

EKOLOGIA POLSKA - SERIA A

Tom XV

Warszawa 1967

Nr 26

Eligiusz PIECZYŃSKI

THE OCCURRENCE OF WATER MITES (*HYDRACARINA*)  
AND SOME OTHER INVERTEBRATES IN THE LITTORAL  
AND CENTRAL PART OF LAKE ŚNIARDWY\*

By using the trap method it was found that environmental differences between the littoral, which was overgrown by reeds, and the central part of the lake, which was free of plants and had a muddy bottom, are very clearly reflected in the domination structure of *Hydracarina*.

The aim of the study was to analyse the occurrence of aquatic invertebrates (chiefly *Hydracarina*) in two distinctly different environments: the littoral overgrown by reeds and the central, shallow but plantless part of the lake. The study area was formed by lake Śniardwy (10588.4 ha in area, mean depth about 4.5 m, eutrophic, polymictic). The trap previously described (Pieczyński 1961) was used, which consisted of two main parts connected together, a glass funnel (the inlet of which was 15 cm in diameter) and a glass jar (capacity 1 litre). The traps were placed in fours on wooden bases to prevent their sinking into the mud. The technical description of this kind of simple device is to be found in the study by Pieczyński and Kajak (1965). Trapping was carried out on two stations: (1) in the littoral (at a depth of 1.2 m); overgrown by reeds; this station was situated near the south-west margin of lake Śniardwy in a little bay sheltered by a reed bed; (2) in the central part of the lake (at a depth of 8 m) where the bottom was muddy, at a distance

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

of about 0.5 km from the nearest shore (by which the littoral station was situated). Four traps were placed in position on each of these stations at one time, and left for a period of 48 hours. Captures were made 6 times (at the same times on both stations) during the period from 8th to 31st August 1964, obtaining material from a total of 24 traps with joint sampling period of 12 whole days on each station.

It had previously been found by using the trap method that the central part of lake Śniardwy possesses *Hydracarina* fauna rich both from the quantitative and qualitative aspects, exhibiting a considerable degree of similarity to the littoral fauna (Pieczyński and Kajak 1965).

## RESULTS

1. When the number and percentage of individuals of the various groups and species of invertebrates caught in traps in the littoral and central part of lake Śniardwy are compared the following is found (Tab. I).

A slightly larger number of components of the fauna (19) are observed in the littoral than in the central part (15), which can be explained by the greater environmental differentiation in the first of these biotopes. *Hydracarina* (50.2%) are most numerous represented in the littoral, then *Ostracoda* (14.0%) and *Ephemeroptera* (14.0%). Similarly in the central part *Hydracarina* (75.8%) are decidedly the most numerous, then *Ostracoda* (19.3%). These two groups greatly predominate in numbers over the remaining components of the fauna.

2. When the number and percentage of individuals of the various species of *Hydracarina* caught in traps in the littoral and central part of lake Śniardwy are compared the following is found (Tab. II).

A larger number of species (24) occur in the littoral than in the central part (18), despite the fact that a far larger number of individuals were caught in the second of these habitats. Sørensen's species similitude index<sup>1</sup> attains a value of 57.1% for these environments, which indicates their fairly considerable similarity. It is however lesser than the similarity in the species composition of the *Hydracarina* fauna living in the littoral and sublittoral of the lake, where this index exceeds 70% (Pieczyński 1964).

In the littoral the following are among the most numerous represented species: *Arrenurus affinis* (23.7%), *Unionicola crassipes* (19.3%) and *Hydrodroma despiciens* (18.1%), and in the central part — *Piona rotunda* (48.5%), *Unionicola crassipes* (15.5%), *Piona coccinea* (14.0%) and *Forelia liliacea* (11.2%).

---

<sup>1</sup>The index is calculated according to the formula:  $P = \frac{2c \cdot 100}{a + b}$  where  $c$  — number of species common to both the environments compared,  $a$  — number of species in one environment,  $b$  — number of species in the second environment.

Number and percentage of individuals of different groups and species of invertebrates caught in the littoral and central part of lake Śniardwy  
N – number of individuals. In frames – most numerous forms

Tab. I

Group or species of invertebrates	Littoral		Central part	
	N	%	N	%
<i>Turbellaria</i>	1	0.1	8	0.5
<i>Stylaria lacustris</i> L.	5	0.7	3	0.2
<i>Hirudinea</i>	4	0.6	—	—
<i>Argulus foliaceus</i> L.	1	0.1	3	0.2
<i>Ostracoda</i>	100	14.0	295	19.3
<i>Asellus aquaticus</i> L.	21	2.9	—	—
<i>Gammarus</i> sp.	6	0.8	5	0.3
<i>Hydracarina</i>	359	50.2	1153	75.8
<i>Odonata</i>	28	3.9	—	—
<i>Ephemeroptera</i>	100	14.0	—	—
<i>Corixidae</i>	5	0.7	1	0.1
<i>Trichoptera</i>	8	1.1	2	0.1
<i>Lepidoptera</i>	—	—	1	0.1
<i>Coleoptera</i>	59	8.3	2	0.1
<i>Chironomidae</i>	7	1.0	22	1.4
<i>Chaoborus</i> sp.	1	0.1	—	—
<i>Theodoxus fluviatilis</i> L.	1	0.1	—	—
<i>Valvata piscinalis</i> Müll.	—	—	24	1.6
<i>Bithynia tentaculata</i> L.	—	—	1	0.1
<i>Lymnea stagnalis</i> L.	4	0.6	—	—
<i>Radix</i> sp.	4	0.6	1	0.1
<i>Planorbis</i> sp.	—	—	1	0.1
<i>Dreissena polymorpha</i> Pall.	1	0.1	—	—

3. Comparison of the trappability of different groups and species of invertebrates in the littoral and central parts shows the following (Fig. 1).

Some of them, such as *Asellus aquaticus*, *Odonata*, *Ephemeroptera* and *Coleoptera* exhibit distinctly greater trappability in the littoral (trappability equal to or near 100%). In the case of these groups the character of trappability presumably reflects the character of quantitative occurrence (far greater numbers in the littoral than in the central part, or even occurrence only in the littoral). Other groups, such as *Valvata piscinalis*, *Hydracarina*, *Chironomidae* and *Ostracoda* exhibit greater trappability in the central part of the lake.

4. Comparison was made analogically of the trappability of different species of *Hydracarina* in the littoral and central part of the lake (Fig. 2). Greater trappability in the littoral is found chiefly in the case of the following species: *Hygrobates longipalpis*, *Piona variabilis*, *Arrenurus affinis* and *A. tricuspikator*

Number and percentage of individuals of different species of *Hydracarina* caught in the littoral and central part of lake Śniardwy

N — number of individuals. In frames — most numerous forms

Tab. II

Species	Littoral		Central part	
	N	%	N	%
<i>Eylais</i> sp.	7	2.0	—	—
<i>Hydrodroma despiciens</i> (Müller 1776)	62	18.1	1	0.1
<i>Lebertia</i> sp.	3	0.9	—	—
<i>Frontipoda musculus</i> (Müller 1776)	15	4.4	1	0.1
<i>Limnesia maculata</i> (Müller 1776)	—	—	2	0.2
<i>L. undulata</i> (Müller 1776)	1	0.3	39	3.5
<i>Hygrobates longipalpis</i> (Hermann 1804)	13	3.8	—	—
<i>H. nigromaculatus</i> Lebert 1879	1	0.3	—	—
<i>Unionicola crassipes</i> (Müller 1776)	66	19.3	173	15.5
<i>Neumania callosa</i> (Koenike 1895)	—	—	11	1.0
<i>N. deltoides</i> (Piersig 1894)	—	—	1	0.1
<i>N. vernalis</i> (Müller 1776)	6	1.7	—	—
<i>Hydrochoreutes krameri</i> Piersig 1896	1	0.3	1	0.1
<i>Piona coccinea</i> (Koch 1836)	1	0.3	156	14.0
<i>P. longipalpis</i> (Krendowskij 1878)	1	0.3	—	—
<i>P. rotunda</i> (Kramer 1879)	1	0.3	541	48.5
<i>P. variabilis</i> (Koch 1836)	12	3.5	—	—
<i>Forelia liliacea</i> (Müller 1776)	2	0.6	125	11.2
<i>Brachypoda versicolor</i> (Müller 1776)	1	0.3	4	0.4
<i>Mideopsis orbicularis</i> (Müller 1776)	—	—	2	0.2
<i>Arrenurus affinis</i> Koenike 1887	81	23.7	—	—
<i>A. bicuspidator</i> Berlese 1885	2	0.6	—	—
<i>A. crassicaudatus</i> Kramer 1875	3	0.9	—	—
<i>A. nobilis</i> Neuman 1880	—	—	4	0.4
<i>A. pustulator</i> (Müller 1776)	1	0.3	—	—
<i>A. tricuspikator</i> (Müller 1776)	10	3.0	—	—
<i>A. coronator</i> (Thor 1901)	—	—	12	1.0
<i>A. globator</i> (Müller 1776)	27	7.9	8	0.7
<i>A. perforatus</i> (George 1881)	7	2.0	4	0.4
<i>A. sinuator</i> (Müller 1776)	18	5.2	29	2.6

(100% trappability in the littoral), then *Hydrodroma despiciens*, *Frontipoda musculus* and *Arrenurus globator*. On the other hand greater trappability in the central part is exhibited by: *Arrenurus coronator*, *Neumania callosa*, *Piona rotunda*, *P. coccinea* and *Limnesia undulata*. It must be considered that the

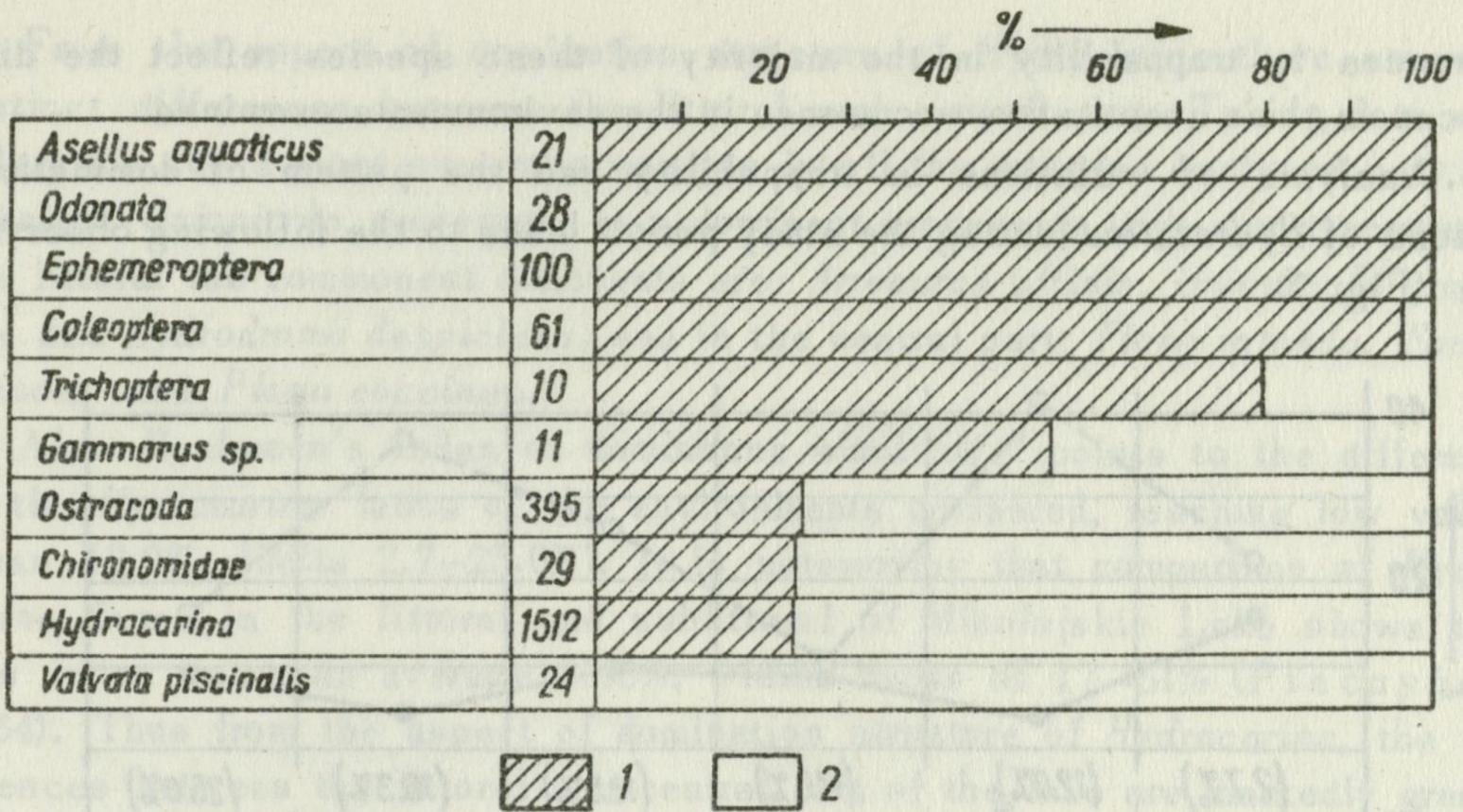


Fig. 1. Comparison of trappability (in %) of different groups and species of invertebrates in the littoral and central part of lake Śniardwy  
 1 - littoral, 2 - central part; figures after Latin names indicate the number of individuals (taken as 100%)

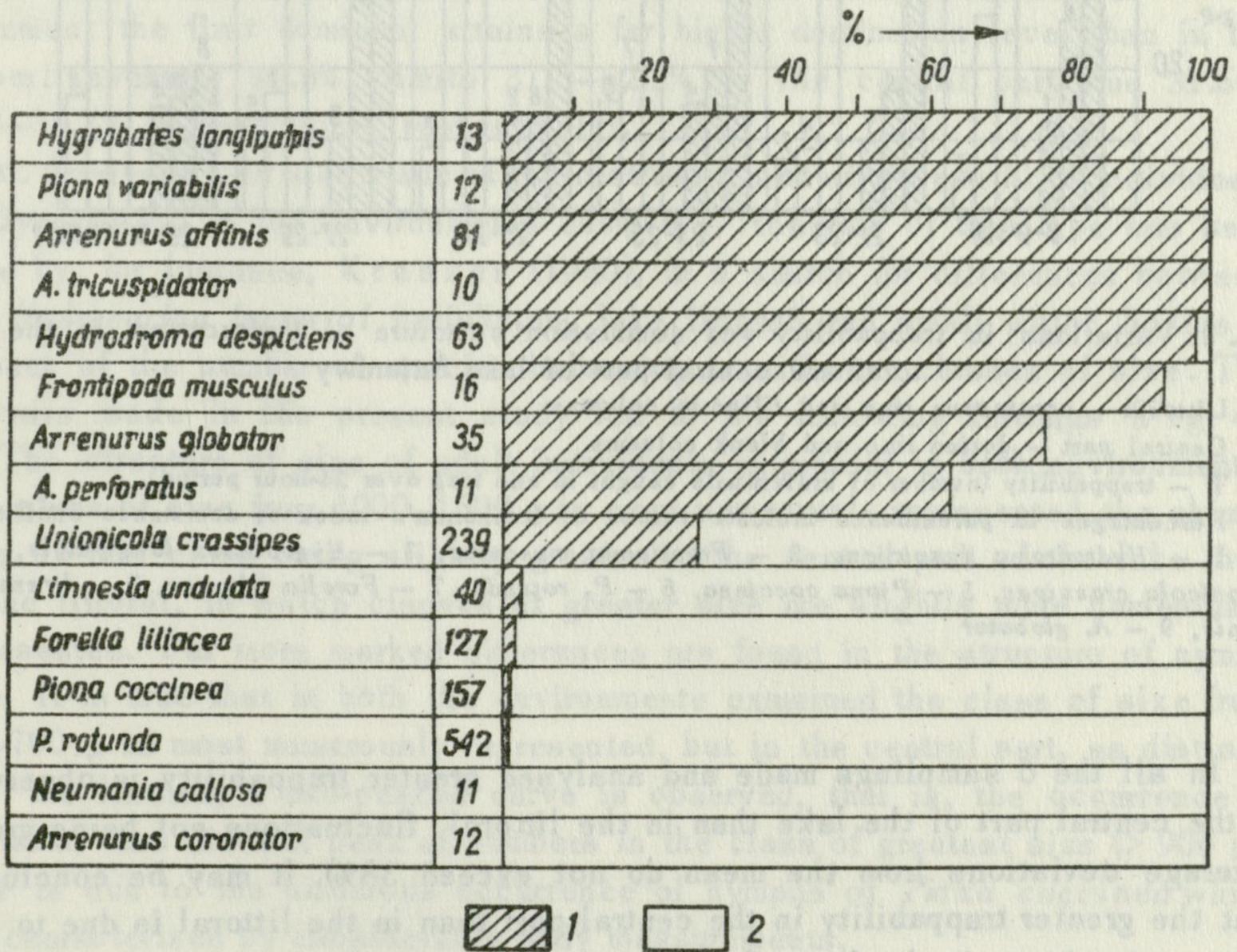


Fig. 2. Comparison of trappability (in %) of different species of *Hydracarina* in the littoral and central part of lake Śniardwy  
 For indications see Fig. 1

differences in trappability in the majority of these species reflect the differences in their quantitative occurrence in the environments examined.

5. Analysis of variations in trappability and the pattern of domination relations of *Hydracarina* during the study period leads to the following observations (Fig. 3).

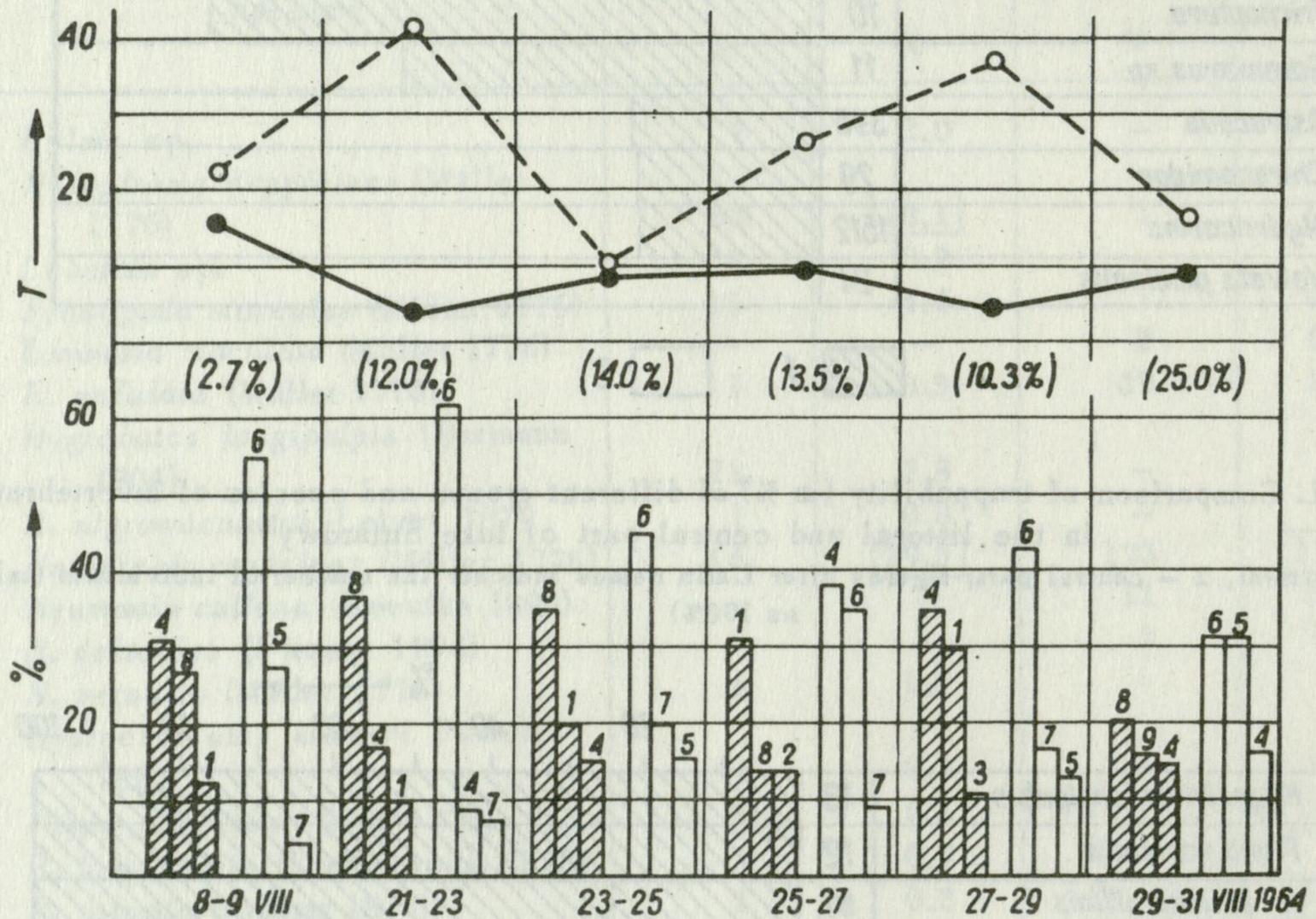


Fig. 3. Variations in trappability and domination structure of *Hydracarina* in the littoral and central part of lake Śniardwy

Littoral — continuous line and filled-in columns

Central part — dotted line and blank columns

T — trappability (number of individuals caught in one trap over 24-hour period).

Percentages in parentheses indicate values of Renkonen's index of dominance similitude

1 — *Hydrodroma despiciens*, 2 — *Frontipoda musculus*, 3 — *Hygrobates longipalpis*, 4 — *Unionicola crassipes*, 5 — *Piona coccinea*, 6 — *P. rotunda*, 7 — *Forelia liliacea*, 8 — *Arrenurus affinis*, 9 — *A. globator*

In all the 6 samplings made and analysed greater trappability is observed in the central part of the lake than in the littoral, fluctuations not being great (average deviations from the mean do not exceed 38%). It may be concluded that the greater trappability in the central part than in the littoral is due to the greater abundance in the first of these environments and not to greater activity. The lesser depth, and in consequence the higher temperature and better insolation in the littoral should rather favour greater activity of invertebrates in the littoral environment.

From the aspect of domination structure of *Hydracarina* there are very distinct differences between the littoral and central part. Taking into consideration the 3 most numerous species in all the samples analysed only one species, *Unionicola crassipes*, is a dominant common to both environments. In the littoral the commonest dominants are: *Arrenurus affinis*, *Unionicola crassipes* and *Hydrodroma despiciens*, and in the central part: *Piona rotunda*, *Forelia liliacea* and *Piona coccinea*.

Also Renkonen's index of dominance similitude<sup>2</sup> points to the difference in the *Hydracarina* fauna of the environments compared, reaching low values (mean 12.9%, limits 2.7–25.0%). It is noteworthy that comparison of *Hydracarina* fauna in the littoral and sublittoral of Mikołajskie Lake shows that this index is on an average 33.3%, within limits of 17–51% (Pieczyński 1964). Thus from the aspect of domination structure of *Hydracarina*, the differences between the littoral and central part of the lake are markedly greater than the differences between the littoral and sublittoral.

In addition it may be said that the domination structure of *Hydracarina* is characterised by greater persistence in the central part than in the littoral of the lake examined (Fig. 3). In the central part, in 5 out of the 6 cases examined, *Piona rotunda* occupies the position of first dominant. In this environment the first dominant attains a far higher domination level than in the littoral (average 45.8%, limits 31.5–62.2% in the central part and 31.6%, 20.3–36.7% in the littoral, respectively).

6. Analysis was also made of the distribution of size (length) of individuals of *Hydracarina* in the environments compared. Analysis of this type has been made by, for instance, Kreuzer (1940), in a search for differences between the *Hydracarina* fauna of periphyton, lake littoral and small water bodies in respect of the number of species belonging to different classes of size. The analysis made in the present study led to the following findings (Fig. 4).

The structure of size of adult individuals is similar in both environments. The class of size from 1000–1500  $\mu$  is most numerous represented, the abundance of this class being slightly greater in the central part of the lake than in the littoral, in which classes of greater size are slightly more numerous represented. Far more marked differences are found in the structure of nymph size. It is true that in both the environments examined the class of size from 600–700  $\mu$  is most numerous represented, but in the central part, as distinct from the littoral, a two-peaked curve is observed, that is, the occurrence of a second less distinct peak of numbers in the class of greatest size (> 900  $\mu$ ). This is due to the numerous occurrence of nymphs of *Piona coccinea* which are characterised by considerable body measurements.

---

<sup>2</sup>The index is calculated by adding the smaller percentages successively compared of these same species in both environments.

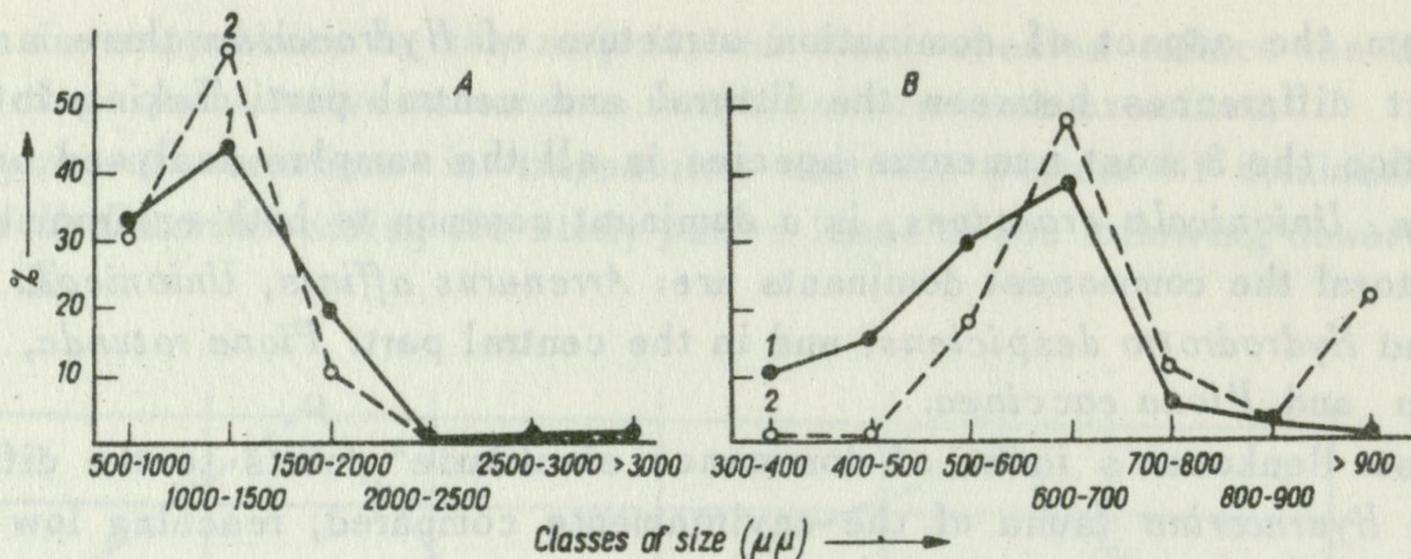


Fig. 4. Distribution of size of individuals of *Hydracarina* in the littoral and central part of lake Śniardwy

A — adults, B — nymphs, 1 — littoral, 2 — central part

#### REFERENCES

1. Kreuzer, R. 1940 — Limnologisch-Ökologische Untersuchungen an holsteinischen Kleingewässern — Arch. Hydrobiol. Suppl. 10: 359—572.
2. Pieczyński, E. 1961 — The trap method of capturing water mites (*Hydracarina*) — Ekol. Pol. B, 7: 111—115.
3. Pieczyński, E. 1964 — Analysis of numbers, activity, and distribution of water mites (*Hydracarina*), and of some other aquatic invertebrates in the lake littoral and sublittoral — Ekol. Pol. A, 12: 691—735.
4. Pieczyński, E. and Kajak, Z. 1965 — Investigations on the Mobility of the Bottom Fauna in the Lakes Tałowisko, Mikołajskie and Śniardwy — Bull. Acad. Pol. Sci. Cl. II, 13: 345—353.

#### WYSTĘPOWANIE WODOPÓJEK (*HYDRACARINA*) I NIEKTÓRYCH INNYCH BEZKRĘGOWCÓW W LITORALU I ŚRÓDJEZIERZU JEZIORA ŚNIARDWY

##### Streszczenie

Przy użyciu metody pułapkowej analizowano faunę bezkręgowców (głównie *Hydracarina*) w dwu środowiskach jeziora Śniardwy: litoralu porośniętym trzciną (o głębokości 1,2 m) i śródzieziersu o dnie mulistym i pozbawionym roślinności (głębokość 8,0 m). W obydwu środowiskach najliczniej reprezentowane były w pułapkach *Hydracarina* i *Ostracoda* (tab. I). W litoralu, gdzie zanotowano 24 gatunki *Hydracarina*, do najliczniejszych należały: *Arrenurus affinis*, *Unionicola crassipes* i *Hydrodroma*

*despiciens*, natomiast w śródzieżerzu, wśród 18 gatunków najliczniejsze były: *Piona rotunda*, *Unionicola crassipes*, *Piona coccinea* i *Forelia liliacea* (tab. II). Porównano łowność poszczególnych grup bezkręgowców i gatunków wodopójek w litoralu i śródzieżerzu (fig. 1 i 2). W niektórych przypadkach różnice łowności mogą odzwierciedlać różnice w ilościowym zasiedleniu porównywanych środowisk. Wodopójki wykazały wyższą łowność w śródzieżerzu niż w litoralu (fig. 3). Pod względem struktury dominacji *Hydracarina* obserwuje się wyraźne różnice między porównywanymi środowiskami (fig. 3), przy czym jest ona bardziej trwała w śródzieżerzu niż w litoralu. Pod względem struktury wielkości osobników wodopójek różnice między litoralem i śródzieżerzem dotyczą głównie nimf (fig. 4).

AUTHOR'S ADDRESS:  
Dr. Eligiusz Pieczyński,  
Institute of Ecology,  
Polish Academy of Sciences,  
Warszawa, Nowy Świat 72,  
Poland.