5).

As for the frequency of occurrence, the first place (82.0%) among cladocerans is occupied by *Chydorus sphaericus* which often occurs even in winter. Very frequent both in L. Peipsi-Pihkva and L. Võrtsjärv are *Bosmina c. berolinensis*, *B. c. coregoni* and *Daphnia cuccullata*. Very frequent in L. Peipsi-Pihkva and absent in L. Võrtsjärv are *B. c. gibbera*, *B. c. thersites* and *Daphnia cristata*. *Alona affinis, Alonella nana, Bosmina c. obtusirostris* and *B. c. longirostris* are very frequent in L. Võrtsjärv only. The frequent occurrence of littoral species in the pelagic zone of L. Võrtsjärv proves that conditions of life in these biotopes of the lake are rather similar.

The maximal number of species occurring in one month forms 73.0 per cent of the total number of species in L. Peipsi, 69.6 in L. Lämmijärv, 61.5 in L. Pihkva and 66.7 in L. Võrtsjärv. The ratio of species is, on the average, 1 : 6.

Table 1

List of species

Species	L. Peipsi	L. Lämmi-järv	L. Pihkva	L. Võrts-järv
Cladocera				
Acroperus harpae (Baird)	×	×	×	×
Alona affinis Leydig	×	×		×
Alona costata Sars			×	×
Alona guttata Sars				×
Alona quadrangularis (O. F. Müller)		×	×	×
Alona rectangula Sars		×	×	×
Alonella nana (Baird)	×	×	×	×
Bosmina coregoni berolinensis Imhof	×	×	×	×
Bosmina c. coregoni (Baird)	×	×	×	×
Bosmina c. crassicornis (P. E. Müller)	×	×	×	×
Bosmina c. gibbera (Schoedler)	×	×	×	
Bosmina c. kessleri (Uljanin)	×			
Bosmina c. obtusirostris Sars	×	×	×	×
Bosmina c. thersites (Poppe)	×	×	×	
Bosmina longirostris (O. F. Müller)	×	×	×	×
Bythotrephes cederstroemi Schoedler	×			
Bythotrephes longimanus Leydig	×			
Ceriodaphnia pulchella Sars	×	×	×	×
Ceriodaphnia quadrangula (O. F. Müller)	×			
Chydorus gibbus Lilljeborg	×	×	×	×
Chydorus latus Sars			×	×
Chydorus piger Sars		×		×
Chydorus sphaericus (O. F. Müller)	×	×	×	×
Daphnia cristata Sars	×	×	×	
Daphnia cucullata Sars	×	×	×	×
Daphnia galeata Sars	×	×	×	
Diaphanosoma brachyurum (Liévin)	×	×	×	
Drepanothrix dentata Eurin		×		×
Ilyocryptus acutifrons Sars		×		
Ilyocryptus sordidus (Liévin)				×
Leptodora kindti (Focke)	×	×	×	×
Leydigia acanthocercoides (Fischer)		×		
Leydigia leydigii (Leydig)		×		×
Limnosida frontosa Sars	×	×	×	
Monospilus dispar Sars	×	×		×
Pleuroxus trigonellus O. F. Müller	×	×		×
Pleuroxus uncinatus Baird		×	×	×
Polyphemus pediculus (Linné)		×	×	
Rhynchotalona falcata (Sars)		×		×
Rhynchotalona rostrata (Koch)	×	×	×	×
Scapholeberis mucronata (O. F. Müller)		×		
Sida crystallina (O. F. Müller)			×	

A. Mäemets (1966) found 46 taxons of cladocerans in L. Peipsi-Pihkva (pelagic + littoral zone). A. Mäemets considered *Holopedium gibberum* an indicator species of L. Peipsi. In the course of our investigations the species was not found. It means that its number has considerably decreased in the lake. A possible reason is the eutrophication of L. Peipsi. In L. Võrtsjärv 21 species of cladocerans were found by R. Levander (Mühlen, Schneider, 1920). The corresponding figure for the Byelorussian Lake Chervonnoye is 24—25 (Черемисова, 1958), and for some Estonian lakes as follows: L. Veisjärv 40, L. Pikkjärv at Kaarepere 38, L. Saadjärv 35, L. Kavadi 34, L. Valgjärv at Koorküla 32 (Eesti järved, 1968). In L. Ladoga, 61 taxons have been found (Деньгина, Соколова, 1968), and in L. Onega 49 (Смирнова, 1972).

Table 2

Number of cladocerans, ind./m³

Month	L. Peipsi		L. Lämmijärv		L. Pihkva		L. Võrtsjärv	
	1965	1966	1965	1966	1965	1966	1965	1966
I	—	0	—	200	—	500	60	13
II	30	30	900	200	100	0	30	20
III	0	0	300	300	0	0	12	5
IV	60	0	0	—	0	—	2 900	3 900
V	900	40	700	4 400	2 600	7 800	13 900	22 600
VI	7 600	8 400	56 400	49 200	90 700	143 800	98 200	92 800
VII	84 300	34 600	75 000	59 600	237 800	145 300	163 800	78 800
VIII	—	—	—	—	—	—	245 900	118 000
IX	39 500	—	47 000	—	105 600	—	48 600	89 500
X	12 400	26 100	61 700	67 600	165 400	114 700	60 900	41 900
XI	—	—	—	—	—	—	19 200	17 500
XII	—	—	—	—	—	—	740	550

Table 3

Biomass of cladocerans, g/m³

Month	L. Peipsi		L. Lämmijärv		L. Pihkva		L. Võrtsjärv	
	1965	1966	1965	1966	1965	1966	1965	1966
I	—	0	—	0.002	—	0.008	0	0
II	0	0.001	0.002	0.008	0	0	0	0
III	0	0	0.001	0.005	0	0	0	0
IV	0	0	0	—	0	—	0.014	0.029
V	0.009	0	0.006	0.025	0.022	0.072	0.071	0.200
VI	0.052	0.076	0.338	0.408	1.633	3.228	0.617	0.546
VII	1.740	1.076	1.129	1.927	1.349	1.743	0.958	0.281
VIII	—	—	—	—	—	—	0.782	0.403
IX	0.405	—	0.356	—	0.674	—	0.202	0.417
X	0.122	0.335	0.444	0.660	1.179	1.232	0.195	0.300
XI	—	—	—	—	—	—	0.067	0.095
XII	—	—	—	—	—	—	0.002	0.004

Table 4

Maximal and minimal numbers and biomasses of cladocerans

Data	Year	Absolute numbers			
		L. Peipsi	L. Lämmijärv	L. Pihkva	L. Võrtsjärv
Number, ind./m³	1965	0–84 300	0–75 000	0–237 800	12–245 900
	1966	0–34 600	200–67 600	0–145 300	5–118 000
Biomass, g/m³	1965	0–1.740	0–1.129	0–1.633	0–0.598
	1966	0–1.076	0–1.927	0–3.228	0–0.546

The development of cladocerans in L. Peipsi-Pihkva begins in May, in L. Võrtsjärv which is shallower and where water warms up earlier, in April. In L. Peipsi where the warming-up of water is slowest, the beginning of the development may even take place in June. Cladocerans reach their maximum number in July — August, and thereupon their number decreases until the winter minimum. In October the number may, however, increase once more (Table 2). Changes in biomass proceed analogically, the only difference being that the maximum of biomass in L. Pihkva and L. Võrtsjärv arrives, as a rule, a month earlier than that of the number (Table 3). This is caused by the occurrence of the highest number of *Daphnia cucullata,* forming the maximum of the biomass of cladocerans, in June. The maximum of the number is called forth by other, smaller species: mainly *Chydorus sphaericus,* in L. Võrtsjärv also *Bosmina coregoni coregoni.* In 1966 even the maximum of the number of cladocerans in L. Pihkva was caused by *D. cucullata.* However, the species was much smaller in July as compared with June. Several other authors (Луферова, Монаков, 1966; Бабицкий, 1968, etc.) have also pointed out the asynchronism of the dynamics of the number and biomass. In winter both the number and biomass of cladocerans are near zero. They are relatively most numerous in L. Lämmijärv — probably due to the bigger depth of the sample spot and the relatively higher temperature of the bottom layers of water.

Cladocerans reach the highest number in L. Võrtsjärv, the most eutrophic lake. Their number is approximately the same in L. Pihkva. In L. Peipsi and L. Lämmijärv, poorer in nutrients, the number of cladocerans is 2—3 times lower. As regards biomass, the absolute maximum occurs in L. Pihkva, followed by L. Lämmijärv and L. Peipsi. In L. Võrtsjärv the biomass of cladocerans never reaches even 1 g/m^3 and is considerably smaller (up to 6 times) than in the other investigated lakes.

Comparing the years of 1965 and 1966 on the basis of the maximum numbers and biomasses (Table 4), it turns out that in the somewhat colder summer of 1965 the maximum number was higher everywhere. In L. Peipsi and L. Võrtsjärv the maximum biomass was also higher in 1965, while in L. Pihkva and L. Lämmijärv the biomasses in the warmer summer of 1966 were much higher than in 1965.

The mass development of cladocerans in summer months in most water bodies of the temperate zone is a well-known phenomenon. The reason lies in the thermophilic character of cladocerans which is more marked than in other groups of zooplankton. The small maximum in autumn is caused by quite other cladocerans than in summer. In summer *Daphnia cucullata* is the most important species, while in autumn those are representatives of the genus *Bosmina* who prevail among the first cladocerans in spring as well. A rise in the number of cladocerans in October, due to the rise in the number of *Bosmina* species, has also been observed in the Courland Bay (Киселите, 1959) and lakes of South Karelia (Смирнова, 1969). As the temperature of 21—22 °C restrains the development of the genus *Bosmina* (Мануйлова, 1957), most of them are few in number in summer.

The fact that the maximum of number is preceded by that of the biomass in L. Pihkva and L. Võrtsjärv is explained by the rapid development of big forms, especially of *D. cucullata.* Later on the smaller species of *Bosmina* and *Ch. sphaericus* replace *D. cucullata.* This has been observed elsewhere as well (Czapik, 1957). V. Youkhneva (1969) has observed a decrease in the number in July, explaining it with the appearance of young perches feeding on plankton and with the mass bloom of blue-green algae. These factors may also act in Estonian lakes.

The number of cladocerans in the lakes investigated is closely connected with the trophy of lakes. It is generally known that in eutrophic lakes there are more cladocerans (Arnold, 1969; Elster, Schwoerbel, 1970) than in the lakes with a lower trophy. It has also been mentioned that in shallow lakes (which are usually with a higher trophy) the role of cladocerans is higher than in deep ones (Borecky, 1956).

Considering trophy and depth it would be logical to assume that the biomass of cladocerans in L. Võrtsjärv is also highest. Facts, however, prove the opposite (Table 3). The most likely reason for low biomasses of cladocerans in L. Võrtsjärv is the high seston content of water. Seston clogs the filter apparatus and noticeably restrains the development of cladocerans (Мануйлова, 1955). The velocity of wind 5 m/sec stirs the whole water mass in shallow lakes and causes the rise of bottom deposits into the water layer, thus creating unfavourable conditions for cladocerans (Мануйлова, 1955). The influence of wind of 12 m/sec on cladocerans in the shallow Lake Ilmen is catastrophic (Дзюбан, Урбан, 1970). The detrimental influence of detritus on cladocerans has been proved in water bodies of various character, while in very turbid water cladocerans cannot live at all (Коваль, Полторацкая, 1968). A particular problem is why in L. Võrtsjärv seston has an influence on the biomass and not on the number. Supposedly this is due to three kinds of factors. 1. As the filter apparatus of the big *D. cucullata* is much more sensitive to seston than that of the small *Ch. sphaericus* (Мануйлова, 1964), the latter has, taking into account also the decrease of rivalry, favourable conditions for reproduction. The reproduction of *Ch. sphaericus* increases the number of cladocerans but cannot compensate the decrease in the biomass of the group due to the decrease in the number of *D. cucullata*. 2. Small cladocerans (*Ch. sphaericus, B. coregoni coregoni*) propagate more quickly than big ones (*D. cucullata, B. c. berolinensis*) and are thus able to compensate decreases in the number rapidly, for instance, after heavy storms. 3. Only thanks to the possibility to fasten to seston, *Ch. sphaericus* can be found in the water layer (Woltereck, 1913), and thus the abundance of seston may be even favourable for the species.

The size and weight of *D. cucullata* in L. Võrtsjärv are much smaller than in L. Peipsi-Pihkva, although it is generally known that the specimens of this species are bigger in waters with a high trophy.

Relatively low temperatures in the summer of 1965 were obviously especially favourable for the development of *B. c. coregoni* and *Ch. sphaericus,* which caused the high number of cladocerans that year. In several water bodies it has been proved that *B. c. coregoni* does not tolerate high temperatures. Therefore its number falls in midsummer (Мануйлова, 1964). 16—20° (Петрова, 1967), and, according to some data, even 9—15° (Дзюбан, Урбан, 1968) is considered to be an optimum temperature for the development of the species. It has been observed that at the temperature of 18—20° the number of *B. c. coregoni* decreases (Луферова, Монаков, 1966).

Optimum temperatures for *Ch. sphaericus* are approximately the same: 18—20° (Яценко, 1928) or 18—21° (Черемисова, 1958) while the most intensive reproduction of *Daphnia cucullata* occurs at the temperature of 22—23° (Мануйлова, 1964), i. e., its optimum temperature is somewhat higher. Another proof of it is its relatively late appearance in zooplankton in spring, at 14—15° (Филимонова, 1962), 10—12° (Мануйлова, 1964), 12° (Черемисова, 1958). Therefore we may conclude that the warm summer of 1966 caused an intensive reproduction of big-sized *D. cucullata* in eutrophic L. Pihkva and L. Lämmijärv (the biomass of cladocerans in these lakes was in 1966 higher than in 1965, while the number was lower). In L. Peipsi, having mesotrophic features, and L. Võrtsjärv, rich in seston, there are no good conditions for the propagation of *D. cucullata,* and therefore both the biomass and the number of cladocerans were higher in 1965 than in 1966.

The number of cladocerans increases in spring and decreases in autumn most quickly in L. Pihkva (Tables 5, 6, 7). The increase of cladocerans

Table 5

Rate of variability of number of cladocerans, ind./day

Lake	Year	I	II	III	IV	V	VI	VII	IX	X
Peipsi	1965		−1	+2	+28	+223	+2557	−747		−903
	1966	+1	−1		+1	+279	+873		−94	
Lämmijärv	1965		−20	−10	+23	+1857	+620	−467		+490
	1966	0	+3		+68	+1493	+313		+89	
Pihkva	1965		−3	0	+87	+2937	+4903	−2203		+1993
	1966	−17	0		+130	+4530	+50		−340	
Võrtsjärv	1965		−1	+96	+367	+2810	+2187	−1920		+410
	1966	0	−1		+375	+2340	−467		−681	

Table 6

Rate of variability of number of cladocerans, % of biggest growth

Lake	Year	I	II	III	IV	V	VI	VII	IX	X
Peipsi	1965		0	+0.1	+1.1	+8.7	+100.0	−29.2		−35.3
	1966	+0.1	−0.1		+0.1	+31.9	+100.0		−10.8	
Lämmijärv	1965		−1.1	−0.5	+1.2	+100.0	+33.9	−25.1		+26.4
	1966	0	+0.2		+4.6	+100.0	+20.9		+6.0	
Pihkva	1965		−0.1	0	+1.8	+59.9	+100.0	−44.9		+40.6
	1966	−0.4	0		+2.9	+100.0	+1.1		−7.5	
Võrtsjärv	1965		0	+3.4	+13.0	+100.0	+77.9	−68.3		+14.6
	1966	0	0		+16.0	+100.0	−20.0		−29.1	

Table 7

Degree of fluctuation of number of cladocerans, % of biggest growth in comparison with previous month

Lake	Year	II	III	IV	V	VI	VII	IX	X
Peipsi	1965		0.1	1.0	7.6	91.3	129.2		6.1
	1966	0.2		0.2	31.8	68.1		110.8	
Lämmijärv	1965		0.6	1.7	98 8	66.1	59.0		51.5
	1966	0.2		4.4	95.4	79.1		14.9	
Pihkva	1965		0.1	1.8	58.1	40.1	144.9		85.5
	1966	0.4		3.3	97.1	98.9		8.6	
Võrtsjärv	1965		3.4	9.6	87.0	22.1	146.2		82.9
	1966	0		16.0	84.0	120.0		9.1	

in L. Lämmijärv and L. Peipsi is slowest. The rate of the variability of biomass is also quickest in L. Pihkva, followed by L. Peipsi, L. Lämmijärv, and far behind the others — L. Võrtsjärv (Tables 8, 9, 10). The increase in the number of cladocerans is mostly highest in May — June, in L. Peipsi (in 1965 also in L. Pihkva) in June — July. The increase in biomass in L. Võrtsjärv and L. Pihkva is quickest in May — June, in L. Lämmijärv and L. Peipsi in June — July. The increase of the number and biomass of cladocerans is always more intensive than the decrease. As we deal here with thermophile cladocerans, the rate of both the increase

Table 8

Rate of variability of biomass of cladocerans, mg/day

Lake	Year	I	II	III	IV	V	VI	VII		IX	X
Peipsi	1965		0	0		+0.3	+1.4	+56.3	−22.2		−9.4
	1966	0	0		0		+2.5	+33.3		−8.2	
Lämmijärv	1965		0	0		+0.2	+11.1	+26.4	−12.9		+2.9
	1966	+0.2	−0.1		+0.3		+12.8	+50.6		−14.2	
Pihkva	1965		0	0		+0.7	+53.7	−9.5	−11.1		+16.8
	1966	−0.3	0		+2.4		+105.2	−49.5		−5.7	
Võrtsjärv	1965		0	+0.5		+1.9	+18.2	+11.4	−12.6		−0.2
	1966	0	0		+3.3		+11.5	−8.8		+0.2	

Table 9

Rate of variability of biomass of cladocerans, % of biggest growth

Lake	Year	I	II	III	IV	V	VI	VII		IX	X
Peipsi	1965		0	0		+0.5	+2.5	+100.0	−39.4		−16.7
	1966	0	0		0		+7.5	+100.0		−24.6	
Lämmijärv	1965		0	0		+0.8	+42.0	+100.0	−48.9		+11.0
	1966	+0.4	−0.2		+0.6		+25.2	+100.0		−27.8	
Pihkva	1965		0	0		+1.3	+100.0	−17.7	−20.8		+31.3
	1966	−0.3	0		+2.3		+100.0	−47.0		−5.4	
Võrtsjärv	1965		0	+2.8		+10.4	+100.0	+62.6	−69.2		−1.1
	1966	0	0		+28,7		+100.0	−76.6		+1.7	

Table 10

Degree of fluctuation of biomass of cladocerans, % of biggest growth in comparison with previous month

Lake	Year	II	III	IV	V	VI	VII		IX	X
Peipsi	1965		0		0.5	2.0	97.5	139.4		22.7
	1966	0		0		7.5	92.5		124.6	
Lämmijärv	1965		0		0.8	41.2	58.0	148.9		59.9
	1966	0.6		0.8		24.6	74.8		127.8	
Pihkva	1965		0		1.3	98.7	117.7	3.1		52.1
	1966	0.3		2.6		97.7	147.0		41.6	
Võrtsjärv	1965		2.8		7.6	89.6	37.4	131.8		68.1
	1966	0		28.7		71.3	176.6		78.3	

and decrease should essentially depend on the rate of the water's warming up and cooling down in the lake which, in turn, correlates with the depth of the lake.

If one compares relative figures, one will notice that the increase and decrease of the number and biomass are smoothest in L. Peipsi and L. Lämmijärv, and sharpest in L. Võrtsjärv. Correspondingly, the indices of instability of the number and biomass (Table 11) are lowest for L. Peipsi, and highest for L. Võrtsjärv. In comparison with copepods and

Table 11

Indices of instability of cladocerans

Lake	Number			Biomass		
	1965	1966	Average	1965	1966	Average
Peipsi	39.2	42.2	40.7	43.6	44.9	44.2
Lämmijärv	46.3	38.8	42.6	51.4	45.7	48.6
Pihkva	55.1	41.6	48.4	45.5	57.8	51.6
Võrtsjärv	58.5	45.8	52.2	56.2	71.0	63.6

Table 12

Average weight of cladocerans, mg

Lake	Year	I	II	III	IV	V	VI	VII	IX	X
Peipsi	1965	—	0	0	0	0.0100	0.0068	0.0206	0.0102	0.0098
	1966	0	0.0333	0	0	0	0.0090	0.0311	—	0.0128
Lämmijärv	1965	—	0.0022	0.0033	0	0.0086	0.0060	0.0150	0.0076	0.0072
	1966	0.0100	0.0400	0.0167	—	0.0057	0.0083	0.0323	—	0.0098
Pihkva	1965	—	0	0	0	0.0085	0.0180	0.0057	0.0064	0.0071
	1966	0.0160	0	0	—	0.0092	0.0224	0.0120	—	0.0107
Võrtsjärv	1965	0	0	0	0.0048	0.0051	0.0063	0.0058	0.0042	0.0032
	1966	0	0	0	0.0097	0.0088	0.0059	0.0036	0.0047	0.0072

rotifers, cladocerans are the stablest group — probably due to the relatively short period of their mass occurrence.

Data on the average weight of cladocerans are presented in Table 12. If we consider zooplankton as a whole, we can see that the average weight of the zooplankton is directly proportional to trophy (Haberman, 1974). In the case of cladocerans this regularity is not valid (although it could be expected). The tendency is rather opposite. The average weight of a cladoceran in L. Peipsi in early summer as well as that in autumn is higher than in the other lakes. In L. Pihkva and L. Lämmijärv cladocerans are of more or less equal size, while in L. Võrtsjärv they are especially small. The latter fact is the reason why the biomasses of cladocerans in L. Võrtsjärv are low, despite their high number. The great average weight of a cladoceran in L. Peipsi is caused by peculiarities of its species composition. As compared with the other parts of the lake, big *Bythotrephes longimanus* and especially *Bosmina coregoni berolinensis* are more numerous here, while the role of the small species is lower. In L. Võrtsjärv, on the other hand, small *B. c. coregoni* and *Chydorus sphaericus* play an especially big role, while the size of some other species (*Daphnia cucullata*) in this lake is smaller than elsewhere, due to the negative influence of seston. It may well be an objective regularity that the average size of cladocerans and the trophy of the water body are indirectly proportional. During the recent decade, the Polish planktonologists have proved that with the increase of trophy, filtrators and sedimentators switch over from feeding on nannoplankton to that on bacteria (Hillbricht-Ilkowska et al., 1966). It is quite probable that feeding on nannoplankton is in a certain correlation with the size of filtrators. If so, then it is clear why the cladocerans of eutrophic lakes, who feed on bacteria, are small, on the average. In Polish lakes (Patalas, Patalas, 1966) the size of *D. cucullata* decreases with the increase of trophy.

Table 13

The role of cladocerans (%) in the total number of zooplankton

Lake	Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Peipsi	1965	—	0.3	0	0.7	4.3	10.7	24.1	—	30.8	36.2	—	—
	1966	0	0.7	0	0	0.1	8.4	11.6	—	—	50.7	—	—
Lämmijärv	1965	—	2.1	2.5	0	1.3	32.5	25.7	—	56.6	71.6	—	—
	1966	0.9	0.8	2.2	—	5.1	33.3	25.8	—	—	86.3	—	—
Pihkva	1965	—	0.3	0	0	3.8	25.1	42.6	—	42.6	72.2	—	—
	1966	1.7	0	0	—	7.9	37.8	28.9	—	—	81.4	—	—
Võrtsjärv	1965	0.3	0.2	0.1	5.9	6.9	25.6	56.1	68.9	51.3	58.5	34.3	4.7
	1966	0.2	0.4	0.1	2.7	3.6	28.9	29.2	55.0	65.4	68.6	42.6	5.4

Table 14

The role of cladocerans (%) in the total biomass of zooplankton

Lake	Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Peipsi	1965	—	0	0	0	9,2	20.6	61.5	—	43.0	42.4	—	—
	1966	0	4.2	0	0	0	27.9	65.6	—	—	58.2	—	—
Lämmijärv	1965	—	1.0	0.9	0	5.2	44.2	61.4	—	58.2	61.5	—	—
	1966	2.8	7.9	15.1	—	5.3	46.4	69.5	—	—	84.6	—	—
Pihkva	1965	—	0	0	0	6.5	54.6	52.6	—	37.0	60.3	—	—
	1966	4.6	0	0	—	15.0	70.2	47.5	—	—	73.0	—	—
Võrtsjärv	1965	0	0	0	6.8	11.2	51.6	64.9	57.7	31.5	28.5	12.2	1.7
	1966	0	0	0	3.0	7.8	47.3	24.5	42.0	53.3	55.5	25.0	4.8

The role of cladocerans in the number of the whole zooplankton (Table 13) is negligible in winter, begins to increase in spring and, as a rule, reaches its maximum in October, thereupon decreasing again. In L. Lämmijärv and L. Pihkva the role of cladocerans in biomass is also maximal in October, while in L. Peipsi and partly in L. Võrtsjärv it is maximal in July (Table 14). According to Z. Filimonova (1962), the role of cladocerans in Lake Syamozero is also highest in autumn. Comparing the lakes, we can state that the role of cladocerans in the number is highest in L. Pihkva, while the difference between that lake and L. Võrtsjärv and L. Lämmijärv is rather small. The role of cladocerans is lowest in L. Peipsi. In biomass, the role of cladocerans in summer mostly exceeds 50 per cent. This has also been observed by A. Mäemets (Мяэметс, 1966). In L. Võrtsjärv, however, the role of cladocerans in summer is lower. Both during a whole year and in the summer months the role of cladocerans in the biomass of zooplankton in L. Pihkva and L. Lämmijärv is higher than that in L. Peipsi and L. Võrtsjärv.

In the estimation of the zooplankton of lakes. nutrition conditions for fishes are regarded good if crustaceans noticeably dominate over rotifers (Филимонова, 1962). The high productivity of a water body depends, first and foremost, on the mass development of cladocerans (Мануйлова, 1955). Their nutritive value is high. As compared with other groups of zooplankton, cladocerans are obviously most important as feed for fishes. The same has been mentioned in connection with the feed of fishes of L. Peipsi-Pihkva and L. Võrtsjärv as well as other Estonian lakes (Erm, 1955; Haberman, 1964; Kangur, 1971). According to M. Saldau (1953), it is mainly the mass development of cladocerans that determines the nutritive value of zooplankton.

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PEIPSI-PIHKVA JÄRVE JA VÕRTSJÄRVE PELAGIAALI KLADOTSEERIDE SESOONNE DÜNAAMIKA

Resümee

Artikkel põhineb 1003 zooplanktoniproovil, mis on kogutud Peipsi-Pihkva järve ja Võrtsjärve pelagiaalist 1965. ja 1966. aastal. Antakse ülevaade proovide liigilisest koostisest (tab. 1), arvukusest (tab. 2), biomassist (tab. 3), miinimumidest ja maksimumidest (tab. 4), arvukuse (tab. 5, 6, 7) ja biomassi (tab. 8, 9, 10) muutlikkuse tempost, määrast ja labiilsusindeksitest (tab. 11), kladotseeride keskmisest kaalust (tab. 12) ja osatähtsusest planktonis (tab. 14, 15).

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Юта ХАБЕРМАН

СЕЗОННАЯ ДИНАМИКА ВЕТВИСТОУСЫХ ПЕЛАГИАЛИ ЧУДСКО-ПСКОВСКОГО ОЗЕРА И ОЗЕРА ВЫРТСЪЯРВ

Резюме

Материалом статьи служат 1003 количественные пробы зоопланктона, собранные в пелагиали Чудско-Псковского озера и озера Выртсъярв в 1965 и 1966 гг.

Приводится видовой состав (табл. 1), численность (табл. 2), количество биомассы (табл. 3), а также минимумы и максимумы (табл. 4), и темп и степень изменчивости численности (табл. 5, 6, 7) и биомассы (табл. 8, 9, 10), индексы лабильности (табл. 11), средний (табл. 12) и удельный вес (табл. 13, 14) ветвистоусых в зоопланктоне.

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