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**Badania nad makrofauną rzeki Warty w obrębie  
miasta Poznania**

**An investigation on the macrofauna of the River Warta  
within the city of Poznań**

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**Abstract** — The described investigation was carried out on the macrofauna of a strongly polluted sector of the River Warta within the city of Poznań in the years 1974 and 1975. 87 species from 13 systematic groups were noted. The occurrence of individual taxons at 3 stations lying along the river course was noted, special attention being paid to changes of the faunistic structure which accompany the increase of pollution.

**Introduction**

The great lowland rivers, among which is the River Warta, are the most strongly polluted rivers in Poland. The Warta is particularly strongly polluted within the city of Poznań. Although it is widely known that pollution chiefly affects the aquatic fauna by a strong reduction in its quality, no detailed investigation has previously been carried out on the macrofauna of the polluted sectors of lowland rivers in Poland. The aim of the present study was to determine the qualitative and quantitative composition of the macrofauna in that sector of the River Warta within the city of Poznań, which is surely the most polluted part of this river receiving as it does large amounts of industrial and municipal sewage. No detailed investigations had been conducted on the macrofauna of the River Warta in the region of Poznań. The occurrence of certain systematic groups (*Oligochaeta*, *Hirudinea*, *Ephemeroptera*, *Heteroptera*, *Tri-*



choptera, and Chironomidae) has been reported in the literature, but in general, these works were concerned with greater parts of the Great Poland region. Neither was the macrofauna ever included in the elaborations concerning the sanitary control of the Warta waters, carried out by the Laboratory of Water, Sewage, and Atmospheric Air Research in Poznań or by the Poznań Branch of the Institute of Environmental Management.

### Stations and method

The investigation was carried out at three stations lying along the river course within the boundaries of the city of Poznań. The distribution of the stations and the discharge of the most important sewage to the river is shown in fig. 1.

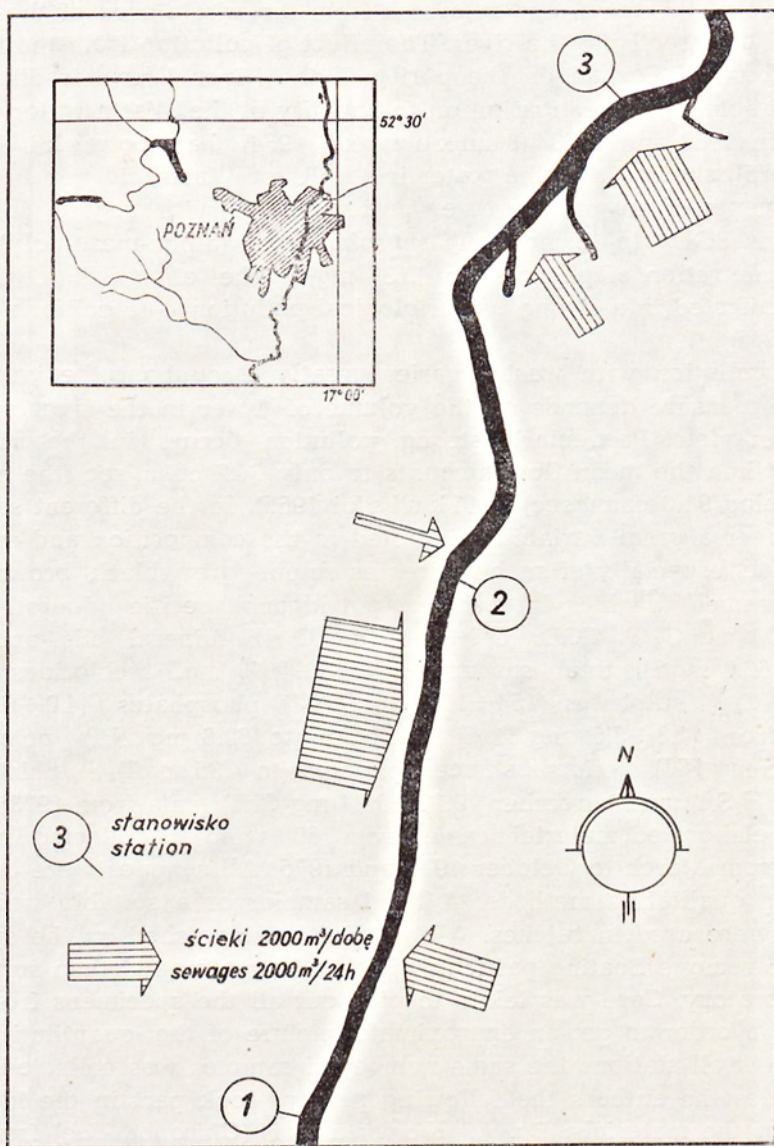
Station 1. Poznań-Starołęka, km 250.0 of the river course. The banks are reinforced with stone spurs. In the bays between the spurs the water current is very slow, the bottom muddy, sandy-muddy, or sandy with a layer of detritus. Sometimes, near the banks patches of *Potamogeton fluitans* Roth, *P. lucens* L., *P. filiformis* Pers., and *Butomus umbellatus* L. occur. In the current the bottom is sandy, not overgrown. Small amounts of suspension are noted in the water.

Station 2. Poznań-Marchlewski Bridge, km 244.5 of the river course. The banks are reinforced with a concrete belt covered with an abundant growth of periphyton. The bottom is sandy and sandy-muddy, in the current sandy. Near the banks small patches of aquatic vegetation: *Potamogeton perfoliatus* L., *P. fluitans* Roth, *P. lucens* L., *P. filiformis* Pers. The water is turbid, sometimes with a strong specific smell from petroleum pollution.

Station 3. Poznań—Szeląg, km 240.0 of the river course, about 0.5 kilometre below the mouth of the main sewage interceptors. The banks are reinforced with stone spurs. The bottom is muddy, sandy-muddy, sandy, and stony-shingle; in the current the bottom is sandy and near the banks very strongly slimed in some places. Small patches of *Potamogeton fluitans* Roth and *P. filiformis* Pers. occur. The water is turbid, very strongly polluted.

The investigated sector of the river, particularly stations 2 and 3, are strongly influenced by large amounts of sewage from the city of Poznań. The total amount of sewage fed to the municipal sewage system from the left bank part of the town is about 150 thousand cubic metres/24 hrs (i.e. more than  $\frac{1}{3}$  of the whole yield), consisting in 60% of industrial wastes. Only a small part of the sewage (about 50 thousand





Ryc. 1. Rozmieszczenie badanych stanowisk i dopływ najważniejszych ścieków do rzeki Warty w Poznaniu

Fig. 1. Distribution of the main sewage discharge points and of sampling stations in the River Warta at Poznań

cubic metres/24 hrs) is mechanically purified before being discharged into the river. The remainder (about 100 thousand cubic metres/24 hrs) is fed directly into the River Warta, without any purification. Moreover, wastes from some industrial plants, municipal sewage from the right



bank part of the town, and rainwash from the whole area of the town, are drained directly to the river. The effect of pollution from the region of the town of Poznań on the purity of the River Warta is distinctly unfavourable. An investigation on the quality of the Warta water, carried out in 1968 and 1973 (Jankowski 1974, Jankowski, Lubner 1975), showed that the water in the River Warta did not meet the requirements of any of the three purity classes with regard to such indices as BOD<sub>5</sub> (to 15 mg O<sub>2</sub>/l), saprobic zone (alpha-mezo-poly), and the concentration of phenols (to 0.139 mg/l). The effect of sewage is also manifested in a strong bacteriological pollution — a coliform count up to 0.001.

The pollution with wastes varies greatly throughout the year and in large measure depends on the volume of water in the river and on the mean yield. Particularly strong pollution occurs in the summer season when the mean flow amounts to only 64.2 cu.m./sec (the annual mean being 91.0 cu.m./sec) (Mikulski 1965). In the different seasons of the year a great variability is noted in the composition and amount of sewage, especially of such indices as colour (grey, black, brown, and yellow), smell (various intensity of putrid and specific odours), BOD<sub>5</sub> (290÷610 mg O<sub>2</sub>/l), COD (549÷1184 mg O<sub>2</sub>/l), mineral oils and fats (47.5÷166.0 mg/l), total suspension (288÷1068 mg/l), chlorides (96÷126 mg Cl/l), sulphates (154÷184 mg SO<sub>4</sub>/l), phosphates (4.0÷6.5 mg PO<sub>4</sub>/l), iron (1.8÷5.5 mg Fe/l), nitrogen (to 62.6 mg N/l), potassium (5.8÷8.5 mg K/l), toxic substances: phenols (to 4.35 mg/l), sulphides (to 0.86 mg H<sub>2</sub>S/l), and chromium (0.12÷0.24 mg Cr/l) (data from 1973).

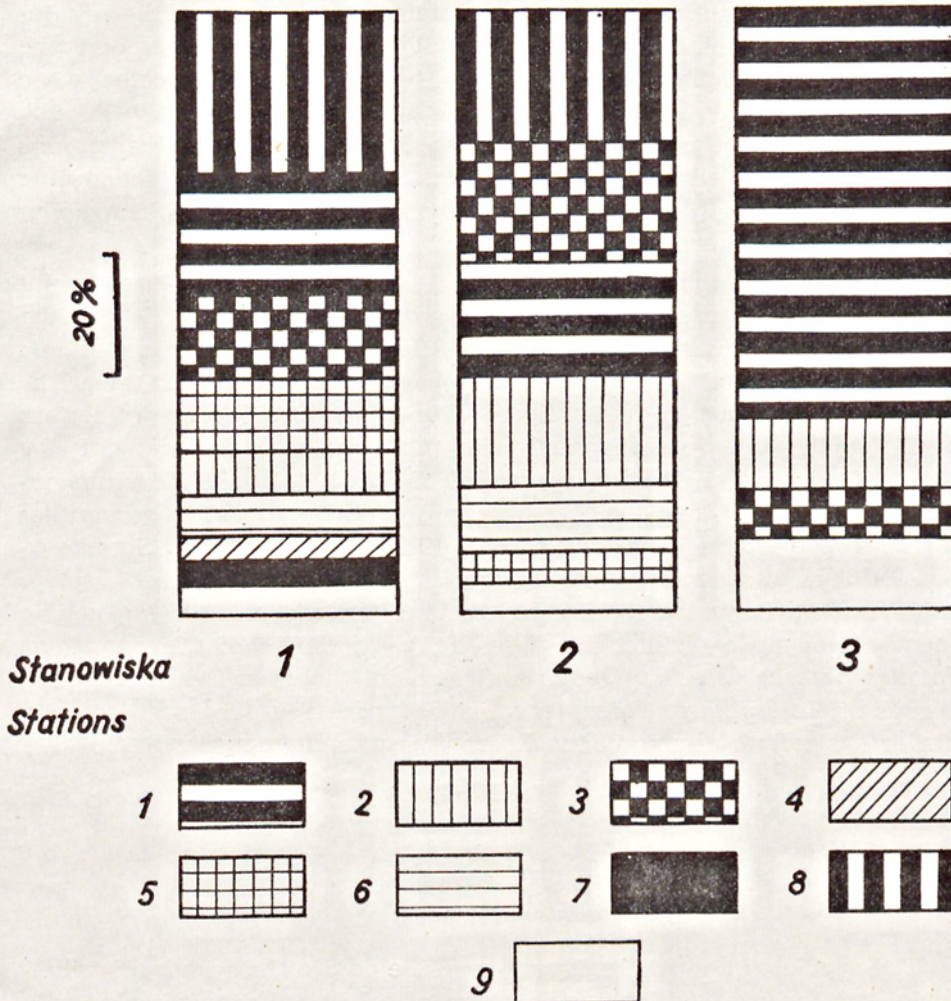
The elaborated material came from 60 samples collected in the period from March to October 1974 and 1975. All samples were collected using qualitative methods. A hand sampler or a suitably weighted dredge were used in catches. All samples were washed on the spot in order to remove floating particles of the substratum, and then sorted in the laboratory. Care was taken to pick out all the specimens from the sample in order to get an approximate picture of the quantitative relations. At all stations the same number of samples was collected.

Besides the authors the following persons took part in the identification of the materials: Dr. A. Kownacki (*Chironomidae*) from the Laboratory of Water Biology of the Polish Academy of Sciences, Dr. B. Szczesny (*Trichoptera*) from the Laboratory of Nature Protection of the Polish Academy of Sciences in Kraków, Dr. J. Kolaszka (*Turbellaria*) and Dr. S. Mielewczyk (*Odonata*) from the Department of Agrobiolgy of the Institute of Ecology of the Polish Academy of Sciences in Poznań. The help of all the above-mentioned persons is here gratefully acknowledged. Also used were the unpublished data on *Mollusca* collected in the River Warta in the year 1956 by Docent L. Berger, to whom thanks are due for making the materials available.



## General description of the macrofauna in the investigated sector of the river Warta

The collected material included 3062 specimens, 87 species being identified among them (Table I). Only 1750 specimens were identified as to species (57.18% of the material).



Ryc. 2. Ilościowy udział poszczególnych grup systematycznych na badanych stanowiskach rzeki Warty. 1 — *Oligochaeta*, 2 — *Hirudinea*, 3 — *Mollusca*, 4 — *Amphipoda*, 5 — *Ephemeroptera*, 6 — *Trichoptera*, 7 — *Coleoptera*, 8 — *Chironomidae*, 9 — inne  
Fig. 2. Quantitative share of particular taxa at the investigated stations of the River Warta. 1 — *Oligochaeta*, 2 — *Hirudinea*, 3 — *Mollusca*, 4 — *Amphipoda*, 5 — *Ephemeroptera*, 6 — *Trichoptera*, 7 — *Coleoptera*, 8 — *Chironomidae*, 9 — others



*Oligochaeta* have the greatest quantitative share (31.37% of the material), followed by *Chironomidae* (19.60%), *Mollusca* (14.50%), and *Hirudinea* (12.45%). The numbers of all other groups are much smaller, *Hydracarina* being decisively the least numerous out of all groups found at the investigated stations. The small numbers of *Turbellaria* are probably connected with the method of sampling.

*Chironomidae* were certainly the group with the greatest number of species; unfortunately, their taxonomy being poorly known, the greater part of the material could not be identified as to species. Among the most numerous group, the *Oligochaeta*, as many as 25 species were determined, this being about 30% of the aquatic *Oligochaeta* in Poland. The number of *Mollusca* species was also considerable. The other groups were rather poor with regard to species, this particularly concerning *Hydracarina* which were represented by as few as 2, this being about 0.33% of the *Hydracarina* fauna of Poland.

The most numerous material was collected at the least polluted point located at the highest station up the river course (station 1). As the pollution increased at stations 2 and 3 the numbers of the fauna distinctly decreased. The quantitative share of individual groups at the investigated stations (shown in fig. 2) allows the determination of certain trends in the changes connected with the increasing pollution of the river. As the pollution rose, the share of *Oligochaeta* in the fauna increased distinctly, this being also supported by observations in other parts of the country (Szczęsny 1974, Kasprzak, Szczęsny 1976, Kasprzak 1976). It should be stressed that the absolute numbers of this group also increased. The increase in pollution is also accompanied by a distinct decrease in the numbers of *Chironomidae*, *Ephemeroptera*, and *Amphipoda* and also in those of less numerous groups of *Heteroptera*, *Coleoptera*, and *Isopoda*. The occurrence of particular systematic groups in the River Warta is characterized below.

#### Turbellaria

The species found in the River Warta belong to the widely distributed forms characterized by a wide range of habitats. In the samples only single specimens were found, this being probably because the animals were destroyed when the materials were washed. Therefore, the absence of *Turbellaria* at station 3 is of no great significance. It should be stressed that no representatives of *Tricladida* were found at any of the stations, probably owing to the limiting action of pollution with regard to their occurrence.



Tabela I. Ilościowe zestawienie zebranego materiału

+ - stwierdzenie występowania gatunku bez oceny liczebności  
x - osobniki o cechach pośrednich

Table I. Quantitative comparison of the collected materials

+ - recording of occurrence of species without estimation of the number  
x - individuals with medial taxonomical features

Taksony Taxons	Stanowiiska Stations			Razem: Total:	Stanowiiska Stations			Razem: Total:
	1	2	3	1 2 3	1	2	3	1 2 3
<b>Turbellaria</b>								
<i>Macrostomum lineare</i> (Müll.)	+							
<i>Stenostomum leucops</i> (Ant. Dug.)	+	+						
- <i>constrictum</i> Luth.		+						
<i>Phenocora rufodorsata</i> (Sek.)								
<i>Dochmiotrema limicola</i> Hofst.								
<b>Oligochaeta</b>								
<i>Aeolosoma hamprichi</i> Ehren.	2			2				
- <i>travancorensis</i> Aiyer		2	1	3				
<i>Stylaria lacustris</i> (L.)	16	30	35	81				
<i>Neis barbata</i> Müll.	23	10	10	43				
- <i>brotschleri</i> Mich.	44	88	5	137				
- <i>pardalis</i> Fig.	22	4	4	30				
- <i>simplax</i> Fig.	1			1				
- <i>communis</i> Fig.	2			2				
- <i>olinguus</i> Müll.								
- <i>christinae</i> Kasp.	7		56	63				
<i>Ophidionis serpentina</i> (Müll.)	2	1	8	11				
<i>Dero obtusa</i> d'Udek.	1	1	11	13				
<i>Chaetogaster diaphanus</i> (Gruith.)	1	1	95	97				
- <i>diastrophus</i> (Gruith.)								
<i>Psammoryctides barbatus</i> (Grube)	4	2	3	9				
<i>Tubifex tubifex</i> (Müll.)	9	3	74	86				
<i>Lamodrilus hoffmeisteri</i> Clap.		3	3	6				
- <i>udekianus</i> Clap.		4	4	8				
- <i>claparedeanus</i> Ratze	115	47	299	461				
<i>Tubificoides</i> juv. non det.	14			14				
<i>Propepulus volki</i> Mich.								
<i>Henlea ventriculosa</i> d'Udek.	1		7	8				
<i>Enchytraeus buchholzi</i> Vejd.	1	22	23	26				
<i>Marionina riparia</i> Bret.	1	1	1	3				
<i>Jaembriellus lineatus</i> (Müll.)		16	16	32				
<i>Enchytraeus</i> juv. non det.		11	11	22				
<i>Eiseniella tetraedra</i> (Sav.) f. typica								
<b>Hirudinea</b>								
<i>Glossiphonia complanata</i> (L.)	2	2	1	5				
- <i>Haemopsis sanguisuga</i> (L.)		1	1	2				
<i>Piscicola geometra</i> (L.)	1	1	1	3				
<i>Helobdella stagnalis</i> (L.)	2	5	2	9				
<i>Eryobdella octoculata</i> (L.)	87	185	92	364				
<b>Mollusca</b>								
<i>Theodoxus fluviatilis</i> L.	42	2		44				
<i>Viviparus fasciatus</i> Müll.	32	1		33				
<i>Valvata piscinalis</i> Müll.	2			2				
<i>Bithynia tentaculata</i> L.	9	52	11	72				
<i>Lymnaea stagnalis</i> L.	2	1	3	6				
<i>Radix balthica</i> ovata Drap.	66	134	39	239				
<i>Pisanoorbis cornuus</i> L.		1	1	2				
<i>Cyranulus albus</i> Müll.		1		1				
<i>Physa fontinalis</i> L.		5	5	10				
<i>Unio tumidus</i> Retz.		1		1				
- <i>pictorum</i> L.								
<i>Anodonta anatina</i> L.		3		3				
<i>Spherium corneum</i> L.		3		3				
<i>Pisidium amicum</i> Müll.	18	4	1	23				
<i>Euglesa nitida</i> (Stelph.)	3			3				
<i>Dreissena polymorpha</i> Fall.	1	1	1	3				
<b>Isopoda</b>								
<i>Asellus aquaticus</i> L.	12	9	8	29				
<b>Amphipoda</b>								
<i>Gammarus (Bavulogammarus) rooseelli</i> Gerv.	55	9		64				
<b>Odonata</b>								
<i>Calopteryx speldens</i> (Harr.)	4	1		5				
<i>Isechnura elegans</i> (Vander Lind.)	1	3	8	12				
<i>Erythronna najas</i> (Hans.)		1	1	2				
<i>Gomphus flavipes</i> (Charp.)	4		1	5				
<b>Ephemeroptera</b>								
<i>Heptagenia flava</i> Rost.	2		1	3				
<i>Proclion ornatum</i> Tsch.		6		6				
<i>Ephemera ignita</i> Poda	3	6		9				
<i>Coenis undulosa</i> Tiens.	2	1		3				
<i>Cleon diptherum</i> L.	1			1				
<i>Baëtis</i> sp. non det.	145	34	9	188				
<b>Heteroptera</b>								
<i>Gerris lacustris</i> (L.)	3			3				
- <i>pallidum</i> (Fabr.)	21			21				
<i>Llyocoris cimicoides</i> (L.)	1			1				
<i>Mepa cinerea</i> L.	2			2				
<i>Sigara striata</i> (L.)	3	4		7				
- <i>falleni</i> (Fieb.)		4	1	5				
- <i>praevata</i> (Fieb.)		4		4				
<i>Sigara</i> sp. juv.	4			4				
<b>Trichoptera</b>								
<i>Neuroclipsis bimaculata</i> (L.)	1			1				
<i>Hydropsyche angustipennis</i> (Quat.)	46	9	6	61				
- <i>contubernalis</i> McLach.	19	14	5	38				
- <i>guttata</i> Pict.	7	24	2	33				
- <i>ornatula</i> McLach.	1	5		6				
<i>H. contubernalis</i> McLach. - <i>H. guttata</i> Pict. x	14	61	1	76				
<b>Coleoptera</b>								
<i>Haliphus flavicollis</i> Strm.	1			1				
- <i>fluviatilis</i> Aube	16	15	1	32				
- <i>ruficollis</i> Deg.	3	2		5				
<i>Guignotus pusillus</i> F.		1		1				
<i>Laccophilus hyalinus</i> Deg.								
<i>Rhantus pulverosus</i> Steph.	1			1				
<i>Eryohius elevatus</i> Panz.	1			1				
<b>Coleoptera larvae</b>	27	1		28				
<b>Chironomidae</b>								
<i>Psectrotenyx varius</i> (Fabr.)	1			1				
<i>Cricotopus (Cricotopus) ex gr. tresulus</i> (L.)	3			3				
( <i>D. triangulatus</i> (Macq.)?)								
<i>Cricotopus (Cricotopus) sp.</i>	10	15	9	34				
<i>Cricotopus (Isocoladus) ex gr. sylvestris</i>		3		3				
( <i>C. sylvestris</i> (Fabr.)?)								
<i>Rheocricotopus chalybeatus</i> (Edwards)	32	13	2	47				
<i>Microcricotopus sp.</i>	12	2		14				
<i>Corynoneura sp.</i>	5			5				
<i>Chironomus plumosus</i> (L.)	5		1	6				
- <i>reductus</i> Lip.	24			24				
<i>Glyptotendipes sp.</i>	10	11		21				
<i>Harnischia sp.</i>	1	1		2				
<i>Paracladopelma sp.</i>	2			2				
<i>Parachironomus sp.</i>	23	7	19	49				
<i>Polypedium ex gr. nubeculosum</i> (Meig.)	17	1		18				
- <i>ex gr. convictum</i> (Walk.)	69	1	11	81				
- <i>ex gr. scalaenum</i> (Schr.)		9		9				
- <i>breviantennatum</i> Tshern.	8			8				
<i>Pentapedium sp.</i>	2			2				
<i>Rhectanytarsus sp.</i>	100	148		248				
<i>Rhectanytarsus photophilus</i> Goeftg.	2	1		3				
<i>Cladotanytarsus sp.</i>	1			1				
<i>Tanytarsus sp.</i>	8			8				
<b>Tanytopodinae</b>	1			1				
<i>Hydracarina</i>								
<i>Hydrodromia desoipiensis</i> (Müll.)								
<i>Byliss undulosa</i> (Müll.)		2		2				



### Oligochaeta

This is the most numerous group in the fauna of the River Warta. Out of 25 species collected, at the least polluted point (station 1) 16 were found, while at the most polluted one (station 3) 19 species were encountered. At this last station also the greatest numbers of *Oligochaeta* were noted. The smaller numbers of specimens and of species of *Oligochaeta* at station 2 should be attributed to the concrete reinforcement of the river banks. The direct consequence of this covering was the destruction of many littoral environments, chiefly plant ones. At station 2 *Nais bretscheri* Mich. was most numerous, since the occurrence of this species was connected with the periphyton overgrowing the stones and the concrete reinforcement of the bank (Kasprzak 1970). At station 2 this is the best developed habitat.

Among the *Oligochaeta* found in the River Warta the majority are eurytopic forms, while only three (*Propappus volki* Mich., *Nais bretscheri* Mich., and *N. pardalis* Pig.) may be classified as rheophilous. Three species only (*Nais barbata* Müll., *N. pardalis* Pig., and *Propappus volki* Mich.) attained their greatest number at the most polluted station, where the dominant species were *Chaetogaster diastrophus* (Gruith.) and *Limnodrilus hoffmeisteri* Clap. The numerous occurrence of *Oligochaeta* in strongly polluted waters was frequently stressed in the literature (Brinkhurst 1965, Parele 1974, Szczęsny 1974, Kasprzak, Szczęsny 1976). *Nais elinguis* Müll., which occurs only at station 3, is chiefly connected with strongly polluted running waters, where very frequently even a mass appearance of this species can be observed (Wróbel 1965, Kasprzak 1971, Szczęsny 1974). It may be classified among the typical sewage species.

### Hirudinea

Of the leeches *Erpobdella octoculata* (L.) decisively dominated, being the most eurytopic species of Polish leeches (Sandner 1961, Pałowski 1968), connected with strongly eutrophicated waters. The greatest occurrence of this species at station 2 is probably connected with the reinforcement of the river banks in this sector and with the large number of stones in the water below the concrete belt. In the *Hirudinea* fauna no significant differences occur between the stations with the weakest and the strongest pollution.

Some incomplete data on the leeches of the River Warta within the city of Poznań are given in the work of Serafińska (1958—1961). In a sector corresponding with our station 3 that author found three



species of leeches, with *Helobdella stagnalis* (L.) as a dominant. However, her opinion that in the River Warta the leeches are more strongly connected with the aquatic vegetation than in other water bodies is not in agreement with our observations.

### Mollusca

In the investigated sector of the Warta the fauna of *Mollusca* is still relatively rich. The eurytopic *Radix balthica ovata* Drap. and *Bithynia tentaculata* L. are most numerous. The largest numbers of species and specimens were caught at station 2 and the smallest at station 3. The station with the weakest pollution is characterized by the greatest numbers of *Theodoxus fluviatilis* L., *Viviparus fasciatus* Müll., and *Sphaerium corneum* L. These species, characterized as lacustrine-river ones probably have greater ecological requirements than the others.

Tabela II. Mollusca znalezione w Warcie w roku 1956 przez L. Bergera

Table II. Molluscs found in the River Warta in 1956 by L. Berger

Gatunki Species	Stanowiska Stations	
	2	3
<b>Gastropoda</b>		
<i>Theodoxus fluviatilis</i> L.	+	+
<i>Viviparus fasciatus</i> Müll.	+	+
<i>Valvata piscinalis</i> Müll.	+	+
- <i>naticina</i> Menke	+	+
<i>Bithynia tentaculata</i> L.	+	+
<i>Lithoglyphus naticoides</i> L. Pfr.		+
<i>Lymnaea stagnalis</i> L.	+	+
<i>Radix balthica ovata</i> Drap.	+	+
<i>Physa fontinalis</i> L.	+	+
<i>Planorbarius corneus</i> L.	+	
<b>Bivalvia</b>		
<i>Sphaerium corneum</i> L.	+	+
- <i>rivicola</i> Lam.		+
<i>Musculium lacustre</i> Müll.		+

Owing to the good offices of Docent L. Berger, the authors had at their disposal the unpublished materials on *Mollusca* collected in the River Warta at two stations, corresponding with our stations 2 and 3, in the year 1956 (May and August). A total number of 13 occurring species was noted in that period, the majority of them occurring in great numbers or even in masses (Table II). Among the species occurring in the River Warta now, much greater numbers had previously been found of *Theodoxus fluviatilis* L. and *Valvata piscinalis* Müll. During the



present investigation the occurrence of *Sphaerium rivicola* Lam., *Masculium lacustre* Müll., *Valvata naticina* Menke, and *Lithoglyphus naticoides* L. Pfr. was no longer noted, although, in general, these species are fairly numerous in great lowland rivers.

A decrease in the numbers of many species and the elimination of others should be put down to the deterioration of the environmental conditions in the strongly polluted River Warta. Certain species which had not previously been found, suggested a slight enrichment of the fauna. However, it seems that this was due rather to our more careful examination of the fauna in River Warta within the city of Poznań. The investigation carried out by Berger concerned the whole river, the sector studied by the present authors being then only casually considered.

#### Isopoda and Amphipoda

Both *Crustacea* species found in the River Warta decreased in numbers as the pollution increased. This is particularly pronounced with *Gammarus (Rivulogammarus) roeselii* Ger v., a river species rather rare in Poland (Micherdziński 1959). At the most polluted station in the River Warta this species was not noted.

#### Odonata

The *Odonata* fauna of the River Warta is very poor. Among the species encountered only two are river species; these are *Calopteryx splendens* (Harr.) and *Gomphus flavipes* (Charp.). Great numbers of the two species were noted in the River Warta in the territory of the Great Poland National Park (Mielewczyc 1966).

#### Ephemeroptera

This group was relatively numerous in the investigated sector of the River Warta, particularly at station 1. *Baëtis* sp. was the most numerous. The occurrence of the majority of species is connected with great rivers.

The detailed investigations on *Ephemeroptera* of the River Warta carried out in the years 1952—1958 (Keffermüller 1960) included the sector taken into consideration here. In the Warta within the city of Poznań the occurrence of 15 species was recorded there. The species found now (except for the rare *Caenis undosa* Tiens.) were already noted in this region in the earlier investigation. A comparison of the



*Ephemeroptera* fauna in the River Warta with the data of Keffermüller (1960) indicates a distinct qualitative reduction. In fact, already in 1960 the *Ephemeroptera* fauna of the Warta in the city of Poznań was distinctly poorer than in the sectors lying higher up the river.

#### Heteroptera

In the investigated sector of the Warta *Heteroptera* group is not numerous, except for one species: *Gerris palludum* (Fabr.) which, though found in rather small numbers occurs in masses at the highest station. Larvae of this species were also caught, suggesting that it develops in the River Warta. *Gerris palludum* (Fabr.) was at one time regarded as a very rare species. However, recent investigations show that it is very common and numerous in the Warta catchment area (Biesiadka 1969). Among the species collected this is the only rheophilous one, the remainder, in any case not numerous, are eurytopic in great measure. However, the presence of *Corixidae* larvae should be emphasized, as this shows the possibility of occurrence of some other species. A decisive deterioration of the habitat conditions in the River Warta is also indicated by the absence of species of the genus *Micronecta* Kirk., which were still found here in 1935 (Wróblewski 1958).

#### Trichoptera

Among *Trichoptera* two species dominated: *Hydropsyche angustipennis* (Curt.) and *H. contubernalis* McLach. Many specimens (larvae) showed characters intermediate between these two species. All the species found were river forms.

As far as *Trichoptera* were concerned, the Warta sector within the city of Poznań had been previously investigated (Jaskowska 1958—1961). 6 species of *Trichoptera* were caught then, of which only one (*Neuroclipsis bimaculata* (L.)) was noted in the present investigation. *Hydropsyche angustipennis* (Curt.) was found in the River Warta near Puszczykowo. Other species found in the Warta now had not been noted earlier either in the River Warta or in the whole territory of Great Poland. Nevertheless, it seems hardly probable that the changes which occurred in a period of 20-odd years could lead to such a basic change in the *Trichoptera* fauna in the River Warta. Nevertheless, it is striking that some species reported by Jaskowska in 1958—1961 are absent now.



### Coleoptera

Out of *Coleoptera* only representatives of the family *Dytiscidae* were encountered. It is particularly striking that no representatives of the families *Hydraenidae* and *Elmidae* were noted, though many of them are rheobiotic and rheophilous species. Among the *Coleoptera* caught, only *Brychius elevatus* Panz. is a rheobiotic species, though it chiefly occurs in small rivers. Two other species, *Haliphus iluviatilis* Aubé and *Laccophilus hyalinus* Deg., are rheophilous forms. All the others are strongly eurytopic species. The occurrence of *Coleoptera* does not seem to be only periodical (flying insects), this being demonstrated by great numbers of larvae at station 1.

### Chironomidae

Unexpectedly, the *Chironomidae* fauna of the Warta proved to be rich and varied. However, as the pollution increases, a very distinct decrease in the numbers of *Chironomidae* specimens and taxons is noted. Among the taxons found here, the majority were not mentioned in a comprehensive elaboration by Smoleńska (1963), which concerns Great Poland and includes also the running waters. Taxocen where the larvae of *Rheotanytarsus* sp., *Cricotopus* (*Cricotopus*) sp., and *Cricotopus* (*Isocladius*) sp. dominate, is typical for pure or slightly polluted lowland rivers and is chiefly encountered in higher plants or on a substratum covered with algae. Typical sewage forms are relatively few in the River Warta. However, it seems that this estimate, based on whole groups of species insufficiently known with regard to their systematics and ecology, should be approached with great reserve, since other systematic groups suggest a distinct degradation of the fauna.

### Hydracarina

Two species which the authors succeeded in finding in the Warta, belonged to forms from small water bodies, being wholly strange in the environment of running waters. They were probably brought in by flying insects. None of the great number of river species was found in the River Warta. Similarly poor was the *Hydracarina* fauna in the Warta within the Great Poland National Park (Biesiadka 1972).



## Recapitulation

1. In the macrofauna of the River Warta within the city of Poznań 87 species were identified, 42.8% of the collected material not being determined as to species. In general, no extreme qualitative impoverishment of the fauna of this Warta sector is noted, though the eurytopic species dominate, while the fauna of the river is distinctly degraded.

2. Along with the growing pollution a decrease in the number of species and specimens of the fauna is observed. This is chiefly true of *Chironomidae*, *Ephemeroptera*, *Trichoptera*, *Coleoptera*, *Heteroptera*, and *Crustacea*. An increase in the pollution is accompanied by an increase in the numbers of species and specimens of *Oligochaeta*.

3. The results of the investigation suggest a great adaptation ability on the part of some of the aquatic fauna.

## STRESZCZENIE

W pracy przedstawiono wyniki badań nad makrofauną odcinka rzeki Warty znajdującego się w obrębie miasta Poznania. Badania terenowe prowadzone były w okresie od marca do października 1974 i 1975 roku na trzech stanowiskach usytuowanych wzdłuż biegu rzeki. Wszystkie badane stanowiska (zwłaszcza stanowiska 2 i 3) znajdują się pod silnym wpływem licznych ścieków, głównie komunalnych i przemysłowych, z miasta Poznania. W opracowaniu uwzględniono także nie publikowane materiały *Mollusca* zebrane w 1956 roku przez L. Bergera.

Z badanego odcinka Warty wykazano 87 gatunków przedstawicieli makrofauny, należących do następujących grup: *Turbellaria*, *Oligochaeta*, *Hirudinea*, *Mollusca*, *Isopoda*, *Amphipoda*, *Odonata*, *Ephemeroptera*, *Heteroptera*, *Trichoptera*, *Coleoptera*, *Chironomidae*, *Hydracarina*. Do gatunku udało się oznaczyć tylko 57,18% zebranego materiału. W faunie badanego odcinka rzeki Warty największy udział ilościowy mają *Oligochaeta* (31,37%), następnie *Chironomidae* (19,60%), *Mollusca* (14,50%) i *Hirudinea* (12,45%). Zdecydowanie najmniej liczne są *Hydracarina*. Ogólnie w makrofaunie Warty nie widać skrajnego zubożenia gatunkowego, dominują jednak gatunki o dużej eurytopowości. Fauna badanego odcinka Warty odznacza się więc wyraźną degradacją. W miarę wzrostu zanieczyszczenia obserwowano zmniejszanie się liczby gatunków i spadek liczebności fauny. Taki kierunek zmian charakteryzuje głównie *Chironomidae*, *Ephemeroptera*, *Trichoptera*, *Coleoptera*, *Heteroptera* i *Crustacea*. Wzrostowi zanieczyszczenia towarzyszy równocześnie wzrost liczebności i liczby gatunków *Oligochaeta*.

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