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*CRUSTACEA OF THE SUMMER PLANKTON IN THE LITTORAL  
OF LAKES IN THE WĘGORZEWO DISTRICT\**

Analysis was made of the occurrence of crustacean plankton in the littoral of 37 Mazurian lakes. It was found that the composition of the crustacean plankton does not exhibit any correlation with the limnological features of the lakes. The specialised littoral species occur, as distinct from the ubiquitous species, in the overwhelming majority in single habitats with presumably narrow specialisation.

Investigations of lake plankton are usually limited to the pelagial zone, while there are relatively few papers on littoral plankton.

A lake littoral forms a specific environment differentiated by the occurrence or its fauna. The vicinity of the pelagial zone influences the formation of the fauna of the littoral plankton. The littoral, however, maintains a certain degree of separateness and the boundary between it and the pelagial is unexpectedly sharp (Rybak 1960).

The present publication is part of more comprehensive studies of this problem made by the authors.

1. METHODS

A total of 57 littoral stations in 37 lakes were included in the investigations (Tab. I, Fig. I).

\* From the Institute of Ecology, Polish Academy of Sciences.

From 1 to 3 stations were chosen in the littoral of the various lakes in places most typical and representative of the littoral of a given lake. The investigations were made in the second half of the summer (July-September) 1954 and on certain stations these were repeated the following year. A few stations were investigated in 1955 only.

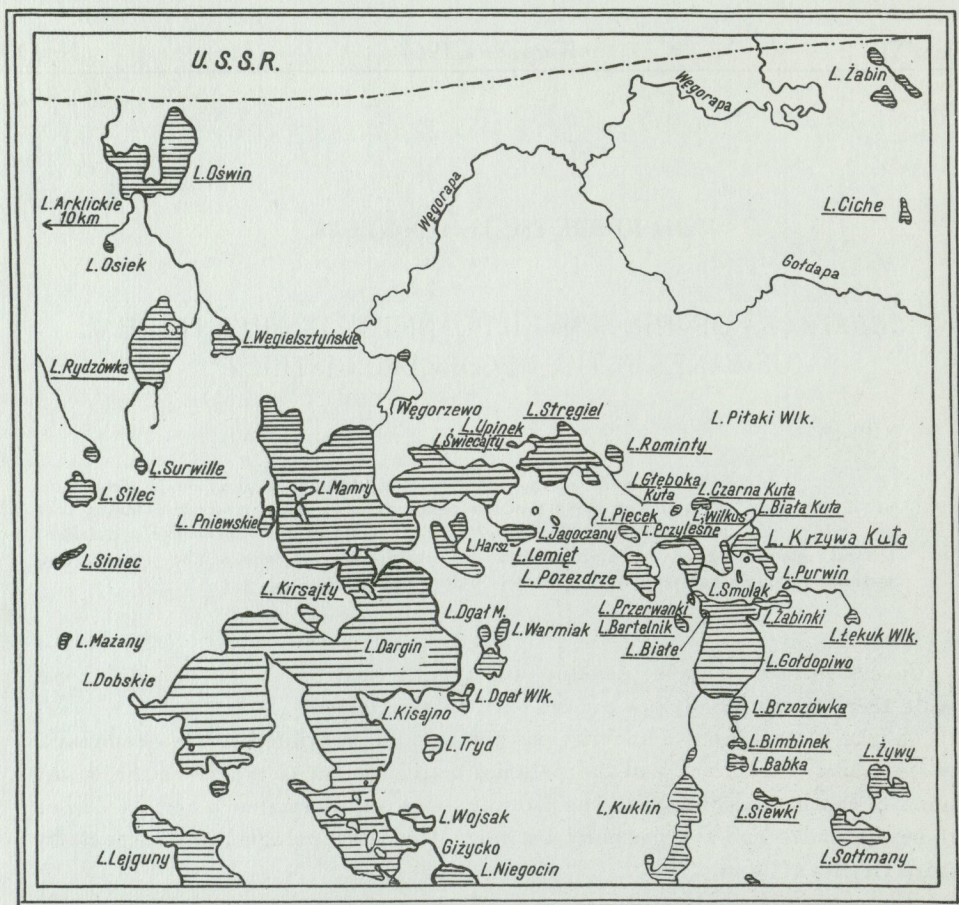


Fig. 1 - Sketch of the study area (after J. Kondracki and M. Szostak - amended)  
1 cm = 2 km. The names of the lakes in which the investigations were made are underlined

Samples of the plankton were taken, 5 litres at a time, by a sampler of the Bernatowicz type. Three samples were taken from the middle of a belt of vegetation on each station. The distance between the places in which each sample was taken was about 50 m. The samples were strained through a no 17 plankton net and preserved in formalin.

Description of the lakes	Name of lakes and number of habitats	Date of sampling	Floristic description of the habitat	Number of species	Number of individuals per 1 litre of water	Characteristic species	Notes
Extensive, shallow lakes with circulation of water reaching to the bottom	Oświn	14. IX. 54	<i>Phragmites communis</i>	4	17	<i>Ceriodaphnia quadrangula</i>	Centre of lake occupied by vegetation
	Węgielsztyńskie	13. VII. 55	" "	9	30		
	Kirsajty L <sub>1</sub>	10. VII. 54	" "	2	2		
	L <sub>2</sub>	"	" "	9	13		
	Stręgiel L <sub>1</sub>	9. VII. 54	" "	5	11	<i>Polyphemus pediculus</i> <i>Bosmina longirostris</i>	
	L <sub>2</sub>	"	" "	6	48		
	Pozezdrze	15. IX. 54	" "	6	24	<i>Ceriodaphnia quadrangula</i> <i>C. megops</i>	
	Wilkus L <sub>1</sub>	14. VIII. 54	" "	3	4		
	L <sub>2</sub>	"	<i>Typha angustifolia</i>	3	3		
	Brzozówka	3. IX. 54	<i>Phragmites communis</i>	4	16	<i>Ceriodaphnia quadrangula</i> <i>C. megops</i>	
Sołtmany	15. IX. 54	" "	5	20			
Arklickie	1. IX. 54	<i>Ph. communis, T. angustifolia, Scirpus sp.</i>	1	2	<i>Bosmina coregoni</i>		
	26. VIII. 55	" "	4	29			
Extensive, deep lakes with hypolimnion	Żywy L <sub>1</sub>	15. IX. 54	<i>Phragmites communis</i>	3	5	<i>Ceriodaphnia megops</i> <i>C. reticulata</i>	
	Rydzówka L <sub>1</sub>	4. VIII. 54	" "	9	52		
	L <sub>2</sub>	"	" "	1	1		
	L <sub>3</sub>	"	" "	3	3		
	Silec	17. IX. 54	" "	2	2	<i>Ceriodaphnia quadrangula</i>	
	Świącayty	16. IX. 54	" "	4	4		
	Lemięt	31. VIII. 54	" "	4	32		
	Krzywa Kuta L <sub>1</sub>	12. IX. 54	" "	10	35		
	L <sub>2</sub>	"	" "	2	6	<i>Simoceph. vetulus</i>	
	L <sub>3</sub>	"	" "	3	6		
Gołdopiwo L <sub>1</sub>	2. IX. 54	" "	3	6			
L <sub>2</sub>	"	" "	3	5	<i>Simoceph. vetulus</i>		
Żywy L <sub>2</sub>	15. IX. 54	" "	3	5			
Small shallow lakes with circulation of water reaching to the bottom	Surwile	6. VIII. 54	<i>Phragmites communis</i>	2	7	<i>C. megops</i>	Occupied by vegetation Occupied by vegetation Occupied by vegetation Occupied by vegetation
	Pniewskie L <sub>1</sub>	10. VIII. 54	" "	1	2		
	L <sub>2</sub>	"	" "	9	38		
	Upinek	31. VIII. 54	" "	8	18	<i>Cyclops vicinus</i>	
	Rominty L <sub>1</sub>	16. VII. 55	<i>P. communis, T. angustifolia</i>	1	3		
	L <sub>2</sub>	"	<i>P. communis, Stratiotes aloides</i>	11	200	<i>Alona rectangula, C. quadrangula</i>	
	Jagoczany	21. VIII. 54	<i>P. communis, T. angustifolia, Equisetum sp.</i>	11	87		
		20. VIII. 55	" "	6	26	<i>Mesocycl. (Th) crassus</i> <i>Ceriodaphnia quadrangula</i>	
	Czarna Kuta	14. IX. 54	<i>Phragmites communis</i>	5	15	<i>Bosmina longirostris</i>	
	Piecek L <sub>1</sub>	19. VII. 54	" "	4	637		
	L <sub>2</sub>	"	<i>Equisetum sp., T. angustifolia, Ceratophyllum sp.</i>	7	115	" "	
	Przyleśne L <sub>1</sub>	14. VIII. 54	<i>Phragmites communis</i>	9	76	<i>Mesocyclops (Th) crassus</i>	
		25. VIII. 55	" "	5	35		
Przyleśne L <sub>2</sub>	14. VIII. 54	" "	5	68	<i>Daphnia cucullata</i>		
	25. VIII. 55	" "	4	20			
Small, deep lakes with hypolimnion	Biała Kuta	13. IX. 54	" "	3	3	<i>Ceriodaphnia quadrangula</i>	Sulphuretted hydrogen at bottom Occupied by vegetation Occupied by vegetation
	Przerwanki	24. VIII. 55	" "	2	2		
	Bartelnik	9. VII. 55	<i>P. communis, Equisetum sp., Potamogeton sp.</i>	7	32		
	Białe Purwin	2. IX. 54	<i>Phragmites communis</i>	4	6		
		24. VIII. 55	<i>P. communis, T. angustifolia, Equisetum sp.</i>	5	18		
	Babka Siewki	5. VIII. 55	<i>Phragmites communis</i>	2	2		
	3. IX. 54	" "	13	320	<i>Bosmina longirostris</i>		
Small, deep lakes with hypolimnion	Siniec L <sub>1</sub>	17. IX. 54	<i>Phragmites communis</i>	1	2	<i>Bosmina longirostris</i>	
	L <sub>2</sub>	"	" "	4	10		
	Głęboka Kuta	14. IX. 54	" "	4	40	<i>Ceriodaphnia quadrangula</i>	
		10. IX. 55	" "	3	14		
	Żabinki	5. VIII. 54	" "	0	0	<i>Acroperus harpae</i>	
	Łę kuk Wielki	16. IX. 54	<i>Acorus calamus, Nuphar luteum</i>	7	12		
	Bimbinek L <sub>1</sub>	3. IX. 54	<i>Phragmites communis</i>	6	13		
	L <sub>2</sub>	"	<i>P. communis, Nuphar luteum, Nymphaea alba</i>	5	22		
Ciche	23. VIII. 54	<i>Scirpus sp. P. communis</i>	6	17			



The number of samples taken and their distribution in the area is descriptive only of the general faunistic relations of the littoral plankton in a given group of lakes. We have treated this as a description of the physiographical type (in the sense used by Tarwid 1955), and not as a description of each station.

The faunistic material obtained (list of species) meets the Beklemiszew criterion (check test in the sense used by Tarwid in 1956), i.e. it gives an exhaustive list of the species in the littoral environment of the study area, and includes species, the probability of encountering which is higher than 0.03 (i.e. encountered at least three times in 100 samples taken at random, distributed over the whole area). We, therefore, consider that the material contains all the species of littoral *Crustacea* plankton occurring fairly frequently in the given area and at a given time.

## 2. DESCRIPTION OF HABITATS

The work described in this paper was carried out in the lakes in the Węgozewo district (Mazurian Lake District). Limnological and fishery investigations have been carried out in this area by the Institute of Inland Water Fishery and by the Institute of Ecology, Polish Academy of Sciences. The present paper is based on material from the latter institute.

Full limnological information about these lakes is given in the following papers: Zawisza, Patalas (1960), Kondracki, Szostak (1960), Bernatowicz (1960), Patalas (1960, 1960b, 1960c, 1960d).

The faunistic and limnological data of importance in our discussion are set out in two tables (Tab. I and II). Basic data on the characteristics of the lakes and stations are given in Tab. I. Where samples were taken on more than 1 station, the samples have been marked according as  $L_1$ ,  $L_2$ ,  $L_3$ .

The column headed "characteristic species" give the dominating or exclusive species, while the absence of the name of a species in this column indicates the lack of a distinct dominant.

The great majority of the habitats were overgrown by the common reed (*Phragmites communis* Trin.) and were of a typical lake littoral character. In addition the following species grew in a few of the habitats: *Typha angustifolia* L., *Schoenoplectus lacustris* (L.) Palla., *Equisetum* sp., *Stratiotes aloides* L., *Ceratophyllum* sp. etc. In the investigations preceding this paper (M. Rybak 1956 - type script) the influence of the vegetation cover on the composition of the crustacean plankton was investigated, and it was found that within the limits of accuracy of the analyses used, there is a correlation between the specific composition of the higher plants and the relations which we investigated.

In all the littoral habitats which we investigated the occurrence of 28

species of *Cladocera* and 6 species of *Copepoda* was found. A list of species and of the stations examined are given in Table II.

### 3. DISCUSSION OF RESULTS

The material obtained exhibits considerable variations (Tab. I and II). The search for causal connections between the differences in the littoral plankton and the littoral environment makes it necessary to determine whether these differences are significant, and to analyse the connection between or possible independence of the littoral plankton of the features of the lake as a whole. These features may exert a formative effect on the fauna in the littoral of the lakes.

An analysis was made of the correlation of these variations with the following limnological features of the lake: limnological type, degree of productivity acc. to Patalas (1960d), degree to which it is static acc. to Patalas (1960b), type of temperature stratification, area and average depth of the lakes.

The lakes examined can be allocated to 3 limnological trophic types acc. to Stangenberg's classification (Patalas 1960d). Two lakes (Goldopiwo and Święcayty)<sup>1</sup> belong to the  $\beta$  - mesotrophic type, 19 lakes to the eutrophic type and 15 to the pond type.

The number of species in the littoral of lakes belonging to the different types was on an average 3 in the  $\beta$ -mesotrophic type, 4 in the eutrophic and 4 in the pond type. The mean number of individuals in 1 litre of water varied considerably, being respectively 4, 28, 32.

No great differences can be found in any of the groups of lakes classified according to increasing productivity when the primary productivity of the lakes of the Węgorzewo district (Patalas 1960d) is compared with the mean number of species and individuals of *Crustacea* plankton. The mean number of species did not differ from each other (on an average 5 species in each group), but the number of individuals was 65 per 1 litre of water in lakes with low productivity, 34 in lakes with average productivity, 30 in lakes with high productivity and 28 individuals per 1 litre of water in the group of lakes with very high productivity. Apart from the first group the differences are inconsiderable, although the sequence of gradually diminishing numbers exhibits an interesting regularity.

The same comparisons according to the degree of static character (Patalas 1960b) shows that in this case there are no differences in the number of species of *Crustacea* plankton, while there are certain differences

<sup>1</sup>Despite the small number of lakes representing this type, it was taken into consideration in the typological analysis, since a large number of samples were available from these lakes and material for working on them was amply sufficient.







in the number of individuals. Clearly larger numbers of individuals were found on the stations of the lakes of group I (acc. to Patalas) – lakes without permanent summer division into temperature zones – on an average 42 individuals in 1 litre of water and on stations in the lakes of group IV – lakes with temperature stratification, epilimnion 3 to 5 m – average 78 individuals per 1 litre of water. In the remaining groups of lakes the average numbers of individuals fluctuated from 13 to 17 in 1 litre of water.

Comparison made according to temperature stratification (Patalas 1960) also revealed an absence of significant differences in the average number of species (4, 6, 5 in each of the groups of lakes). On the other hand the average numbers were higher in the littoral of the lakes of group II (with epi- and metalimnion) – 95 individuals per 1 litre of water. In the two remaining groups the figures were – in group I (lakes with epi-, meta- and hypolimnion) – 13 individuals and in group III (lakes without temperature stratification) – 32 individuals per 1 litre of water.

The area of the lakes in which the investigations were made varied to a fairly considerable degree. In addition to very small lakes not exceeding 10 ha (Purwin, Jagoczany, Przerwanki, Bimbinek, Białe, Upinek), there are also extensive lakes with an area of over 500 ha (Rydzówka 511.9 ha, Oswin 637 ha, Święcajty 813.6 ha, Gołdopiwo 860.4 ha). Maximum depth of the lakes varied from 0.8 m (Przerwanki), to 42.5 m (Żabinki).

We divided the lakes we investigated into three groups according to area:

- 1) small – not exceeding 50 ha in area,
- 2) medium – from 51 to 200 ha in area,
- 3) large – over 200 ha in area.

A total of 21 lakes were classified as small, 10 as medium and 6 as large (for measurements cf. Kondracki, Szostak 1960).

The analysis made of the abundance and number of species in each of the groups showed that the highest values were those in the group of small lakes. Particularly great abundance, differing widely from all the remaining lakes (regardless of size) distinguished three stations in Lakes Piecek, Siewki and Rominty. The figures were 637 and 115 for Lake Piecek, 320 for Lake Siewki and 200 individuals per 1 litre of water, for Lake Rominty (on one station only for the last lake). Analysis of the remaining stations in the lakes belonging to this group showed that on an average 5 species and 21 individuals occurred per 1 litre of water. In the group of lakes of medium size, these figures were respectively 4 species and 15 individuals, while in the group of large lakes the figures were 4 and 13. There is therefore no difference which could be attributed to the size of the lake. The existing differences are non-significant.

The average depth of the lakes examined fluctuates from 0.5 m (Przerwanki) to 12.6 m (Gołdopiwo). We divided the lakes into the following three groups:

- 1) shallow – up to 3 m average depth, this group including 19 lakes

2) of medium depth – from 3 to 8 m average depth – 15 lakes

3) deep – over 10 m average depth – 3 lakes.

Both the mesotrophic lakes, the only ones among those examined, are included in these three lakes. The deep lakes – Świącjayty and Gołdopiwo are taken into consideration in the trophic division.

On an average five species of *Cladocera* and *Copepoda* were found in each of the shallow and medium deep lakes, and 3 species in the group of deep lakes. The number of individuals was 21 for shallow lakes, 17 for the medium deep lakes and 4 for deep lakes.

The analyses made show that there is no correlation between the different features of the lakes discussed and the number of species and abundance of individuals, correlation existing only between abundance and trophism. With an increase in trophic capacity the number of individuals of crustacean plankton increases, especially distinctly between the group of  $\beta$ -mesotrophic lakes and eutrophic lakes. In the light of the results obtained by analysis of the faunistic connections in different morphological types of littoral (M. Rybak, J.I. Rybak, K. Tarwid, 1964) this correlation should however, be connected with the type of littoral, and coincidence with the degree of eutrophisation results from the coincidence of occurrence of different morphological forms of the littoral with the degree of eutrophisation of the lakes. The composition of the crustacean plankton depends on the type of littoral. A larger number of richer stations was chosen in the eutrophic lakes, and this induced secondly an apparent correlation with the degree of eutrophy. The number of species does not exhibit any great or significant differences in any of the groups of lakes.

There are fairly considerable differences in the settlement of different littoral habitats by crustacean plankton fauna. Large numbers of species of *Cladocera* and *Copepoda* occur on a small number of stations. Out of a total number of 34 species, 18, that is, over half (52.9%) occur on 1, 2 or at most 3 stations. This figure included all except one (*Mesocyclops* (Th.) *crassus*) species of *Copepoda* (Tab. II). In a slightly larger number of stations (up to 20) 11 species occur. The remaining species were found on different stations, 4 of them occurred however in less than half of the stations examined, and are: *Acroperus harpae* – on 22 stations, *Diaphanosoma brachyurum* and *Bosmina longirostris* – on 26 stations and *Ceriodaphnia megops* – on 27 stations. Only one species, *Ceriodaphnia quadrangula*, occurred on more than half of the stations examined, being found on 38 stations (Tab. II).

On the basis of data given in literature – Wolski (1914, 1926), Lityński (1915, 1922), Bowkiewicz (1925), Stark (1930), Brząk (1935), Rzóśka (1935), Koźmiński (1937), Krasnodębski (1937), Ryłov (1948), Fic (Tarwid et al. 1953) three groups of species were distinguished depending on the place in which they occurred. Our own materials collected from Lake

Tajty (Rybak 1960a), in the lake district in which we made our investigations, give a slightly different picture in regard to other species, and these have been marked with a star in the list given below. These differences may possibly arise from the specific nature of the area or the way in which samples were collected and worked upon. Data in literature most often refer to quality, while our investigations were based on a quantitative analysis. In treating the relations described here as typical regional and limnological features (in the sense used by Naumann 1932) we have not gone beyond Polish literature in our analysis.

Classification of species according to habitat is as follows<sup>2</sup>

Species typical of the littoral:

<i>Sida crystallina</i>	<i>Alona rectangula</i>
<i>Scapholeberis mucronata</i>	<i>Graptoleberis testudinaria</i>
<i>Simocephalus vetulus</i>	<i>Alonella nana*</i>
<i>Ceriodaphnia megops</i>	<i>Alonella excisa</i>
<i>Ceriodaphnia reticulata</i>	<i>Alonella exigua</i>
<i>Eurycercus lamellatus</i>	<i>Peracantha truncata</i>
<i>Camptocercus lilljeborgi</i>	<i>Pleuroxus striatus</i>
<i>Acroperus harpae*</i>	<i>Pleuroxus aduncus*</i>
<i>Alona guttata</i>	<i>Pleuroxus uncinatus*</i>
<i>Alona costata</i>	<i>Polyphemus pediculus</i>
<i>Alona quadrangularis*</i>	<i>Ectocyclops phaleratus</i>

Species typical of the pelagial:

<i>Daphnia longispina</i>	<i>Diaptomus graciloides</i>
<i>Daphnia cucullata</i>	<i>Mesocyclops (Th.) oithonoides</i>
<i>Cyclops vicinus</i>	<i>Cyclops scutifer</i>

Species occurring equally frequently in both environments (ubiquitous):

<i>Diaphanosoma brachyurum</i>	<i>Chydorus sphaericus</i>
<i>Ceriodaphnia quadrangula</i>	<i>Mesocyclops (Th.) crassus*</i>
<i>Bosmina longirostris</i>	<i>Bosmina coregoni</i>

As can be seen from the above list, more than half the species found are typical of the littoral. Despite this fact, of these species only three (*Sida crystallina*, *Ceriodaphnia megops* and *Acroperus harpae*) were found on a large number of stations (28.0–47.3%). The remaining species occurred rarely. The species which occurred most frequently in the littoral proved to be ubiquitous, and therefore not specialised species. Out of a total number of 6 ubiquitous species, 4 occurred on 31.5 to 63% of the stations. It would therefore seem that the habitats investigated do not create predisposition favourable to the

<sup>2</sup>We have not taken "forms" into consideration within certain species. In the light of our materials we are of the opinion, that we are concerned here with a considerable degree of plasticity, the ecological sense of which now requires investigation.

frequent occurrence in them of specialised species, particularly those specialised for life in the littoral (apart from *A. harpae* and *C. megops*). This would mean that habitat specialisation of littoral species does not apply to the littoral at all, and that for the majority of the species it is specialisation for the more particular conditions of the habitat mosaics of this very variable environment.

Of the three groups of species distinguished, the greatest percentage in the majority of the stations was formed by littoral species. Of 33 stations (57.9% of the total number of stations) they form at least 50% of the species found (Fig. 2), and in 5 stations 100% of littoral species was found, from 1 to 3 species occurring on these latter stations. The group of ubiquitous species forms at least 50% of the species found on 28 stations (49.1% of the total).

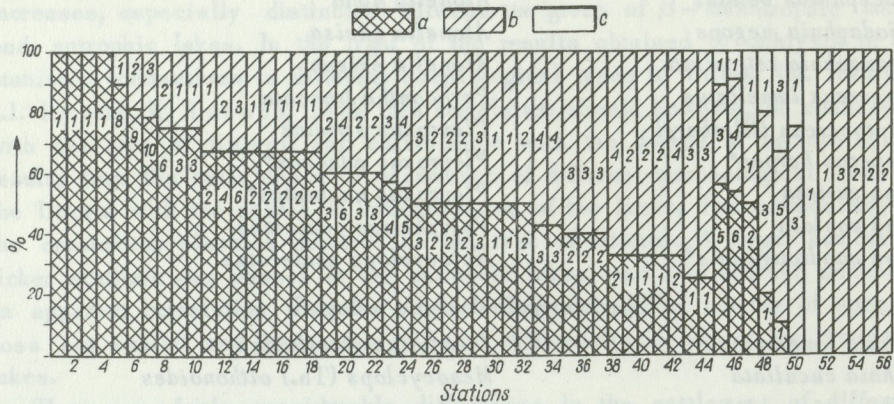


Fig. 2 - Occurrence of groups of species of *Crustacea* on different littoral stations (in %). (Figures in diagram indicate the mean number of species)

a - littoral species, b - ubiquitous species, c - pelagial species. 1 - Gołdopiwo, 2 - Rydzówka L<sub>2</sub>, 3 - Arklickie 1954, 4 - Pniewskie L<sub>1</sub>, 5 Kirsajty L<sub>2</sub>, 6 - Rominty L<sub>2</sub>, 7 - Siewki, 8 - Upinek, 9 - Lemiąt, 10 - Mały Siniec, 11 - Rydzówka L<sub>3</sub>, 12 - Bimbinek L<sub>1</sub>, 13 - Rydzówka L<sub>1</sub>, 14 - Głęboka Kuta 1955, 15 - Biała Kuta, 16 - Żywy L<sub>1</sub>, 17 - Krzywa Kuta L<sub>3</sub>, 18 - Wilkus L<sub>2</sub>, 19 - Purwin, 20 - Krzywa Kuta L<sub>1</sub>, 21 - Bimbinek L<sub>2</sub>, 22 - Przyleśne L<sub>1</sub> 1955, 23 - Łękuk Wielki, 24 - Przyleśne L<sub>1</sub> 1954, 25 - Jagoczany 1955, 26 - Brzozówka, 27 - Głęboka Kuta 1954, 28 - Święcajt, 29 - Stręgiel L<sub>2</sub>, 30 - Przerwanki, 31 - Kirsajty L<sub>1</sub>, 32 - Oświn, 33 - Piecek L<sub>2</sub>, 34 - Bartelnik, 35 - Stręgiel L<sub>1</sub>, 36 - Sołtmany, 37 - Czarna Kuta, 38 - Pozezdrze, 39 - Krzywa Kuta L<sub>2</sub>, 40 - Wilkus L<sub>1</sub>, 41 - Gołdopiwo L<sub>1</sub>, 42 - Ciche, 43 - Piecek L<sub>1</sub>, 44 - Białe, 45 - Pniewskie L<sub>2</sub>, 46 - Jagoczany 1954, 47 - Przyleśne L<sub>2</sub> 1955, 48 - Przyleśne L<sub>2</sub> 1954, 49 - Węgielsztyńskie, 50 - Arklickie 1955, 51 - Rominty L<sub>1</sub>, 52 - Duży Siniec, 53 - Żywy L<sub>2</sub>, 54 - Silec, 55 - Babka, 56 - Surwille

Pelagial species occurred on 7 stations (12.3% of the total). Their participation in the crustacean plankton was slight (apart from littoral L<sub>1</sub> of Lake Rominty) - not exceeding 33% of the species found (Fig. 2).

The majority of the species distinguished were represented by a number of

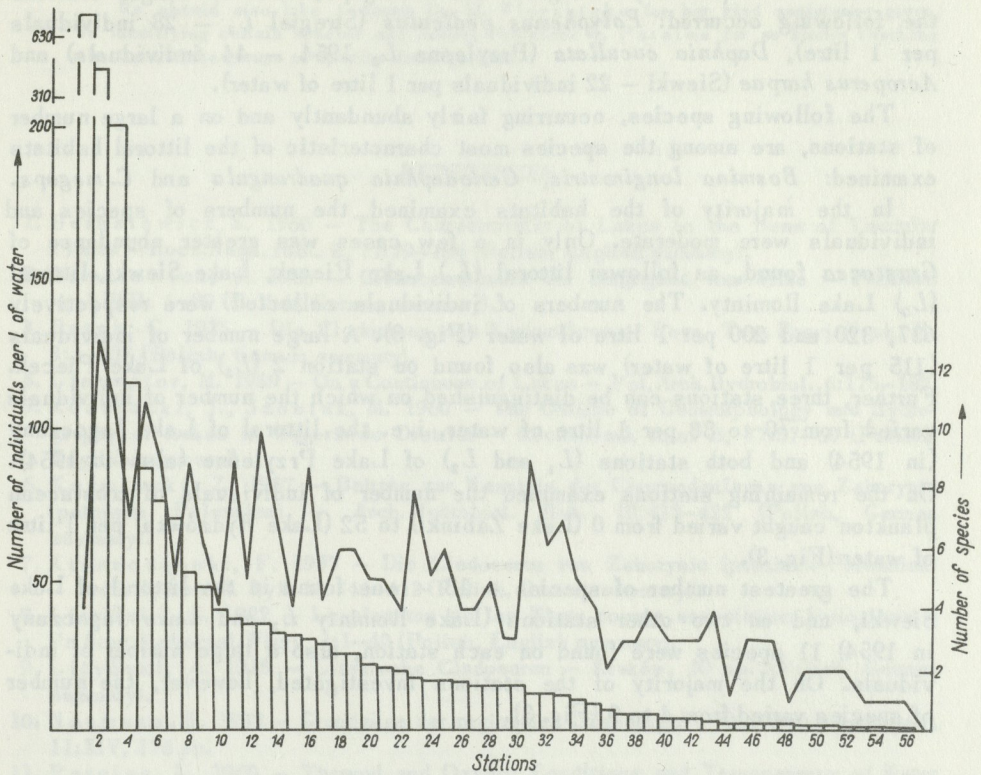


Fig. 3 - Quantitative occurrence of crustacean plankton on different littoral stations 1 - Piećek  $L_1$ , 2 - Siewki, 3 - Rominty  $L_2$ , 4 - Piećek  $L_2$ , 5 - Jagoczany 1954, 6 - Przyłęśne  $L_1$  1954, 7 - Przyłęśne  $L_2$  1954, 8 - Rydzówka  $L_1$ , 9 - Stręgiel  $L_2$ , 10 - Głęboka Kuta 1954, 11 - Pniewskie  $L_2$ , 12 - Przyłęśne  $L_1$  1955, 13 - Krzywa Kuta  $L_1$ , 14 - Bartelnik, 15 - Lemięt, 16 - Węgielsztyńskie, 17 - Arklickie 1955, 18 - Jagoczany 1955, 19 - Pozezdrze, 20 - Bimbinek  $L_2$ , 21 - Sołtmany, 22 - Przyłęśne  $L_2$  1955, 23 - Upinek, 24 - Purwin, 25 - Ciche, 26 - Oświn, 27 - Brzozówka, 28 - Czarna Kuta, 29 - Głęboka Kuta 1955, 30 - Krzywa Kuta  $L_3$ , 31 - Kirsajty  $L_2$ , 32 - Bimbinek  $L_1$ , 33 - Łękuk Wielki, 34 - Stręgiel  $L_1$ , 35 - Mały Siniec, 36 - Surwille, 37 - Gołdopiwo  $L_1$ , 38 - Krzywa Kuta  $L_2$ , 39 - Białe, 40 - Wilkus  $L_1$ , 41 - Żywy  $L_1$ , 42 - Żywy  $L_2$ , 43 - Święcajt, 44 - Rominty  $L_1$ , 45 - Wilkus  $L_2$ , 46 - Biała Kuta, 47 - Rydzówka  $L_3$ , 48 - Duży Siniec, 49 - Silec, 50 - Kirsajty  $L_1$ , 51 - Przerwanki, 52 - Babka, 53 - Pniewskie  $L_1$ , 54 - Arklickie 1954, 55 - Rydzówka  $L_2$ , 56 - Gołdopiwo  $L_2$ , 57 - Żabinki

individuals rarely exceeding 10 in 1 litre of water. Only a few species occurred in larger numbers, in certain cases even in great abundance. Among these latter species must be included in the first place *Bosmina longirostris*, which attained the following numbers on the stations examined in Lake Piećek: 519 individuals per 1 litre of water (on station  $L_1$ ) and 382 individuals (on

station  $L_2$ ). The following species also occur abundantly on several littoral stations: *Ceriodaphnia quadrangula* and *C. megops*, and on single stations the following occurred: *Polyphemus pediculus* (Stręgiel  $L_2$  - 28 individuals per 1 litre), *Daphnia cucullata* (Przyleśne  $L_2$  1954 - 44 individuals) and *Acroperus harpae* (Siewki - 22 individuals per 1 litre of water).

The following species, occurring fairly abundantly and on a large number of stations, are among the species most characteristic of the littoral habitats examined: *Bosmina longirostris*, *Ceriodaphnia quadrangula* and *C. megops*.

In the majority of the habitats examined the numbers of species and individuals were moderate. Only in a few cases was greater abundance of Crustacea found, as follows: littoral ( $L_1$ ) Lake Piecek, Lake Siewki, littoral ( $L_2$ ) Lake Rominty. The numbers of individuals collected were respectively 637, 320 and 200 per 1 litre of water (Fig. 3). A large number of individuals (115 per 1 litre of water) was also found on station 2 ( $L_2$ ) of Lake Piecek. Further, three stations can be distinguished on which the number of individuals varied from 70 to 88 per 1 litre of water, i.e. the littoral of Lake Jagoczany (in 1954) and both stations ( $L_1$  and  $L_2$ ) of Lake Przyleśne (also in 1954). On the remaining stations examined the number of individuals of crustacean plankton caught varied from 0 (Lake Żabinki) to 52 (Lake Rydzówka) per 1 litre of water (Fig. 3).

The greatest number of species - 13 - was found in the littoral of Lake Siewki, and on two other stations (Lake Rominty  $L_2$  and Lake Jagoczany in 1954) 11 species were found on each station, also a large number of individuals. On the majority of the stations investigated, however, the number of species varied from 4 to 9 (Fig. 3).

#### 4. CONCLUSIONS

The investigations made lead to the following conclusions:

1. None of the species found occurred on all of the littoral stations examined. More than half the species occurred only on 1, 2 or 3 stations out of the 57 examined. The following are species characteristic of the habitats studied: *Acroperus harpae*, *Diaphanosoma brachyurum*, *Bosmina longirostris*, *Ceriodaphnia megops* and *C. quadrangula*. This latter species is the only one which was found on more than 50% of the littoral stations.

2. The majority of the typically littoral species occur only in certain (presumably more narrowly specialised) habitats. On many of the stations in so variable and differentiated environment as the littoral, it is primarily ubiquitous species which occur (apart from *Ceriodaphnia megops* and *Acroperus harpae*).

We have pleasure in expressing our gratitude to Professor K. Tarwid (Institute of Ecology, Polish Academy of Sciences, Warsaw) for his valuable suggestions and assistance during the preparation of this paper, and also Assoc. Professor J. Zawisza

and Assoc. Professor S. Bernatowicz (Institute of Inland Water Fishery - Olsztyn and Giżycko) for their help with field work and for facilitating our work generally.

We should also like to thank Dr. M. Wierzbicka for her kind assistance given in identifying certain species and Assoc. Professor K. Patalas for so kindly checking the lists of the groups of species distinguished.

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## SKORUPIAKI LETNIEGO PLANKTONU LITORALU JEZIOR OKOLIC WĘGORZEWA

### Streszczenie

Materiały do pracy zebrano z 57 stanowisk litoralowych 37 jezior okolic Węgorzewa (Tab. I i II). Próby planktonu skorupiakowego pobierano w drugiej połowie 1954 i częściowo 1955 r., 5-cio litrowym chwytaczem typu Bernatowicza. Na każdym stanowisku pobierano po 3 próby w środku pasa roślinności. Stwierdzono występowanie 28 gatunków wioślarek (*Cladocera*) i 6 gatunków widłonogów (*Copepoda*) (Tab. II).

Nie stwierdza się wyraźnej korelacji między liczbą gatunków i liczebnością skorupiaków planktonowych występujących w środowiskach litoralowych a cechami limnologicznymi jezior. Skład planktonu skorupiakowego jest uzależniony od typu litoralu (Rybak, Rybak, Tarwid 1964).

Więcej niż połowa znalezionych gatunków jest typowa dla litoralu. Jednakże tylko 3 z nich (*Sida crystallina*, *Ceriodaphnia megops* i *Acroperus harpae*) znaleziono na większej liczbie stanowisk. Wynika z tego, że specjalizacja gatunków litoralowych do środowiska nie dotyczy litoralu w ogóle a jest specjalizacją do szczególnych warunków mozaik tego bardzo zmiennego środowiska.

Gatunki litoralowe na 33 stanowiskach (57,9% badanych stanowisk) stanowią co najmniej 50% znalezionych gatunków.

Gatunki ubikwistyczne natomiast stanowią co najmniej 50% na 28 stanowiskach (49,1%). Gatunki pelagiczne wystąpiły na 7 stanowiskach (12,3%) (Fig. 2). Większość gatunków reprezentowana była przez niewielką liczbę osobników. Do najbardziej charakterystycznych dla badanych środowisk należą na tym terenie: *Bosmina longirostris*, *Ceriodaphnia quadrangula*, *C. megops*, *Acroperus harpae*, *Diaphanosoma brachyurum*.

Większą liczebność skorupiaków planktonowych stwierdzono jedynie na kilku stanowiskach (Fig. 3).

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