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Freshwater *Gastrotricha* of Poland. VII. *Gastrotricha* of extremely eutrophicated water bodies

[With 1 figure and 3 tables]

Abstract. In extremely eutrophicated waters of Poland 71 species of *Gastrotricha* were found, including 50 identified ones. Eight species occurred only in this environment, whereas other 14 found optimum conditions there. Higher taxa as a whole are connected with this environment: genus *Polymerurus* and families *Dasydytidae* and *Neogosseidae*. The fauna was most abundant in water bodies with the association *Hydrocharitetum morsus-ranae*. All available data on freshwater *Gastrotricha* from Poland are recapitulated.

The present paper is the last in a series of seven publications on *Gastrotricha* fauna of various environments of Polish inland waters. The first paper (KISIELEWSKI and KISIELEWSKA 1986 — cited further in the text as "I") discussed the *Gastrotricha* of mountain waters, both oligotrophic lakes, sources and streams and eutrophic water bodies. Altogether 32 identified species were found there. The second paper (KISIELEWSKA and KISIELEWSKI 1986a — cited further on as "II") concerns *Gastrotricha* of young shallow lakes of marine origin on the Baltic coast — 26 species. The third paper (KISIELEWSKA and KISIELEWSKI 1986b — cited further on as "III") deals with *Gastrotricha* of a vast complex of primary forests of the Białowieża Forest and eutrophic water bodies of the Białowieża Glade — 48 identified species. In the fourth paper NESTERUK (1986) — cited further on as "IV" — describes the *Gastrotricha* fauna from fish ponds near Siedlce — 39 species. KISIELEWSKA and KISIELEWSKI (1986c — cited further on as "V") present the results of investigations on *Gastrotricha* of alder woods — 41 species. The paper before the last (SZKUTNIK 1986 — cited further on as "VI") deals with *Gastrotricha* of astatic water environments overgrown with rush vegetation — 43 species. Altogether, in all papers, 72 identified species and forms of

Gastrotricha were found, of which 67 belong to the family *Chaetonotidae* and 5 to *Dasydytidae*.

The present paper deals with the gastrotrichan fauna of highly eutrophicated water bodies. *Gastrotricha* of these environments have been already investigated in Poland. ROSZCZAK (1935, 1968), when investigating water bodies in central Great Poland, has given a number of species from waters of a high degree of fertility. Data on *Gastrotricha* of eutrophic waters are given in two of my taxonomic papers (KISIELEWSKI 1974, 1979); full faunistic data, partly used in papers mentioned, have been included here. KISIELEWSKA (1982) has examined *Gastrotricha* of two complexes of highly eutrophicated peat-hags near Siedlce. Finally, in some papers of the series (III, IV and VI) data on *Gastrotricha* of this environment are given, whereas paper IV is entirely devoted to *Gastrotricha* of highly eutrophicated waters under constant man's control (fish ponds).

The additional aim of the present paper, as the last one in the series, is to sum up the data given in all papers concerning particular species and also the entire freshwater gastrotrichan fauna of Poland.

METHODS

None of the modifications of methods described in paper I have been used here. Some of the data are from many years ago (see the next chapter) and were collected in such a way that it was impossible to use them when considering the dominance structure and species diversity. Thus they were only included in the systematic review and in the list of species.

MATERIAL AND CHARACTERISTICS OF ENVIRONMENTS EXAMINED

Gastrotricha of rather small highly eutrophicated water bodies have been an object of investigation. In Poland these environments are a very common type of waters characterized among other features by a small depth, well developed rush vegetation and also by a usually abundant floating vegetation (duckweed, *Hydrocharis morsus-ranae* and *Stratiotes aloides*) or floating leaves (*Nuphar luteum*, *Nymphaea* spp.). In these water bodies there is a fast increment of both phytoplankton and vascular vegetation mass; considerable part of this mass is deposited periodically at the bottom, where it is only partly decomposed. Here, investigated were *Gastrotricha* occurring in the poorly decomposed surface mud layer or among thick layers of floating vegetation mixed with detritus. The investigations have shown that the most differentiated and abundant gastrotrichan fauna occurs in very shallow water bodies with dense vegetation of the association *Hydrocharitetum morsus-ranae* and therefore further investigations were mostly conducted there. The typical form of the association is a cluster of plants consisting of species *Stratiotes aloides* and *Hydrocharis morsus-ranae* on the surface of water body. The duckweed, *Nuphar luteum* and *Nymphaea alba*, commonly occurring in other types of eutrophic waters, are here a quantitatively insignificant component. The surface of bottom sediments consists of poorly decomposed detritus of a light brown colour, frequently floating in big clusters up to the surface and remaining among neuston plants.

The studies were conducted irregularly between 1972 and 1983. On the whole 73 samples were taken from the following localities (Fig. 1).

1. Okoninek, commune Cekeyn, Bydgoszcz province. Peat-hag surrounded by willows and among meadows. Its surface totally covered by a typical well developed vegetation of the association *Hydrocharitetum morsus-ranae*. 30 m from the border an edge of raised peat-bog (locality No 20 in KISIELEWSKI 1981). 9 samples, including 1 quantitative.

2. Krzywogoniec, commune Cekeyn. Mid-field peat-hag with *Hydrocharitetum morsus-ranae*. 2 samples.

3. Cekeyn. A pond in the middle of the village covered with duckweed. Shores overgrown with *Typha* spp. 1 sample.

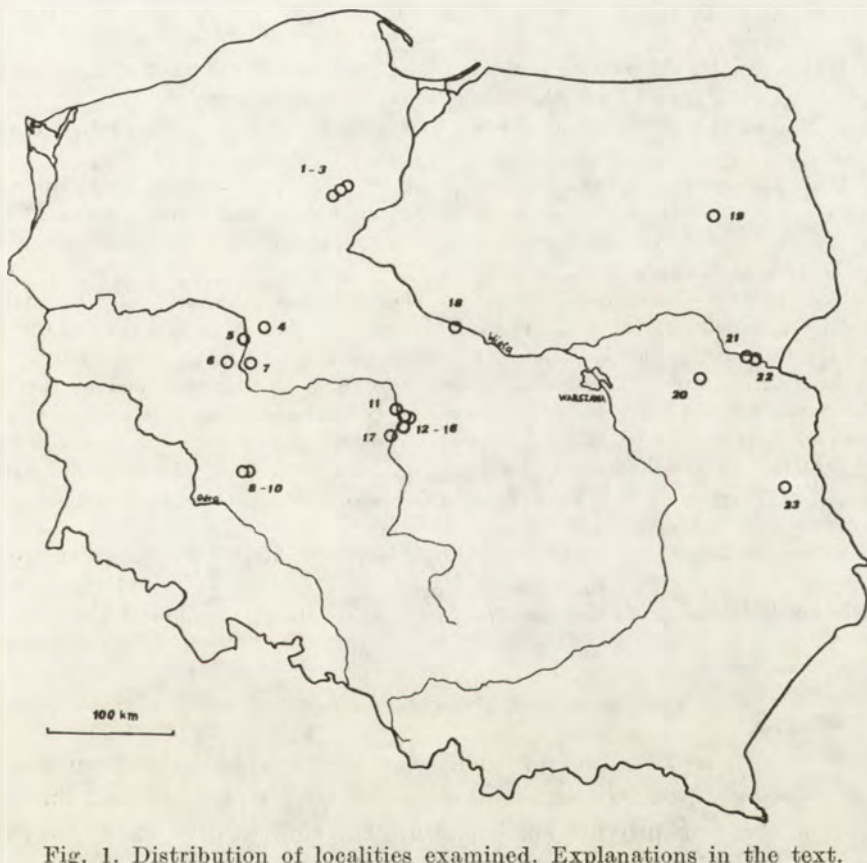


Fig. 1. Distribution of localities examined. Explanations in the text.

4. Promno, commune Pobiedziska, Poznań province. Pond in the middle of forest, its surface totally covered with duckweed. 1 sample.

5. Reserve "Żurawiniec" on the area of Poznań. A mid-field pond with shores overgrown by trees and shrubs. 4 samples of which 2 were used for aquarium cultures.

6. Pond "Żabiak" in the Wielkopolski National Park. A pond in the middle of forest with *Hydrocharitetum morsus-ranae*. 17 samples.

7. Rogalin, commune Mosina, Poznań province. Small astatic water body on a flooded terrace of the Warta. 1 sample.

8. Niezgodą, commune Żmigród, Wrocław province. Small pond near a vast complex of fish ponds. Abundant herbal vegetation without duckweed, *Typha* sp. and *Stratiotes aloides*. 1 sample.

9. Niezgodą. A ditch with stagnant water running into fish ponds. *Hydrocharitetum morsus-ranae*. 1 sample.
10. Niezgodą. Small pond in the village, covered with duckweed, with shores overgrown by *Typha latifolia*. 1 sample.
11. Jeziorsko, commune Ustków, Sieradz province. Old river-bed outside the village, covered with duckweed. 1 sample.
12. Milkowice, commune Pęczniew, Sieradz province. Old river-bed on the Warta right bank, 600 m from the bridge down the river. Its surface totally covered with duckweed, banks overgrown with *Typha* sp. 1 sample.
13. Milkowice. Two old river-beds some 30 m from the previous one. *Hydrocharitetum morsus-ranae*. 3 samples.
14. Milkowice. An old river-bed at the road to Popów, on the level of the second bridge counting from the river. *Hydrocharitetum morsus-ranae*. 3 samples.
15. Pęczniew, Sieradz province. A pond by the road to Lubola. The surface dominated by duckweed. 2 samples.
16. Brodnia, commune Pęczniew. A pond on the Warta right bank, some 100 m from the river, near the ferry. Surface covered with duckweed and *Nuphar luteum*. 1 sample.
17. Warta, Sieradz province. A mid-field pond on the Warta right bank, some 500 m from the bridge. 1 sample.
18. Dobięgniewo, Włocławek commune and province. A pond on the right side of the road from Włocławek to Plock, at a kilometre stone 28.2, some 200 m from the Vistula left bank. Dominated by *Typha latifolia*. 1 sample used for an aquarium culture.
19. Barwik, commune Trzecie, Łomża province. An old river-bed on the Biebrza left bank. Surface totally covered with leaves of *Nymphaea alba*. 1 quantitative sample.
20. Siedlce. Mid-field peat-hag near fish ponds to the N from the town. 6 samples.
21. Zabuże, commune Sarnaki, Biała Podlaska province. Big Bug old river-bed with typical vegetation of the association *Hydrocharitetum morsus-ranae*. 6 samples, of which 4 were used for aquarium cultures.
22. Mierzvice Stare, commune Sarnaki. Big old river-bed of the Bug with *Hydrocharitetum morsus-ranae*. 5 samples, of which 3 were used for aquarium cultures.
23. Lake Wytyckie, on the side of Wytyczno village, commune Urszulini, Chełm province. 4 samples.

REVIEW OF THE SPECIES

During the investigations 71 species of *Gastrotricha* have been found, of which 50 were identified. Other forms were unknown to science and the present investigation did not provide sufficient information to give their descriptions and name them. The review of species identified, apart from data, includes the characteristics of occurrence of particular gastrotrichs in Poland based on material from all papers in the series and earlier data.

Family Chaetonotidae

Genus *Chaetonotus* EHRENBERG

1. *Ch. simrothi* VOIGT, 1909

Material. 6 localities, 12 samples, 33 specimens. March–August. Locality 1, 5, 15, 20, 21 and 23.

Ch. simrothi is a species commonly occurring on Polish lowland. Its main

life habitat are eutrophic waters (KISIELEWSKA 1982 and IV) and rush communities (VI), where it occurred regularly. Also known from alder woods (III and V). In papers of the series found to occur from spring to autumn, although KISIELEWSKA's (1982) data for peat-hags near Siedlce show an all year round occurrence of the species.

2. *Ch. insigniformis* GREUTER, 1917

Material. 1 locality, 6 samples, 7 specimens. December–March. Locality 6.

A rather rare and not very abundant species. In Poland found in various environments such as transitional peat-bogs (KISIELEWSKI 1981), rush communities (VI), fertile peat-hags (KISIELEWSKA 1982) and fish ponds (IV) as well as in clean lakes (ROSZCZAK 1968). However, it is not a quantitatively significant component of fauna in these environments. Occurs all year round.

3. *Ch. schultzei* MEČNIKOV, 1851

Material. 2 localities, 2 samples, 2 specimens. July and August. Locality 17 and 21.

Species rather rare, recorded from very few medium fertile and fertile water bodies (STEINECKE 1924, ROSZCZAK 1968, II and IV).

4. *Ch. maximus* EHRENBERG, 1830

Material. 5 localities, 7 samples, 14 specimens, including 5 from aquarium cultures. March, June and July. Locality 1, 6, 14, 15 and 21.

Commonly occurring in Poland, both on lowlands and in mountains. Found in various environments, but only in clean stagnant and running waters (I) is a quantitatively significant and a regularly occurring fauna component. ROSZCZAK (1968) has found it all the year round.

5. *Ch. brevispinosus* GREUTER, 1917

Material. 1 locality, 2 samples, 3 specimens from aquarium cultures. Locality 21.

Not very common in eutrophic waters (ROSZCZAK 1968, III), alder woods (V), sedge meadows (VI) and transitional peat-bogs (KISIELEWSKI 1981). Found from spring to autumn.

6. *Ch. cordiformis* GREUTER, 1917

Material. 1 locality, 5 samples, 16 specimens. December–March. Locality 6.

A rare species found in Poland in alder woods (III and V), medium fertile and fertile waters (II and III) and on transitional peat-bogs (KISIELEWSKI 1981). Occurs all the year round.

7. *Ch. disiunctus* GREUTER, 1917

Material. 7 localities, 15 samples, 23 specimens. February–April, June–October and December. Locality 1, 5, 6, 19, 20, 22 and 23.

One of the most common and abundant gastrotrichs in Poland, widely distributed on lowlands and in mountains. Found in all environments examined (in the series of papers), being usually one of the dominant species. Found in many samples containing very few or only one gastrotrichan species, which proves its wide ecological tolerance and the fact that it colonizes environments not accessible for other species. Occurs all the year round.

8. *Ch. heideri* BREHM, 1917

Material. 4 localities, 5 samples, 7 specimens, including 2 from aquarium cultures. May and August. Locality 2, 6, 21 and 22.

Commonly occurring on transitional peat-bogs (KISIELEWSKI 1981) and quite common in eutrophic waters (I, II and III). Also found in alder woods (III and V). Occurs on lowlands and in mountains from spring to autumn.

9. *Ch. heteracanthus* REMANE, 1927

Material. 6 localities, 16 samples, 27 specimens, including 6 from aquarium cultures. February–April, June–August, October and December. Locality 1, 2, 6, 20, 21 and 23.

Quite common in eutrophic waters as proved by KISIELEWSKA's (1982) data and present material. Much rarer in alder woods (V), rush communities (VI), also recorded from an oligotrophic lake in the Tatra Mts (I). Occurs all the year round (KISIELEWSKA 1982).

10. *Ch. microchaetus* PREOBRAŽENSKAJA, 1926

Material. 2 localities, 2 samples, 4 specimens. May and August. Locality 6 and 8.

A rare species. Recorded from Poland for the first time by KISIELEWSKI (1979) on two localities, one of which (No 6) is included in the present paper. Occurs in extremely eutrophicated and less eutrophic water bodies with abundant aquatic vegetation, also on transitional peat-bogs (KISIELEWSKI 1981) and in rush communities (VI). Found from spring to autumn.

11. *Ch. oculifer* KISIELEWSKI, 1981

Material. 1 specimen. August. Locality 8.

Widely distributed on the lowland and mountains in Poland. One of the most common gastrotrichs of raised and transitional peat-bogs (KISIELEWSKI 1981), also occurring, but less frequently, in alder woods (III and V) and rush communities (VI). It is interesting that *Ch. oculifer* is a common and quantitatively significant component of fauna of oligotrophic mountain waters, both stagnant and running, and of sources (I). Rare in highly eutrophic water bodies, which is confirmed by the fact that only one specimen has been found during the present study. Occurs all the year round (KISIELEWSKI 1981).

12. *Ch. pawlowskii* KISIELEWSKI, 1984

Material. 3 localities, 3 samples, 30 specimens including 1 from an aquarium culture. June–August. Locality 1, 21 and 22.

This species is described in a separate paper, amongst others on the basis of material collected on all localities above mentioned. It is a rather common, but not abundant gastrotrich occurring mainly in eutrophic waters (II, III, IV and the present paper). Also recorded from alder woods (III and V) and rush communities (VI). Occurs all the year round.

13. *Ch. aff. pawlowskii* KISIELEWSKI, 1984

Material. 1 sample, 4 specimens. September. Locality 19.

Described in a separate paper on the basis of material collected on the locality above mentioned. Earlier found only by KISIELEWSKA (1982) — as "*Chaetonotus* sp.") in fertile peat-hags near Siedlee.

14. *Ch. polyspinosus* GREUTER, 1917

Material. 5 localities, 9 samples, 12 specimens including 4 from aquarium cultures. April–May and July–August. Locality 5, 6, 15, 22 and 23.

One of the most common gastrotrichs of Poland occurring widely and abundantly on lowlands and in mountains. Lives in eutrophic water bodies (ROSZCZAK 1968, KISIELEWSKA 1982, I, II and IV). However, its most abundant occurrence seems to be on transitional peat-bogs (KISIELEWSKI 1981). Also recorded from alder woods (V) and rush communities (III and VI). Occurs all the year round.

15. *Ch. rafalskii* KISIELEWSKI, 1979

Material. 1 locality, 7 samples, 15 specimens. December–March. Locality 6.

Species described earlier, amongst others, on the basis of the material above mentioned. A rather rare gastrotrich occurring on lowlands and in mountains. Found mainly in eutrophic waters (KISIELEWSKA 1982 and I), also recorded from alder woods (III). Occurs all the year with the exception of summer months, its highest numbers recorded in winter.

16. *Ch. similis* ZELINKA, 1889

Material. 3 localities, 5 samples, 15 specimens including 9 from aquarium cultures. July and August. Locality 10, 21 and 22.

A species common in Poland, but not very abundant, occurring on lowlands and in mountains. Found in oligotrophic lakes (I) and in more fertile waters (ROSZCZAK 1968, I, II, III and IV), sporadically in alder woods (V). Seems to prefer transitional peat-bogs (KISIELEWSKI 1981) and rush communities (VI). Occurs from spring to autumn.

17. *Ch. sphagnophilus* KISIELEWSKI, 1981

Material. 4 localities, 4 samples, 5 specimens. June–September. Locality 1, 8, 19 and 22.

A common and rather abundant species on transitional and more fertile raised peat-bogs of Poland, much rare on mountain peat-bogs (KISIELEWSKI 1981). Also found in other environments such as eutrophic waters (I, III), alder woods (V), oak-hornbeam woods (III) and rush communities (VI), but in none of them as a significant fauna component. Occurs from spring to autumn.

18. *Ch. zelinkai* GRÜNSPAN, 1908

Material. 2 localities, 4 samples, 4 specimens including 1 from an aquarium culture. April and May. Locality 6 and 21.

A species common on lowlands and in mountains. Mainly connected with transitional peat-bogs (KISIELEWSKI 1981), rush communities (VI) and medium fertile water bodies (I and II). Also recorded from a mountain oligotrophic lake (I) and in alder woods (III and V). Results of the present paper show that it is not a significant fauna component of highly eutrophic waters: it is also confirmed by the fact that the species has not been found in fertile peat-bogs (KISIELEWSKA 1982) and fish ponds (IV). Occurs all the year round.

19. *Ch. hystrix* MEČNIKOV, 1865

Material. 8 localities, 13 samples, 48 specimens including 9 from aquarium cultures. April–August. Locality 1, 2, 5, 6, 14, 20, 21 and 22.

One of the most common gastrotrichs of Poland, quite abundant on lowlands and in the mountains. Has an exceptionally wide range of occurrence including oligotrophic lakes and sources (I), medium fertile and extremely eutrophic waters (I, III and IV), alder woods (III and V) and rush communities (III and VI). In all these environments it is a common and quantitatively significant fauna component, but does not seem to show any special preference for either of them. *Ch. hystrix* is also commonly found on transitional and raised peat-bogs, but not abundantly (KISIELEWSKI 1981). Also recorded from oak-hornbeam woods (III). Occurs all year round (IV).

20. *Ch. macrochaetus* ZELINKA, 1889

Material. 2 localities, 2 samples, 2 specimens. June and August. Locality 1 and 21.

Similarly as the previous species *Ch. macrochaetus* is commonly found on lowlands and in mountains of Poland, and has a wide scale of ecological adaptations. A significant component of fauna of oligotrophic lakes and sources (I), also of medium fertile and fertile waters (ROSZCZAK 1968, I, II, III and IV). Commonly occurs on all types of raised peat-bogs and on transitional ones (KISIELEWSKI 1981). Also recorded, but less frequently, from alder woods (III and V); recorded from rush communities (VI). Despite its wide range of occurrence it shows some preference for more oligotrophic environments as proved by its common and abundant occurrence in clean mountain lakes and sources and on all types of raised peat-bogs. According to the material available it is rare and not abundant in extremely eutrophicated water bodies. Occurs from spring to autumn.

21. *Ch. octonarius* STOKES, 1887

Material. 2 localities, 3 samples, 19 specimens. June and August. Locality 1 and 21.

Up to now a species recorded only from two localities in Poland — alder woods (V). In Poland found between June and September.

22. *Ch. persetosus* ZELINKA, 1889

Material. 4 localities, 5 samples, 12 specimens including 10 from aquarium cultures. May and July. Locality 6, 7, 21 and 22.

A quite common gastrotrich occurring mainly in rush communities (VI), and also on transitional peat-bogs (KISIELEWSKI 1981 and I), medium fertile and fertile water bodies (ROSZCZAK 1968 and I), rarely in alder woods (V). Occurs in Poland from spring to autumn.

23. *Ch. greuteri* REMANE, 1927

Material. 4 localities, 5 samples, 17 specimens including 1 from an aquarium culture. June and August–September. Locality 1, 10, 19 and 22.

Not very common on lowlands of Poland. Mainly found in eutrophic waters (III, IV) and alder woods (V), exceptionally on transitional peat-bogs (KISIELEWSKI 1981). Occurs from spring to autumn.

24. *Ch. uncinus* VOIGT, 1902

Material. 2 localities, 3 samples, 3 specimens. July. Locality 12 and 13.

Occurs rarely and not abundantly on lowlands and in the mountains. So far only one locality from Poland was known — from the Tatra Mts — which is an eutrophic water body (I). Found between July and September.

25. *Ch. bisacer* GREUTER, 1917

Material. 8 localities, 10 samples, 13 specimens. April–August. Locality 1, 2, 5, 6, 10, 20, 21 and 23.

A species common on Polish lowlands, usually not abundant. Connected mainly with alder woods (III and V) and eutrophic waters (KISIELEWSKA 1982 and III), although recorded also from rush communities (VI). Found from spring to autumn.

26. *Ch. macrolepidotus* GREUTER, 1917

Material. 3 localities, 6 samples, 6 specimens. March, June, August and November. Locality 1, 10 and 20.

Similarly as the previous species *Ch. macrolepidotus* occurs commonly although not abundantly on lowlands of Poland. Also mainly connected with alder woods (III and V) and eutrophic waters (KISIELEWSKA 1982, III and IV). Also found in rush communities (VI). Occurs from spring to autumn.

27. *Ch. multisetosus* PREOBRAŽENSKAJA, 1926

Material. 2 localities, 2 samples, 2 specimens. June and July. Locality 1 and 21.

A rare species. In Poland found only in lowland eutrophic waters (KISIELEWSKA 1982, III and IV).

28. *Ch. ophiogaster* REMANE, 1927

Material. 5 localities, 5 samples, 5 specimens. April and June–September. Locality 1, 2, 7, 13 and 20.

A common although usually a not abundant species occurring on Polish lowlands, mainly in eutrophic waters (KISIELEWSKA 1982, III and IV), alder woods (V) and rush communities (VI), also exceptionally on transitional peat-bogs (KISIELEWSKI 1981). Found all the year round.

29. *Ch. succinctus* VOIGT, 1902

Material. 5 localities, 12 samples, 18 specimens including 1 from an aquarium culture. January–March, May–August and October. Locality 1, 5, 6, 15 and 21.

Common on lowlands of Poland. Its main environments are eutrophic waters (ROSZCZAK 1968, KISIELEWSKA 1982, III and IV). Occurs also but less commonly in alder woods (V) and on transitional peat-bogs (KISIELEWSKI 1981). Found all the year round.

Genus *Heterolepidoderma* REMANE

30. *H. gracile* REMANE, 1927

Material. 20 localities, 29 samples, 57 specimens including 7 from aquarium cultures. March, June–October. Locality 1, 2, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 23.

One of the most common and abundant gastrotrichs of Polish lowlands. It is interesting that it has not been recorded yet from Polish mountains (KI-

SIELEWSKI 1981 and I). Has a wide range of ecological adaptations, being a quantitatively significant and regularly occurring component of fauna of alder woods (III and V), eutrophic waters (ROSZCZAK 1968, KISIELEWSKA 1982, II, III and IV) and rush communities (VI). Also found regularly on transitional peat-bogs, mainly arriving there from the neighbouring fertile waters (KISIELEWSKI 1981). Recorded from an oak-hornbeam wood (III). In waters of unstable environmental conditions directly influenced by activities of man (fish ponds) it is an especially significant component of gastrotrichan fauna, regularly attaining a high individual dominance D (12.1–28.6%; IV). According to almost all papers cited *H. gracile* occurs only between May and October. Only NESTERUK (IV) has found single specimens of this species also in winter (fish ponds near Siedlce).

31. *H. longicaudata* KISIELEWSKI, 1979

Material. 1 specimen. April. Locality 20.

A species described earlier on the basis of a specimen found on the locality above mentioned and not found any more.

32. *H. majus* REMANE, 1927

Material. 6 localities, 10 samples, 19 specimens including 8 from aquarium cultures. May, July–August. Locality 1, 6, 8, 21, 22 and 23.

One of the most common gastrotrichs of Poland occurring both on lowlands and in mountains. Its main habitat are rush communities (III and VI) and medium fertile and highly eutrophic waters (I, II, III and IV), whereas on the two first ones it is more abundant than on the last environments. It is also common in alder woods (III and V) and on transitional peat-bogs (KISIELEWSKI 1981). Recorded from alder-ash carr and oak-hornbeam wood (III). Occurs from spring to autumn.

33. *H. ocellatum* (MEČNIKOV) sensu KISIELEWSKI 1981

Material. 1 locality, 2 samples, 5 specimens. June. Locality 1.

Very common on lowlands and in mountains on *Sphagnum* peat-bogs of all types (KISIELEWSKI 1981). Occurs also regularly in rush communities (VI) and in clean running and stagnant waters of the Karkonosze Mts. Also recorded in the Tatra Mts from a more fertile water body and a dystrophic lake (I), and from single localities in alder woods (III and V), alder-ash carr (III) and eutrophic waters (III). However, it seems that none of these environments is typical for the species and its presence is only a result of penetration from the neighbouring *Sphagnum* peat-bogs. Found between April and December.

Genus *Lepidodermella* BLAKE

34. *L. minus* REMANE, 1936

Material. 1 specimen. June. Locality 1.

Rare species, not abundant, on lowlands and mountains. Found in medium

fertile stagnant waters (I and II), also in dystrophic lakes (KISIELEWSKI 1981) and rush communities (VI).

35. *L. squamatum* (DUJARDIN, 1841)

Material. 6 localities, 8 samples, 13 specimens including 2 from aquarium cultures. April–August. Locality 1, 2, 6, 7, 15 and 22.

Common although not an abundant species, eurytopic. Recorded from various water bodies from oligotrophic mountain lakes to lowland extremely eutrophic water bodies (ROSZCZAK 1968, KISIELEWSKA 1982, I, II and III), and also from transitional peat-bogs (KISIELEWSKI 1981), alder woods (V) and rush communities (VI). It is not a significant fauna component in these environments. Occurs from spring to autumn.

Genus *Aspidiophorus* VOIGT

36. *A. bibulbosus* KISIELEWSKI, 1979

Material. 2 localities, 3 samples, 3 specimens. June and July. Locality 1 and 23.

Species described, amongst others, on the basis of material obtained on one of the localities above mentioned (KISIELEWSKI 1979). *A. bibulbosus* is a not very common and usually a not abundant gastrotrich of Polish lowland. So far recorded mainly from highly eutrophic water bodies (KISIELEWSKA 1982, II, III and IV), alder woods (III and V), and also from transitional peat-bogs (KISIELEWSKI 1981). Occurs all the year round.

37. *A. squamulosus* (ROSZCZAK, 1935)

Material. 6 localities, 7 samples, 11 specimens. March–May and July–August. Locality 3, 14, 17, 20, 21 and 22.

A rare species, found mainly in eutrophic waters of Polish lowland (ROSZCZAK 1968). Results of the present paper confirm its relation with this type of environment. Also recorded from rush communities (VI). Found from spring to autumn.

38. *A. ?paradoxus* (VOIGT, 1902)

Material. 1 specimen. June. Locality 1.

Rare and not abundant species, connected mainly with eutrophic waters (KISIELEWSKA 1982 and IV). Recorded also from single localities in alder woods (V) and rush communities (VI). In Poland found so far in summer and autumn.

Genus *Ichthyidium* EHRENBERG

39. *I. bifurcatum* PREOBRAŽENSKAJA, 1926

Material. 1 sample, 4 specimens. August. Locality 1.

The finding mentioned above has been included already in an earlier taxonomic paper (KISIELEWSKI 1979). A rare species. Apart from the locality mentioned there is another one given by NESTERUK (IV) — one fish pond near Siedlce.

In both cases a relation of this species with highly eutrophic waters is noticeable. Recorded in summer.

40. *I. palustre* KISIELEWSKI, 1981

Material. 3 localities, 3 samples, 5 specimens. June and August. Locality 1, 9 and 21.

A common and sometimes abundant gastrotrich having a wide range of environments. Regularly recorded from eutrophic waters (KISIELEWSKA 1982, I, III and IV), transitional peat-bogs (KISIELEWSKI 1981), rush communities (VI) and alder woods (III and V). Occurs on lowlands and in mountains. So far recorded in summer months and in autumn.

41. *I. podura* (MÜLLER, 1773)

Material. 2 localities, 2 samples, 4 specimens. June and October. Locality 1 and 6.

Quite common but not abundant on Polish lowland. Connected mainly with eutrophic water bodies (ROSZCZAK 1968, III and IV), although it is also recorded from transitional peat-bogs (KISIELEWSKI 1981) and sporadically from alder woods (V). Occurs all the year round (ROSZCZAK 1968).

Genus *Polymerurus* REMANE

42. *P. nodicaudus* (VOIGT, 1901)

Material. 10 localities, 14 samples, 22 specimens including 6 from aquarium cultures. May–November. Locality 1, 5, 13, 14, 17, 19, 20, 21, 22 and 23.

A common although a not very abundant species in highly eutrophic waters (KISIELEWSKA 1982, III and IV). Occurs regularly and abundantly in rush communities (VI), less frequently in alder woods (III and V). So far recorded only from lowlands. Occurs all the year round (KISIELEWSKA 1982).

43. *P. rhomboides* (STOKES, 1887)

Material. 14 localities, 31 samples, 80 specimens including 6 from aquarium cultures. February–April, June–August, October and December. Locality 1, 2, 5, 6, 9, 10, 12, 13, 14, 17, 20, 21, 22 and 23.

Material from some of these localities has been used in an earlier taxonomic paper (KISIELEWSKI 1979). A species very common on lowlands and usually abundant. Distinctly related with very fertile waters (KISIELEWSKA 1982, II, III and IV), less frequently found in water bodies of a lower trophic level (II), on transitional peat-bogs (KISIELEWSKI 1981), in alder woods (V) and rush communities (VI). Not recorded yet from Polish mountains. Occurs all the year round (IV).

44. *P. serraticaudus* (VOIGT, 1901)

Material. 2 localities, 2 samples, 2 specimens. July and September. Locality 13 and 19.

A rare and not abundant species. So far recorded in Poland by STEINECKE (1924) from a Warmia marsh, by ROSZCZAK (1968) from a highly eutrophic water body in Great Poland and by KISIELEWSKA (1982) from fertile peat-

-hags near Siedlce. The fact that the species has been recently recorded in an extremely eutrophicated water body on the Białowieża Glade (III) and data from the present paper confirm the relation of this species with very fertile waters.

45. *P. squamofurcatus* (PREOBRAŽENSKAJA, 1926)

Material. 1 specimen. August. Locality 1.

The occurrence of *P. squamofurcatus* on the locality above mentioned has been included earlier in one of my taxonomic papers (1979). This rare species, connected probably with highly eutrophic waters only, has been found in Poland also by KISIELEWSKA (1982) in peat-hags near Siedlce. According to her data this gastrotrich occurs all the year round.

Family *Dasydytidae*

Genus *Dasydytes* GOSSE

46. *D. ornatus* VOIGT, 1909

Material. 5 localities, 16 samples, 87 specimens including 5 from aquarium cultures. August and November–April. Locality 1, 5, 6, 8 and 20.

A very common and abundant species in eutrophic water bodies of Polish lowland (ROSZCZAK 1968, KISIELEWSKA 1982, III and IV). Also found frequently in alder woods (V) and exceptionally among rush vegetation (VI) and on transitional peat-bogs (KISIELEWSKI 1981). Occurs all year round, but in summer months only exceptionally, the peak of its occurrence being from October to April (ROSZCZAK 1968, KISIELEWSKA 1982).

47. *D. tongiorgii* BALSAMO, 1983

Material. 4 localities, 7 samples, about 70 specimens. June–August and November. Locality 1, 2, 20 and 22.

A very common gastrotrich occurring usually abundantly on Polish lowland. Recorded regularly both in eutrophic waters (KISIELEWSKA 1982, III and IV) and in alder woods (III and V). Also found in rush communities (VI) and on transitional peat-bogs (KISIELEWSKI 1981), but is rather insignificant in these environments. It occurs with the same intensity all the year round (KISIELEWSKA 1982).

48. *D. crassus* GREUTER, 1917

Material. 8 localities, 19 samples, 41 specimens. December–March and May–August. Locality 1, 6, 10, 13, 14, 21, 22 and 23.

Common and abundant on Polish lowland, connected with eutrophic waters (KISIELEWSKA 1982, III and IV) and alder woods (III and V). Also found on transitional peat-bogs (KISIELEWSKI 1981) and rush communities (VI), but not so frequently as in the environments mentioned above. Occurs with the same intensity all the year round (KISIELEWSKA 1982).

Genus *Stylochaeta* HLAVA49. *S. fusiformis* (SPENCER, 1890)

Material. 10 localities, 16 samples, 26 specimens including 1 from an aquarium culture. May–August. Locality 1, 5, 6, 12, 14, 15, 16, 20, 21 and 22.

A very common and abundantly occurring gastrotrich in highly eutrophic waters of Polish lowland (ROSZCZAK 1968, KISIELEWSKA 1982, III and IV). Also commonly occurring on transitional peat-bogs, where it is the only representative of the family *Dasydytidae* showing a distinct connection with this environment (KISIELEWSKI 1981). Rare in alder woods (III and V) and in rush communities (VI). In Poland occurs from April to October, more abundantly in summer.

Family *Neogosseidae*Genus *Neogossea* REMANE50. *N. antennigera* (GOSSE, 1851)

Material. 4 localities, 4 samples, 7 specimens. June and July. Locality 1, 12, 13 and 15.

In an earlier taxonomic paper (KISIELEWSKI 1974) a representative of the genus *Neogossea* recorded on the basis of material from localities 12, 13 and 15 of the present paper has been included. This gastrotrich has been identified at the time as *N. voighti* (DADAY, 1905) basing on the fact that the isolated scale was of a different shape than rhomboidal (Fig. 4b of the paper cited). Later identification of the same gastrotrich pointed rather to the fact of being identical with *N. antennigera* according to BEAUCHAMP's (1933) redescription, although in the later specimens I have not been able to isolate scales resembling a rhomboidal shape. It can not be excluded that the isolated scale was a scale of the tactile bristle, frequently varying in shape from other cuticular elements of the body. Thus these identifications as well as the later ones concern the species *N. antennigera*.

This rare gastrotrich has been found in Poland only once more by KISIELEWSKA (1982) in a eutrophic peat-hag near Siedlee, confirming thus its close connection with highly fertile water bodies. Found only in June and July.

CHARACTERISTICS OF THE OCCURRENCE OF GASTROTRICHS IN
EXTREMELY EUTROPHICATED WATERS

Among 50 species identified 45 belong to the family *Chaetonotidae*, 4 to *Dasydytidae* and 1 to *Neogosseidae*. The number of species found is higher than in any other of the environments examined in earlier papers of the series, and species *Chaetonotus tenuis* REMANE, *Heterolepidoderma macrops* KISIELEWSKI and *Ichthyidium maximum* GREUTER, found in extremely eutrophicated water bodies of the Białowieża Glade (III), complete the list of forms occurring in

the environment discussed. So far 8 species have been found in Poland exclusively in highly eutrophic waters: *Chaetonotus multisetosus*, *Ch. uncinus*, *Ch. tenuis* (III), *Heterolepidoderma longicaudata*, *Ichthyidium bifurcatum*, *Polymerurus serraticaudus*, *P. squamofurcatus* and *Neogossea antennigera*. Although other 14 species have been found in other environments, they find the best conditions for occurrence in highly eutrophic waters, namely: *Chaetonotus simrothi*, *Ch. heteracanthus*, *Ch. rafalskii*, *Ch. ophiogaster*, *Ch. succinctus*, *Aspidiophorus bibulbosus*, *A. squamulosus*, *A. paradoxus*, *Ichthyidium podura*, *Polymerurus rhomboides*, *Dasydyles ornatus*, *D. tongiorgii*, *D. crassus* and *Stylochaeta fusiformis*.

The high quantitative contribution of representatives of the family *Dasydytidae* is striking: total dominance D 27.1% in water bodies with vegetation of the association *Hydrocharitetum morsus-ranae* in summer, 43.1% in the same water bodies in winter and 8.8% in other water bodies all the year round (Table I). Such a high percentage seems to be a significant character of *Gastro-*

Table I. Individual dominance (D) of particular species in extremely eutrophicated waters. Species found in samples not included in calculations of dominance structure are indicated with +.

No	Species	Water bodies with <i>Hydrocharitetum morsus-ranae</i>		Other eutrophic waters (IV-VIII)
		Summer (VI-VIII)	Winter (XII-III; locality 6 only)	
1	2	3	4	5
1	<i>Chaetonotus simrothi</i>	4.5		6.7
2	<i>Ch. insigniformis</i>		3.7	
3	<i>Ch. schultzei</i>	0.3		
4	<i>Ch. maximus</i>	1.6	4.6	+
5	<i>Ch. brevispinosus</i>	+		
6	<i>Ch. cordiformis</i>		8.3	
7	<i>Ch. disiunctus</i>	2.1	3.7	6.0
8	<i>Ch. heideri</i>	0.8		
9	<i>Ch. heteracanthus</i>	2.9	2.8	0.7
10	<i>Ch. microchaetus</i>	+		1.3
11	<i>Ch. oculifer</i>			1.3
12	<i>Ch. pawlowskii</i>	7.4		0.7
13	<i>Ch. aff. pawlowskii</i>			2.7
14	<i>Ch. polyspinosus</i>	+		2.0
15	<i>Ch. rafalskii</i>		5.5	
16	<i>Ch. similis</i>	0.8		2.0
17	<i>Ch. sphagnophilus</i>	0.5		2.0
18	<i>Ch. zelinkai</i>	+		

Table I — cont.

1	2	3	4	5
19	<i>Ch. hystrix</i>	8.0		0.7
20	<i>Ch. macrochaetus</i>	0.5		
21	<i>Ch. octonarius</i>	4.8		
22	<i>Ch. persetosus</i>	+		+
23	<i>Ch. greuteri</i>	1.6		6.7
24	<i>Ch. uncinus</i>			+
25	<i>Ch. bisacer</i>	0.8		3.4
26	<i>Ch. macrolepidotus</i>	1.1		0.7
27	<i>Ch. multisetosus</i>	0.5		
28	<i>Ch. ophiogaster</i>	0.3		0.7
29	<i>Ch. succinctus</i>	0.8	1.8	+
30	<i>Ch. sp. 1</i>			0.7
31	<i>Ch. sp. 2</i>			0.7
32	<i>Ch. sp. 3</i>	0.3		
33	<i>Ch. sp. 4</i>			0.7
34	<i>Ch. sp. 5</i>			0.7
35	<i>Ch. sp. 6</i>			2.0
36	<i>Ch. sp. 7</i>			6.0
37	<i>Ch. sp. 8</i>			4.0
38	<i>Ch. sp. 9</i>			1.3
	<i>Chaetonotus</i> — indet.	1.6	14.7	3.4
39	<i>Heterolepidoderma gracile</i>	4.8		10.7
40	<i>H. longicaudata</i>			0.7
41	<i>H. majus</i>	1.3		1.3
42	<i>H. ocellatum</i>	1.3		
43	<i>H. sp. 1</i>	0.3		
44	<i>H. sp. 2</i>	0.3		
	<i>Heterolepidoderma</i> — indet.		4.6	
45	<i>Lepidodermella minus</i>	0.3		
46	<i>L. squamatum</i>	1.3		0.7
47	<i>L. sp.</i>	0.3		
	<i>Lepidodermella</i> — indet.	0.3	1.8	
48	<i>Aspidiophorus bibulbosus</i>	0.5		
49	<i>A. squamulosus</i>	0.3		1.3
50	<i>A. ?paradoxus</i>	0.3		
51	<i>A. sp. 1</i>	0.3		
52	<i>A. sp. 2</i>	0.3		
53	<i>A. sp. 3</i>			0.7
54	<i>A. sp. 4</i>			1.3
55	<i>A. sp. 5</i>			0.7
56	<i>A. sp. 6</i>			0.7
57	<i>A. sp. 7</i>	0.3		
58	<i>A. sp. 8</i>		1.8	
59	<i>A. sp. 9</i>	0.3		
	<i>Aspidiophorus</i> — indet.	0.5		1.3
60	<i>Ichthyidium bifurcatum</i>	+		
61	<i>I. palustre</i>	1.3		0.7
62	<i>I. podura</i>	0.8		

Table I — cont.

1	2	3	4	5
	<i>Ichthyidium</i> — indet.	0.3		1.3
63	<i>Polymerurus nodicaudus</i>	0.8		7.4
64	<i>P. rhomboides</i>	13.8	2.8	2.7
65	<i>P. serraticaudus</i>			0.7
66	<i>P. squamofurcatus</i>	+		
	<i>Chaetonotidae</i> — indet.	1.3	0.9	2.0
67	<i>Dasydytes ornatus</i>		33.9	7.4
68	<i>D. tongiorgii</i>	16.8	5.5	+
69	<i>D. crassus</i>	6.6	3.7	0.7
70	<i>Stylochaeta fusiformis</i>	3.7		0.7
71	<i>Neogossea antennigera</i>	0.5		
	Total	100.1	100.1	100.1

tricha fauna in extremely eutrophicated waters. NESTERUK (IV) has obtained similar data for fertile fish ponds near Siedlce, where the percentage of *Dasydytidae* had the total *D* value for five pond complexes examined 3.6–22.1%, on the average 13.5% (calculated on the basis of Table I of the paper cited). It should be remembered that the total percentage of *Dasydytidae*, the highest of all and exceeding 50% during the greatest part of annual cycle, has been recorded by KISIELEWSKA (1982) for the fertile peat-hags near Siedlce. As regards other environments, only in Białowieża alder woods and those examined all over the country, the percentage of *Dasydytidae* is similar having the total *D* value 12.9 and 13.6%, respectively (V). In other environments examined the percentage of *Dasydytidae* is much lower, e. g., SZKUTNIK (VI) has given the total *D* value for rush communities as 1.7%. In mountain waters (I) and in young lakes of marine origin (II) representatives of this family have not been found at all.

General species diversity index H' has been calculated for all localities with the plant association *Hydrocharitetum morsus-ranae* and for the summer period without calculating it for other highly eutrophic water bodies because of their great environmental variety. The value obtained (2.95) is one of the highest given. Only for alder woods this value has been distinctly higher (3.29 — V) and H' recorded for rush communities is a little higher (3.14 — VI). It is worth pointing out that the fauna of some single localities shows only a slightly smaller diversity than the general one. In the most abundant in *Gastrotricha* water body examined — peat-hag at Okoninek in Tuchola Forest (locality No 1) — 33 gastrotrichan species were found and H' index for this water body was 2.75.

The present study was mainly of a qualitative character. Only two samples were quantitatively examined and the results are given in Table II.

Table II. Abundance (*A*) of *Gastrotricha* expressed by the number of specimens per 1 cm³ of mud

No	Locality	Date	Value <i>A</i>
1	Okoninek (No 1)	June 17, 1981	101.0
2	Barwik (No 19)	September 1, 1983	30.0

The scarce material does not allow for a more thorough comparison with results from other environments. It is, however, certain that the value on locality 1 is one of the highest recorded and is only lower than the maximal values obtained by KISIELEWSKA (1982) for fertile peat-hags near Siedlce.

PRELIMINARY RECAPITULATION OF RESULTS OF INVESTIGATIONS ON FRESHWATER *GASTROTRICHA* FROM POLAND

The series of seven papers, of which the last is the present one, provides some new data on the occurrence of Polish gastrotrichs including material from environments in which *Gastrotricha* were not examined before. These data and vast material published earlier should be recapitulated but only initially as the *Gastrotricha* fauna of periphyton and psammon are not sufficiently examined yet.

Up to now in inland environments of Poland 102 forms have been found belonging to 98 species of *Gastrotricha*. Their full list is given below, whereas for forms and species not included in the earlier chapter "Review of the species" a brief characteristic of their occurrence in Poland is given.

Family *Chaetonotidae*

1. *Chaetonotus* (*Ch.*) *simrothi* VOIGT, 1909.
2. *Ch.* (*Ch.*) *insigniformis* GREUTER, 1917.
3. *Ch.* (*Ch.*) *schultzei* MEČNIKOV, 1851.
4. *Ch.* (*Ch.*) *maximus* EHRENBERG, 1830.
5. *Ch.* (*Ch.*) *armatus* KISIELEWSKI, 1981. A rather rare species occurring all over the country. It seems to be connected mostly with transitional peat-bogs, but is also found on a raised peat-bog (KISIELEWSKI 1981), in a mountain oligotrophic lake (I), young lake of marine origin (II) and rush community (VI). Found in summer and autumn.
6. *Ch.* (*Ch.*) *arquatus* VOIGT, 1903. Rare and not numerous on Polish lowland. Found twice in very fertile water bodies (ROSZCZAK 1968 and KISIELEWSKA 1982) and twice in rush communities (VI). Found from May to November.
7. *Ch.* (*Ch.*) *brevispinosus* GREUTER, 1917.
8. *Ch.* (*Ch.*) *chuni* VOIGT, 1904. Recorded in Poland from only two localities near Siedlce — transitional peat-bogs. Found from June to September (KISIELEWSKI 1981).
9. *Ch.* (*Ch.*) *cordiformis* GREUTER, 1917.
10. *Ch.* (*Ch.*) *disiunctus* GREUTER, 1917.

11. *Ch. (Ch.) dybowskii* JAKUBSKI, 1919. This species described from the surroundings of Lvov has been only recorded from three localities in central Great Poland — eutrophic water bodies. Found between July and October (ROSZCZAK 1968).

12. *Ch. (Ch.) heideri* BREHM, 1917.

13. *Ch. (Ch.) heteracanthus* REMANE, 1927.

14. *Ch. (Ch.) hirsutus* MARCOLONGO, 1910. Only one locality in Poland given by ROSZCZAK (1968), who has found this species in central Great Poland in a well-head among aquatic plants *Spirogyra* sp. and *Lemna* sp.

15. *Ch. (Ch.) jakubskii* ROSZCZAK, 1935. A species recorded only by the author of the original description from several eutrophic water bodies near Poznań.

16. *Ch. (Ch.) larus* (O. F. MÜLLER, 1784). So far found in Poland only by ROSZCZAK (1968) in eutrophic water bodies of Great Poland. Found in spring and in autumn.

17. *Ch. (Ch.) microchaetus* PREOBRAŽENSKAJA, 1926.

18. *Ch. (Ch.) mitraformis* GREUTER, 1917. So far recorded in Poland by ROSZCZAK (1968) from two localities in Great Poland — eutrophic waters having elements of dystrophic water bodies. Found in autumn.

19. *Ch. (Ch.) multispinosus* GRÜNSPAN, 1908. The only specimen in Poland was found in one of the alder woods of the Białowieża Forest. Found in May (III).

20. *Ch. (Ch.) murrayi* REMANE, 1929. A rare and not abundant species connected with transitional peat-bogs (KISIELEWSKI 1981) and alder woods (III and V).

21. *Ch. (Ch.) oculifer* KISIELEWSKI, 1981.

22. *Ch. (Ch.) pawlowskii* KISIELEWSKI, 1984.

23. *Ch. (Ch.)* aff. *pawlowskii* KISIELEWSKI, 1984.

24. *Ch. (Ch.) polyspinosus* GREUTER, 1917.

25. *Ch. (Ch.) poznaniensis* KISIELEWSKI, 1981. Occurs quite commonly but not abundantly all over the country. Recorded from transitional peat-bogs (KISIELEWSKI 1981), medium fertile water bodies (I and II), alder woods (III) and rush communities (VI). Occurs between spring and autumn.

26. *Ch. (Ch.) rafalskii* KISIELEWSKI, 1979.

27. *Ch. (Ch.) rarispinosus* ROSZCZAK, 1935. So far given only by ROSZCZAK (1968) from three eutrophic lakes near Poznań. Found from May to September.

28. *Ch. (Ch.) robustus* DAVISON, 1938. Rare and not abundant. In Poland recorded from a transitional peat-bog and an eutrophic and dystrophic lake in Great Poland (KISIELEWSKI 1979 and 1981 — as *Ch. magnus* — see IV), and also from fish ponds near Siedlce (IV). Occurs from spring to autumn.

29. *Ch. (Ch.) rotundus* GREUTER, 1917. The only specimen of this species has been found by ROSZCZAK (1968) in lake Kociołek in the Wielkopolski National Park.

30. *Ch. (Ch.) similis* ZELINKA, 1889.
31. *Ch. (Ch.) sphagnophilus* KISIELEWSKI, 1981.
32. *Ch. (Ch.) tenuis* REMANE, 1927. Two specimens of this species have been found in an extremely eutrophicated water body on the Białowieża Glade (III).
33. *Ch. (Ch.) zelinkai* GRÜNSPAN, 1908.
34. *Ch. (Ch.) hystrix* MEČNIKOV, 1865.
35. *Ch. (Ch.) macrochaetus* ZELINKA, 1889.
36. *Ch. (Ch.) novenarius* GREUTER sensu BALSAMO 1983. Recorded in Poland from several raised and transitional peat-bogs (KISIELEWSKI 1981 — as *Ch. anomalus*) and also from a rather fertile water body in the Tatra Mts (I).
37. *Ch. (Ch.) octonarius* STOKES, 1887.
38. *Ch. (Ch.) persetosus* ZELINKA, 1889.
39. *Ch. (Ch.) quintospinosus* GREUTER, 1917. Two specimens of this species were recorded by ROSZCZAK (1968) from a fertile water body in Great Poland. The specimens were found in August.
40. *Ch. (Ch.) spinulosus* STOKES, 1887. So far recorded in Poland by ROSZCZAK (1968) from three water bodies in Great Poland. Recorded in spring and autumn.
41. *Ch. (Ch.) formosus* STOKES, 1887. Single specimens of this gastrotrich have been recorded in Poland twice; from a rather fertile water body in the Tatra Mts (I) and in a young lake of marine origin in the Słowiński National Park (II). Found in August and September.
42. *Ch. (Ch.) greuteri* REMANE, 1927.
43. *Ch. (Ch.) linguaeformis* VOIGT, 1902. Recorded from one locality in Great Poland by ROSZCZAK (1968) in August.
44. *Ch. (Ch.) uncinus* VOIGT, 1902.
45. *Ch. (Ch.) sudeticus* KISIELEWSKI, 1984. This species, recently described from Poland, has been recorded only in a rather fertile dam reservoir at Karpacz in the Karkonosze Mts (I). Found in September.
46. *Ch. (Ch.) acanthocephalus* VALKANOV, 1937. Rare and not abundant on Polish lowland. Occurs on transitional peat-bogs (KISIELEWSKI 1981), also in medium fertile and fertile water bodies (II and IV). Found between May and September.
47. *Ch. (Ch.)* aff. *acanthocephalus*: KISIELEWSKI 1981. The only specimen of this form has been found on the transitional peat-bog in the Wielkopolski National Park (KISIELEWSKI 1981).
48. *Ch. (Ch.) rectaculeatus* KISIELEWSKA, 1981. This species, recently described from Poland, is known only from one locality — the group of fertile peat-hags near Siedlce, where it occurred regularly and abundantly between February and November (KISIELEWSKA 1982).
49. *Ch. (Zonochaeta) acanthodes* STOKES, 1887. Very common and abundant on raised and transitional peat-bogs all over the country. One of the very few

Polish gastrotrichs having a high stenotopic character. Apart from the environments already mentioned it has been found only three times: in an oligotrophic mountain lake and in two more fertile mountain lakes (I). Occurs from spring to autumn.

50. *Ch. (Z.) bisacer* GREUTER, 1917.

51. *Ch. (Z.) macrolepidotus* GREUTER, 1917.

52. *Ch. (Z.) multisetosus* PREOBRAŽENSKAJA, 1926.

53. *Ch. (Z.) ophiogaster* REMANE, 1927.

54. *Ch. (Z.) succinctus* VOIGT, 1902.

55. *Heterolepidoderma brevitubulatum* KISIELEWSKI, 1981. This species recently described from Poland is very rare and scarce. So far only 4 specimens from 4 localities are known: transitional peat-bog (KISIELEWSKI 1981), medium fertile and fertile water body (II and KISIELEWSKI 1981) and alder wood (III). All specimens were found in August.

56. *H. fallax* REMANE, 1936. One specimen of gastrotrich identified as *H. fallax* is given by ROSZCZAK (1968) for the water body in Great Poland. According to this description it seems that the specimen caught belongs to a species unknown to science and not to *H. fallax*, which is insufficiently described by REMANE.

57. *H. gracile* REMANE, 1927.

58. *H. longicaudata* KISIELEWSKI, 1979.

59. *H. macrops* KISIELEWSKI, 1981. A common but not abundant gastrotrich in Poland. Occurs in fertile water bodies (I, III and IV), alder woods (III and V) and rush communities (VI). One specimen of this species has been also recorded from moss in a *Sphagnum* forest (KISIELEWSKI 1981). Found in summer and in autumn.

60. *H. majus* REMANE, 1927.

61. *H. ocellatum* (MEČNIKOV) sensu KISIELEWSKI 1981.

62. *H. ocellatum* f. *sphagnophilum* KISIELEWSKI, 1981. An ecological form being the commonest and most abundant gastrotrich of *Sphagnum* peat-bogs all over Poland, occurring very regularly on raised peat-bogs including their most oligotrophic and dry forms (KISIELEWSKI 1981). The occurrence of only two specimens on two localities apart from the group of environments mentioned shows best the stenotopic character of this form. These environments are: the dystrophic lake in the Tatra Mts (shore partly overgrown with *Sphagnum* clusters; I) and rush community (VI). Although it has been found regularly from spring to autumn, it seems to occur all the year round (KISIELEWSKI 1981).

63. *H. tenuisquamatum* KISIELEWSKI, 1981. A rare and not abundant gastrotrich connected mainly with *Sphagnum* peat-bogs, especially the transitional ones (KISIELEWSKI 1981). Also found on single localities in alder-ash carr (III), fertile fish ponds (IV) and rush communities (VI). Occurs in the whole country between May and December.

64. *Lepidodermella minus* REMANE, 1936.
65. *L. punctatum* (GREUTER, 1917). This not clearly defined species has been recorded by ROSZCZAK (1968) from several water bodies in Great Poland belonging to various classes of fertility.
66. *L. squamatum* (DUJARDIN, 1841).
67. *L. squamatum* f. *psammica* ROSZCZAK, 1935. An ecological form described from the psammon of Great Polish water bodies.
68. *L. verrucosa* (ROSZCZAK, 1935). Described from three localities in Great Poland – eutrophic and dystrophic water bodies.
69. *L. zelinkai* (KONSULOFF, 1913). Recorded by ROSZCZAK (1968) from two water bodies in Great Poland. Found in August and September.
70. *Aspidiophorus bibulbosus* KISIELEWSKI, 1979.
71. *A. microsquamatus* SAITO, 1937. A species recorded from one locality near Siedlce which is a transitional peat-bog. Found in October (KISIELEWSKI 1981).
72. *A. oculifer* KISIELEWSKI, 1981. A quite common gastrotrich occurring on lowlands and in mountains. Described from transitional peat-bogs of Poland (KISIELEWSKI 1981), but found also in a mountain oligotrophic lake (I), medium fertile water bodies (I and II), alder woods (III and V) and rush communities (VI). Found from spring to autumn.
73. *A. ophiodermus* BALSAMO, 1983. Recently described from the Apennines has been also found on three localities in Poland – medium fertile (II) and fertile (I) water bodies. In Poland found both on lowlands and in mountains, on all localities in September.
74. *A. paradoxus* (VOIGT, 1902).
75. *A. polonicus* KISIELEWSKI, 1981. A rare and not abundant species on lowlands and in mountains. Its main environment are probably transitional peat-bogs (KISIELEWSKI 1981), but it has been also found in a rather fertile water body in the Tatra Mts (I), dystrophic lake (KISIELEWSKI 1981) and alder wood (III). Found between May and September.
76. *A. silvaticus* VARGA, 1963. A species found in Poland on 6 localities, all of them being raised peat-bogs, mainly mountain ones and relatively dry (KISIELEWSKI 1981).
77. *A. slovinensis* KISIELEWSKI, 1986. This species, recently found in Poland, has been so far recorded from 4 localities: young lake of marine origin (II), alder wood (V) and in two water bodies overgrown by rush vegetation (VI). Found in June.
78. *A. squamulosus* ROSZCZAK, 1935.
79. *A. tatraensis* KISIELEWSKI, 1986. Recently described from a rather fertile water body in the Tatra Mts. Found in September (I).
80. *A. tetrachaetus* KISIELEWSKI, 1986. Recently described from an oligotrophic lake in the Karkonosze Mts. Found in September (I).
81. *Ichthyidium bifurcatum* PREOBRAŽENSKAJA, 1926.

82. *I. forficula* REMANE, 1927. One of the commonest and most abundant gastrotrichs of raised and transitional peat-bogs of Polish lowland (KISIELEWSKI 1981). Apart from this environment recorded only from three localities, where altogether three specimens were found; two in alder woods (III and V), the third in a water body overgrown by rush vegetation (VI). Recorded between April and December.

83. *I. maximum* GREUTER, 1917. A rare species recorded from very few eutrophic water bodies on lowlands and in the mountains (ROSZCZAK 1968, I and III). Found in September and October.

84. *I. palustre* KISIELEWSKI, 1981.

85. *I. podura* (O. F. MÜLLER, 1773).

86. *I. rostrum* ROSZCZAK, 1968. Described from two eutrophic water bodies of Great Poland and not found again. Occurred in October and November.

87. *I. sulcatum* STOKES, 1887. Recorded in Poland by ROSZCZAK (1968) from two localities near Poznań. Found in August and October.

88. *Polymerurus nodicaudus* (VOIGT, 1901).

89. *P. rhomboides* (STOKES, 1887).

90. *P. serraticaudus* (VOIGT, 1901).

91. *P. squamofurcatus* (PREOBRAŽENSKAJA, 1926).

Family *Dasydytidae*

92. *Dasydytes* (*D.*) *ornatus* VOIGT, 1909.

93. *D.* (*Setopus*) *iunctus* GREUTER, 1917. The only locality of this species in Poland is recorded by ROSZCZAK (1968) in central Great Poland. Found in August.

94. *D.* (*S.*) *primus* GRÜNSPAN, 1908. Recorded twice on Polish lowland from fertile water bodies (ROSZCZAK 1968 and IV).

95. *D.* (*S.*) *tongiorgii* BALSAMO, 1983.

96. *D.* (*Haltidytes*) *crassus* GREUTER, 1917.

97. *D.* (*Chitonodytes*) *longispinosus* GREUTER, 1917. The only locality of this species is recorded by ROSZCZAK (1968) in a water body in Poznań.

98. *Stylochaeta fusiformis* (SPENCER, 1890).

99. *S. longispinosa* GREUTER, 1917. Recorded in Poland by ROSZCZAK (1968) from two localities in Great Poland.

100. *Metadasydytes quadrimaculatus* ROSZCZAK, 1971. Species and genus described from the Vistula Lagoon, but not found again.

Family *Neogosseidae*

101. *Neogossea antennigera* (GOSSE, 1851).

102. *N. fasciculata* (DADAY, 1905). The only locality of this gastrotrich in Poland is recorded by ROSZCZAK (1968) in Lake Śródeckie in Great Poland.

This list does not include several species unknown to science found during the investigations, which have not been described because of insufficient knowledge.

Among the environments examined only two have a specific gastrotrichan fauna consisting of a considerable percentage of species occurring only in a given environment or showing distinct preference for that environment. These are *Sphagnum* peat-bogs and extremely eutrophicated water bodies. The connection with *Sphagnum* peat-bogs is the strongest for the following species: *Chaetonotus oculifer*, *Ch. sphagnophilus*, *Ch. acanthodes*, *Heterolepidoderma ocellatum*, *H. ocellatum* f. *sphagnophilum*, *Aspidiophorus silvaticus* and *Ichthydium forficula*, and also to a lesser extent for: *Chaetonotus armatus*, *Ch. novenarius*, *Heterolepidoderma tenuisquamatum* and *Aspidiophorus polonicus* (KISIELEWSKI 1981). Species connected with extremely eutrophicated waters have been discussed in the previous chapter. However, it should be indicated that, apart from a number of species belonging to various genera, some higher taxa as the whole are connected with this environment; in extremely eutrophicated waters practically all Polish representatives of the family *Dasydytidae* have the highest occurrence, species of the family *Neogosseidae* and also of the genus *Polymerurus* (*Chaetonotidae*) are found only there. It is an interesting fact that oligotrophic waters, examined in the Tatra and Karkonosze Mts, almost do not have a specific gastrotrichan fauna without taking into consideration the newly from there described species, about the distribution of which little is known. The only gastrotrich having there the best conditions for occurrence is *Chaetonotus maximus* (I). It seems that there is a group of species showing preference for waters of a medium fertility and occurring simultaneously on more fertile *Sphagnum* (transitional) peat-bogs, and also in alder woods and rush communities. This group is represented clearly by *Chaetonotus polyspinosus*, *Ch. zelinkai*, *Heterolepidoderma majus* and *Lepidodermella minus*. Many species are typical eurytopic forms covering a wide range of environments from oligotrophic water bodies and non-fertile peat-bogs to extremely eutrophic waters, occurring simultaneously in alder woods and astatic water bodies with rush vegetation. One should mention here first of all *Chaetonotus disiunctus* and *Heterolepidoderma gracile*, which additionally are dominant gastrotrichs in the majority of environments as well as *Chaetonotus hystrix* and *Ch. macrochaetus*, usually less abundant.

The great majority of species occurs in Poland all the year round, frequently with the same intensity, or at least between early spring to late autumn. *Gastrotricha* having a distinctly seasonal occurrence are rare. Only two species occurred most abundantly in summer without occurring in winter: *Heterolepidoderma gracile* and *Stylochaeta fusiformis*, whereas *Chaetonotus rafalskii* and *Dasydytes ornatus* were the most numerous in winter and hardly appeared at all in summer.

Table III gives the numbers of species found, general diversity index H'

Table III. Comparison of the number of species, general diversity index (H') and abundance (A) for gastrotrichs from various environments.

No	Environment	Number of species	H'		Abundance		Source
			total for environment	for single localities	mean	maximal recorded	
1	Springs and mountain streams	6			1.6 ¹	11.4	I
2	Mountain oligotrophic lakes	14	1.63; 1.68		5.8 ¹	13.8	I
3	<i>Sphagnum</i> forests	11					KISIE- LEWSKI (1981)
4	Raised peat-bogs	13	1.92				"
5	Transitional peat-bogs	51	2.64				"
6	Rush communities	43	3.14		40.7	59.5	VI
7	Alder woods						
	a. Białowieża	33		2.95	20.6	45.9	III
	b. other	48	3.29	2.55; 2.74	29.2	80.0	V
8	Medium fertile waters						
	a. mountain	29		0.47-2.54	14.6	34.4	I
	b. young lakes of marine origin ²	24		1.32-2.47	9.2	25.0	II
9	Highly eutrophic waters						
	a. fertile fish ponds	39		1.90-2.75	16.4 ³	26.0	IV
	b. water bodies of the Białowieża Glade	37		1.82	18.4	50.0	III
	c. fertile peat-bogs	31		1.28-1.72 ⁴	39.0; 61.4	166.7	KISIE- LEWSKA (1982)
	d. water bodies with <i>Hydrocharitetum morsus-ranae</i>	50	2.95	2.75	30.0 101.0	101.0	own data

¹ Calculated on the basis of data in the paper cited.² Without material from extremely eutrophic North Bay of the Gardno Lake.³ For better comparability with other data, calculated for the spring-autumn period on the basis of data in the paper cited.⁴ See I, p. 174

and abundance A for particular environments. This comparison shows that in classic water bodies the attractiveness of environment for *Gastrotricha* increases from oligotrophic waters towards extremely eutrophicated ones, which is proved by the increasing value of all three indices given. A similar tendency can be observed on *Sphagnum* peat-bogs, where the fauna of oligotrophic raised peat-bogs and *Sphagnum* forests is less differentiated than in more fertile transitional peat-bogs. Alder woods and rush communities are similarly attractive for *Gastrotricha* as eutrophic waters, and index H' for alder woods attained even the highest value of all (3.29 — total calculated for the environment).

The abundance of gastrotrichs fluctuates greatly, both within particular environments and among them, having in oligotrophic waters frequently lower values than in eutrophic and especially in the extremely eutrophicated ones. In the majority of cases the mean values are not very representative considering the small amount of material examined. Thus, it seems sensible to compare maximal values for particular environments. So, the highest abundance in oligotrophic waters is almost 10 times lower than the highest values for eutrophic waters (166.7), and 4–7 times lower than that recorded for alder woods and rush communities. A more thorough analysis of quantitative relations in particular environments would be however possible after examining a greater number of samples and using a more representative method of taking quantitative samples.

The majority of papers on freshwater *Gastrotricha* from Poland, including all publications of this series, deal almost exclusively with fauna of bottom mud. Only ROSZCZAK (1968) has investigated also the *Gastrotricha* among aquatic vegetation, psammon and neuston, and KISIELEWSKI (1981) — those among peat-moss. Some data on the occurrence of *Gastrotricha* in psammon are also found in paper II. A fuller analysis of the occurrence of freshwater *Gastrotricha* from Poland shall be possible only after conducting more detailed investigations of psammon and periphyton fauna.

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STRESZCZENIE

[Tytuł: *Gastrotricha* słodkowodne Polski. VII. *Gastrotricha* wód skrajnie eutroficznych]

W trakcie prowadzonych w latach 1972–1983 badań wód eutroficznych całego kraju na 23 stanowiskach wykrytych zostało 71 gatunków brzucho-rzęsków, z których oznaczono 50 (45 z rodziny *Chaetonotidae*, 4 z *Dasydytidae* i 1 z *Neogosseidae*). 8 spośród stwierdzonych gatunków występuje wyłącznie w wodach skrajnie eutroficznych, a 14 dalszych znajduje tu optymalne warunki występowania. Obok gatunków z różnych rodzajów, z wodami eutroficznymi związane są całe taksony wyższego rzędu, jak rodziny *Dasydytidae* i *Neogosseidae* oraz rodzaj *Polymerurus* (*Chaetonotidae*).

Spośród różnych typów wód eutroficznych najbogatszą fauną *Gastrotricha* odznaczają się płytkie zbiorniki zarastające roślinnością należącą do zespołu *Hydrocharitetum morsus-ranae*. Ogólny wskaźnik różnorodności gatunkowej H' , obliczony globalnie dla tego środowiska, osiągnął wysoką wartość 2,95, a obliczony indywidualnie dla najbogatszego stanowiska — 2,75. Najwyższa zanotowana wartość abundancji wynosi 101,0.

W pracy tej dokonane zostało również wstępne podsumowanie dotychczasowych wyników badań fauny słodkowodnej *Gastrotricha* Polski. W kraju stwierdzono dotąd 102 formy należące do 98 gatunków brzucho-rzęsków. Jedynie dwa typy środowisk: silnie zarastające płytkie zbiorniki skrajnie eutroficzne i torfowiska sfagnowe odznaczają się występowaniem znacznej liczby gatunków mniej lub bardziej stenotopowych. W wodach średniożylnych, olsach i drobnych zbiornikach porośniętych roślinnością szuwarową przeważają formy eurytopowe. W zbiornikach wodnych obserwuje się wyraźny wzrost różnorodności gatunkowej i liczebności w kierunku od wód oligotroficznych ku skrajnie eutroficznym. Podobną zależność, zbieżną co do kierunku, obserwuje się na torfowiskach sfagnowych. Olsy i zbiorowiska szuwarowe wykazują pod względem bogactwa fauny *Gastrotricha* zbliżone cechy jak wody o wysokiej trofii.

РЕЗЮМЕ

[Заглавие: Пресноводные *Gastrotricha* Польши. VII. *Gastrotricha* крайне эвтрофных водоемов]

Во время исследований эвтрофных вод, которые велись в 1972—1983 годах в 23 станциях на территории страны найден 71 вид брюхо-ресничных, из которых определено 50 (45 из семейства *Chaetonotidae* 4 из *Dasydytidae* и один из *Neogosseidae*). 8 из найденных видов встречается исключительно в крайне эвтрофных водах, следующие 14 видов находят в этого типа водах оптимальные условия существо-

вания. Кроме видов из разных родов к эвтрофным водам приурочены целые таксоны высшего ранга, как семейства *Dasydytidae* и *Neogosseidae*, а также род *Polymerrurus* (*Chaetonotidae*).

Среди разного типа эвтрофных вод наиболее богатой фауной *Gastrotricha* отличаются мелкие водоемы, покрытые растительностью, относящейся к сообществу *Hydrocharitetum morsus-ranae*. Общий показатель видового разнообразия H' , вычисленный для всей среды в целом достиг высокого уровня 2,95, а вычисленный индивидуально для наиболее богатого местонахождения — 2,75. Наиболее высокая отмеченная величина абунданции (численности) составляет 101,0.

В работе подведен также предварительный итог полученных до настоящего времени результатов исследований по фауне пресноводных *Gastrotricha* Польши. В стране констатировано 102 формы, принадлежащие к 98 видам брюхохоресничных. Только в двух типах биотопов: сильно заросших, мелких, крайне эвтрофных водоемах и сфагновых торфяниках встречается значительное количество более или менее стенотопных видов. В среднекормных водоемах, в ольсах и мелких водоемах заросших камышовой растительностью встречаются преимущественно эвритопные формы. В водоемах наблюдается четкий рост видового разнообразия и численности в направлении от олиготрофных вод к крайне эвтрофным. Такого же рода закономерность наблюдается и по отношению к сфагновым торфяникам. Ольсы и сообщества камышей приближаются с точки зрения богатства фауны *Gastrotricha* к водам с высокой трофией.