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Makrofauna denna zbiornika zaporowego w Rybniku będącego pod wpływem ciepłych wód zrzutowych elektrowni*

Bottom macrofauna of the dam reservoir at Rybnik remaining under the influence of hot discharged waters from the hot power station

Wpłynęło 21 grudnia 1977 r.

A b s t r a c t — The paper contains the results of the investigation on the bottom macrofauna of the reservoir at Rybnik which remains under the influence of hot discharged waters from the power station. The investigations covered the years 1974 to 1977. The bottom macrofauna of that reservoir is exceptionally poor, its number ranging from 909 individuals/m² (1975) to 1448 individuals/m² (1977). Larvae of *Chironomidae*, mainly of the genus *Procladius* prevailed in that reservoir. A limiting influence of hot discharged waters on particular groups of the bottom macrofauna was found in the reservoir, mainly in its upper part. Least tolerant to this influence were *Oligochaeta* which, in certain periods, disappeared from the benthos completely. *Chironomidae* larvae proved to be more resistant to high temperatures. The mollusc *Physa acuta* occurred in the region of hot water discharge.

Hot power stations discharge huge masses of hot water causing changes in the biotope. In the recent years hydrobiological investigations have been carried out in Poland, with particular intensity in the Lake of Konin (W r ó b l e w s k i 1977). They try to elucidate the effect of heated water and the direction in which the changes proceed. The temperature distribution in the reservoirs remaining under the influence of hot discharged waters depends on the distance from the discharge point. The closer to it the more intensive the thermal factor limiting the development of the whole biocenosis.

In the Soviet Union a great many papers have been recently published on the influence of hot discharged waters on the fauna. Apart from those

* Praca wykonana w problemie węzłowym 10. 2.

on the influence of hot discharged waters on the whole bottom macrofauna (Pidgajko 1971, 1974, Poddubnaja 1971, Skalskaja 1975, Zagubiženko 1974, Zgareva 1974) a number of them concerned only the influence on some groups, or even particular species (Kiticyna 1973, 1974, Maksymova 1974, Smirnova 1974).

Investigations carried out in the Lakes of Konin (Wróblewski 1977) gave interesting and valuable data. These concerned, first of all, the faunistic characteristics of numerous groups of the macrobenthos (*Turbellaria, Nemertini, Oligochaeta, Hirudinea, Mollusca, Ostracoda, Odonata, Heteroptera, Coleoptera, Hydracarina*). In those elaborations attention was paid to the positive respectively negative effect of the heated waters on the macrobenthos. Usually a negative effect of the „thermal pollution" was found; both the specific composition and number and biomass were in these reservoirs lower than in not heated waters. Phenological observations pointed to a development accelleration in the *Oligochaeta, Chironomidae* (Pidgajko 1971, Poddubnaja 1971), *Ostracoda* (Sywula 1977), *Odonata* (Mielewczyk 1977), *Hydracarina* (Biesiadka 1977). Moreover, irregular entogenesis, either larger (Kitycyna 1973, Pidgajko 1971), or smaller (Sywula 1977) body sizes were found to occur.

Characteristics of the reservoir

The retention reservoir Rybnik on the River Ruda has been exploited since March 1972. Since that time investigations on the macrobenthos have been carried out in it. In the first two years the investigations were limited to number registration (Bielańska 1973, Grzybowska 1973, 1974). In 1974 investigations on the biomass were begun.

Since 1973 the reservoir of a surface area 555 ha and maximum depth 11 m has been receiving hot discharged waters from the power station at Rybnik. This causes that the water temperature of the layer near the bottom never drops below 5°C. The bottom of the reservoir, which before inundation used to be meadows, became somewhat slimy, more intensively in the zone near the dam. Sediments in that part of the reservoir originating from the River Ruda are of black colour caused by accumulation of toxic compounds (mine waters). In the water layer near the bottom oxygen occurs within the range from 5 to 10 mg O_2/l. Oxygen saturation does not decrease below 60 per cent (Pasternak 1978). At the western bank the bottom is covered with slimy-sandy sediments and with a decaying plant mass; at the eastern bank sand shelves are formed. Sand lies also at station I located in the neighbourhood of the discharge

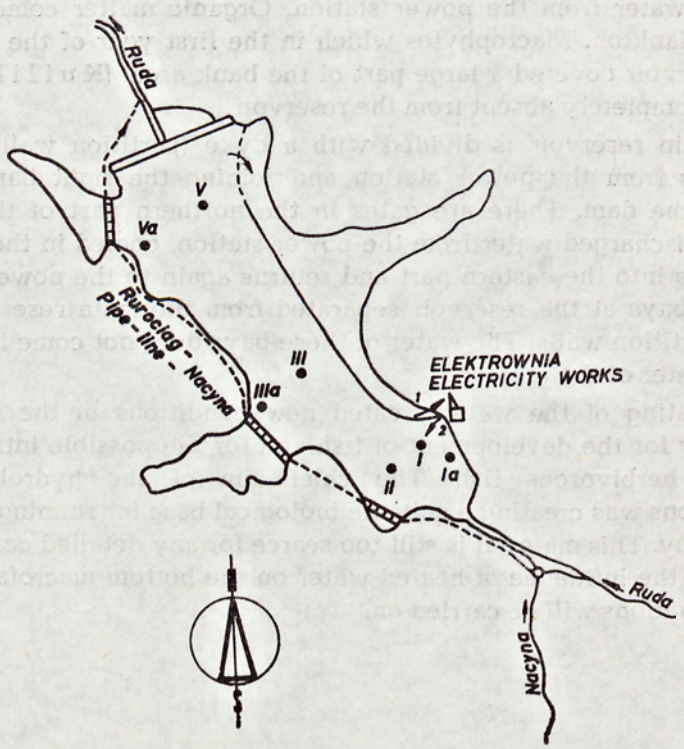
of heated water from the power station. Organic matter comes mainly from the plankton. Macrophytes which in the first year of the existence of the reservoir covered a large part of the bank area (K u f l i k o w s k i 1978) are completely absent from the reservoir.

The main reservoir is divided with a dyke (partition wall) running northwards from the power station and joining the right bank in the region of the dam. There are gates in the northern part of that dyke; there the discharged water from the power station, cooled in the western part, passes into the eastern part and returns again to the power station. There are bays at the reservoir separated from the main reservoir with earthen partition walls. The water of these bays does not come in contact with the water of the reservoir.

The heating of the water created new conditions in the reservoir, particularly for the development of fish and for the possible introduction of exotic herbivorous fish. The chief aim of the hydrobiological investigations was creating a suitable biological base for running a proper fish economy. This material is still too scarce for any detailed conclusions concerning the influence of heated water on the bottom macrofauna, and the investigations will be carried on.

Material and method

Samples were collected once (1 sample) a month during the whole year at seven stations (4 in the central zone and 3 in the litoral zone) (fig. 1). The stations in the central zone represented the part of the reservoir within the former riverbed of the River Ruda, having a slimy and slimy-sandy bottom. The stations of the litoral zone represented the western part of the reservoir where the bottom was slimy with decayed plant remains. The stations were chosen on the basis of spatial distribution of water temperature. The aim of the investigations was to determine the influence of the thermal factor on the distribution of the bottom macrofauna. The eastern part of the reservoir where the bottom consisted exclusively of pure sand deposits of very poor bottom macrofauna was not included into these investigations. The material was collected with Eckman type grabs (225 cm^2); two grabs being used for one sample. The samples were subsequently washed in a net of mesh size 0.5 mm. The collected animals were identified in vivo at the laboratory in the Hydrobiological Station of the Polish Academy of Sciences at Goczałkowice and subsequently preserved in 4 per cent formaline. Every time the water temperature of the layer near the bottom was taken. The distribution



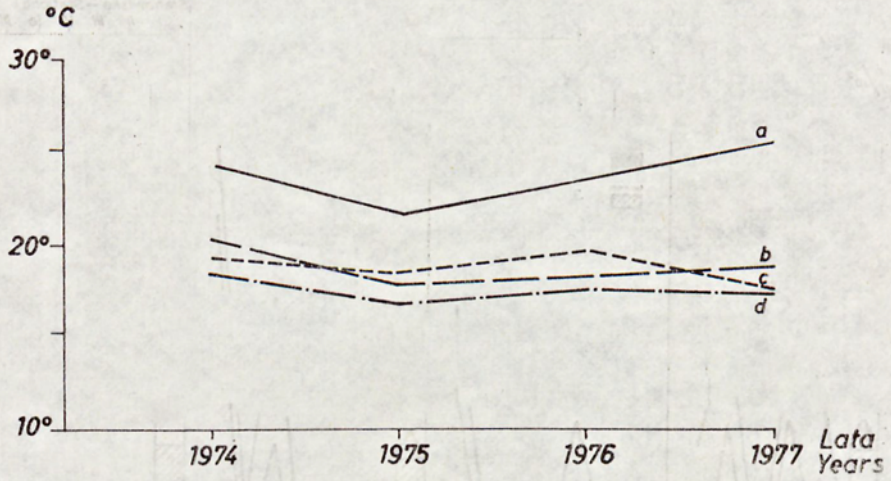
Ryc. 1. Rozmieszczenie stanowisk poboru prób w zbiorniku Rybnik. 1 — pobór wody; 2 — zrzut wody podgrzanej

Fig. 1. Distribution of water sampling stations in the reservoir Rybnik. 1 — water sampling; 2 — hot water discharge

of the means of the annual water temperature at particular stations in the reservoir was presented in fig. 2. Apart from the number, the biomass of particular groups of the bottom macrofauna was determined every time.

General characteristics of the bottom macrofauna in the years 1974 to 1977

In the years 1972 to 1973, both before and after inundation, investigations were carried out by the research workers of the Silezian University in Katowice (Bielańska 1973, Grzybowska 1973, 1974). In 1972 seasonal investigations on the catchment area of the reservoir showed



Ryc. 2. Rozkład średnich rocznych temperatur wody na poszczególnych stanowiskach w latach 1974—1977. a stanowisko I; b — stanowisko II; c — stanowisko III; d — stanowisko V

Fig. 2. Distribution of annual water temperature means at particular stations in the years 1974—1977. a — station I; b — station II; c — station III; d — station V

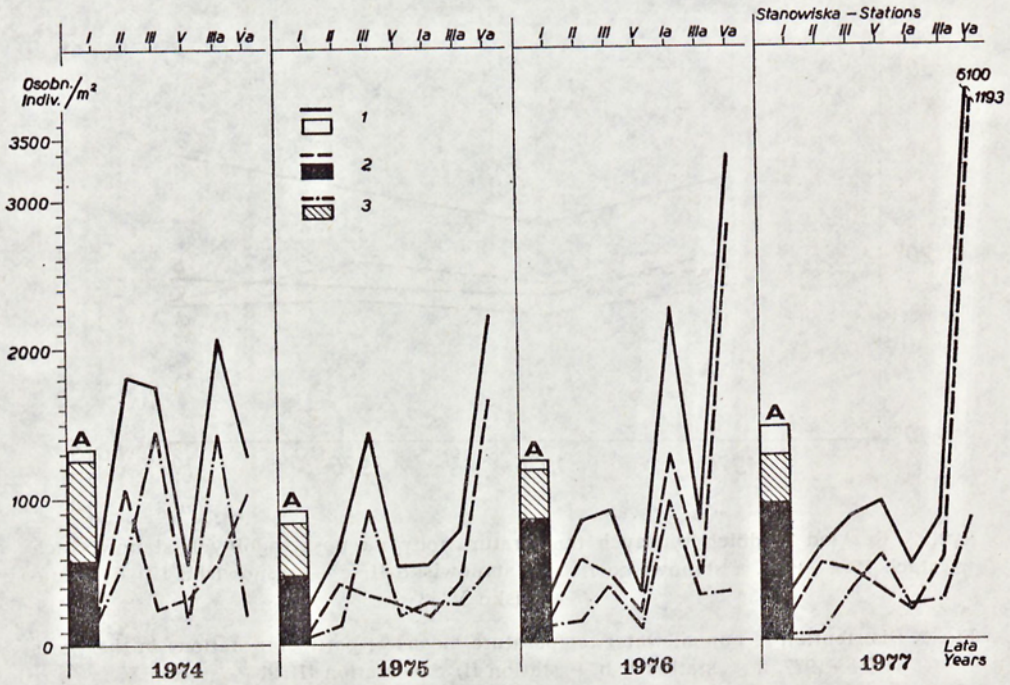
a overwhelming dominance of *Tubificidae* (99 per cent) in the macrobenthos and a gradual increase in the number of *Chironomidae*.

In 1973 investigations were carried out in the main reservoir. Evident differentiation of the fauna was found during the season, this being caused by a great variety of the substrate in the newly inundated reservoir. A characteristic feature of the formation of the bottom macrofauna in that year was a continuous increase in the share of the *Oligochaeta*. In the central part of the reservoir where the *Oligochaeta* constituted periodically over 90 per cent of the macrofauna they were found in great numbers reaching up to 15 300 individuals/m². Apart from the *Oligochaeta*, larvae of *Chironomidae*, in the number of 8000 individuals/m² were the second group as to number.

Throughout the period of the investigations carried out by the author (1974 to 1977) the stations of the central and litoral zone were characterized by similar environment conditions. The water temperature varied from 5 to 27°C. The highest temperature was recorded at station I, the lowest at station V (fig. 2).

In 1974 the mean number of the bottom macrofauna equalled 1338 individuals/m², the biomass 2606 mg/m². The most abundant benthos was found at station IIIa and the least abundant one at station V (fig. 3, Table I).

In 1975 the bottom macrofauna was very poor. The mean number was



Ryc. 3. Przebieg zmian liczebności makrofauny dennej na poszczególnych stanowiskach zbiornika Rybnik i średnie roczne liczebności (A) w latach 1974—1977. 1 — makrofauna denna ogółem; 2 — *Chironomidae*; 3 — *Oligochaeta*

Fig. 3. Course of changes in the numbers of the bottom macrofauna at particular stations in the reservoir Rybnik and annual means of number (A) in the years 1974—1977. 1 — total bottom macrofauna; 2 — *Chironomidae*; 3 — *Oligochaeta*

909 individuals/m², the biomass 1944 mg/m². The respective shares of the *Chironomidae* and *Oligochaeta* larvae were similar. At all stations of the central zone a decrease both in number and in biomass took place. In that group of stations station III was richest in the bottom macrofauna. Among the stations of the litoral zone station Va proved to be the richest. The nearer to the upper part of the reservoir the poorer the stations.

In 1976 the mean number was slightly higher than in 1975, whereas the biomass was almost identical. The number of the *Chironomidae* larvae increased twice. The bottom macrofauna was poor at the stations of the central zone, especially at the stations I and V. In the litoral zone station Va was the richest station. In August larvae of the *Chironomidae* (*Endochironomus tendens* — 6000 individuals/l) occurring in masses, were caught into the plankton net. Since in 1976 this species was not found in the samples of the bottom macrofauna it should be supposed that these larvae developed from eggs laid into the reservoir by adult insects living

Tabela I. Liczebność i biomasa makrofauny dennej w zbiorniku Rybnik w latach 1974-1977 (wartości średnie z terminów poboru materiału). L - liczebność osobn./m^2; B - biomasa mg/m^2

Table I. Number of biomass of the bottom macrofauna in the reservoir Rybnik in the years 1974-1977 (mean values for sampling dates of material). L - number of indiv./m^2; B - biomass in mg/m^2

Stanowisko Station	Rok Year	Ogółem - Total		Chironomidae		Oligochaeta		Lamellibranchia		Gastropoda		Inne - Others	
		L	B	L	B	L	B	L	B	L	B	L	B
I	1974	566	1395	230	396	210	216	11	160	65	357	50	266
	1975	265	753	79	81	56	76	5	28	92	453	33	115
	1976	328	788	180	264	112	400	-	-	20	80	16	44
	1977	336	712	196	168	44	80	8	32	64	372	24	60
II	1974	1806	2973	1067	1466	630	1255	3	6	-	-	106	246
	1975	654	1318	420	621	122	191	3	15	3	20	106	471
	1976	808	1344	564	712	140	140	12	196	-	-	92	296
	1977	628	1116	524	816	56	108	8	28	-	-	40	164
III	1974	1753	3315	235	656	1450	2442	20	66	13	71	35	80
	1975	1425	3935	323	560	916	2010	48	351	41	647	97	367
	1976	888	1924	448	760	384	816	16	144	16	108	24	96
	1977	832	1140	468	708	352	392	8	16	-	-	4	24
V	1974	550	3623	322	2990	162	309	3	1	6	76	57	247
	1975	515	1873	265	1168	188	402	-	-	3	23	59	280
	1976	315	970	193	576	89	239	-	-	-	-	33	155
	1977	929	1957	340	945	571	889	-	-	-	-	18	123
Ia	1975	533	1504	189	322	277	788	-	-	18	156	49	238
	1976	2240	2333	1260	1335	952	205	19	775	-	-	9	18
	1977	495	2978	196	205	224	280	19	131	47	159	9	2203
IIIa	1974	2070	2839	553	462	1425	1848	7	116	25	268	60	145
	1975	763	1555	417	461	267	771	31	137	-	-	48	186
	1976	805	2009	455	1078	308	735	7	28	-	-	35	168
	1977	819	1355	532	770	266	550	-	-	-	-	21	35
Va	1974	1283	1489	1030	1070	185	188	34	11	17	203	17	17
	1975	2210	3022	1642	1851	519	685	8	56	13	359	28	71
	1976	3268	4418	2809	3309	336	442	3	25	30	512	90	130
	1977	6100	5133	4193	3010	828	912	2	7	30	154	1047	1050
Średnio: Mean:	1974	1338	2606	573	1173	677	1043	13	60	21	163	54	167
	1975	909	1994	476	723	335	703	14	84	24	237	60	247
	1976	1236	1969	844	1148	332	425	8	167	9	100	43	129
	1977	1448	2056	921	946	334	459	6	30	20	98	167	523
Ruda	1977	12733	27881	3094	3325	9191	17962	70	441	21	1298	357	4855
Nacyna	1977	286622	84882	924	770	285684	84098	-	-	-	-	14	14
Pniowiec	1977	11424	42476	308	168	84	2016	28	140	28	308	10976	39844
Grabownia	1977	3668	3528	1148	1008	2436	2212	-	-	-	-	84	308

in the bays. Hence, the bays are a source of supplying insect larvae which in the reservoir are immediately eaten up by fish.

Apart from taking samples, additional investigations were carried out in 1977 in the tributaries (the Rivers Ruda and Nacyna) and in the bays separated from the reservoir (fig. 1, Table I and IV). The investigations showed a new, though small increase in the number and biomass of the bottom macrofauna in the reservoir. *Chironomidae* and *Oligochaeta* remained on a similar level with respect to number and biomass. The participation of other groups of the bottom macrofauna increased, espe-

cially that of *Ceratopogonidae, Trichoptera,* and *Ephemeroptera.* In the group of stations of the central zone an increase in number and biomass was found at station V. In the group of the stations of the litoral zone the richest one was station Va where the maximum number was reported in March (19 320 individuals/m^2), and the minimum in May (576 individuals/m^2).

Investigations carried out in the bays and tributaries showed an unusually abundant bottom macrofauna (Table I). Especially numerous was the benthos in the River Nacyna where *Oligochaeta* dominated. Among the bays, a richer benthos was found in the bay of Pniowiec. The above investigation have confirmed that the bays constitute an important complementary reserve of nutrient compounds for the reservoir.

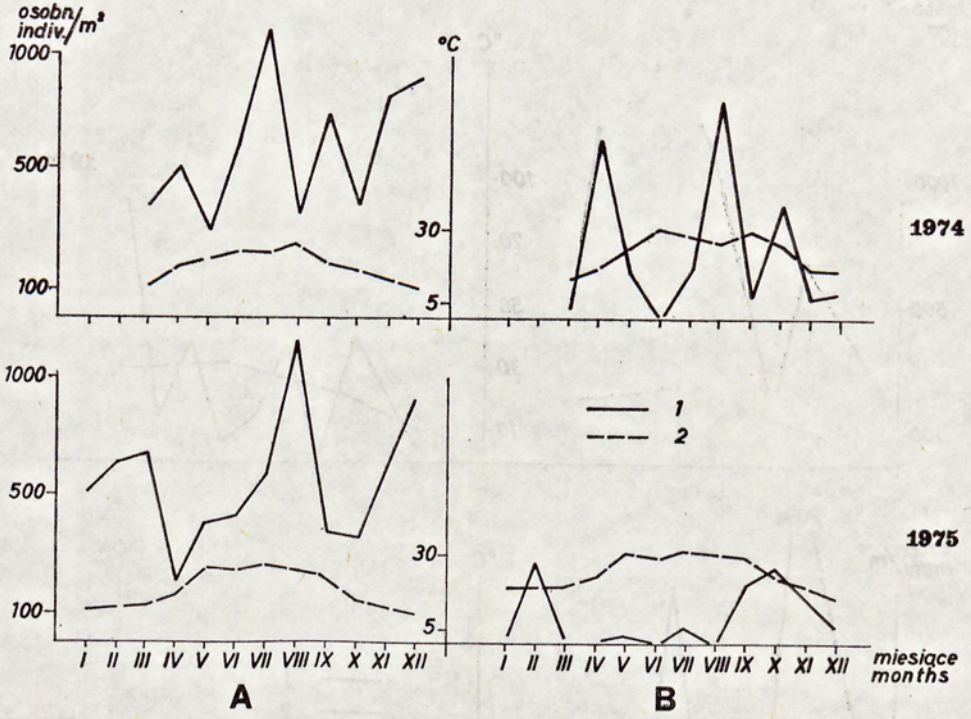
Characteristics of the bottom macrofauna at station I

Station I was located at 50 m distance from the discharge point of hot waters from the power station. The depth at that station varied from 1.5 to 2 m. The bottom was covered with a thick layer of sand with a small addition of detritus. The water temperature of the layer close to the bottom varied in 1974 from 14°C to 31°C (mean temperature 23°C), in 1975 from 15°C to 31°C (mean temperature 24°C), in 1976 from 10°C to 31°C (mean temperature 25°C), and in 1977 from 19°C to 32°C (mean temperature 26°C). The annual mean temperature in the years 1974 to 1977 systematically increased by 1°C.

The most numerous bottom macrofauna was reported in 1974. In 1975 a decrease in the number and in biomass was observed. In the successive years a small increase in the number was found, the biomass, however, remained similar. Larvae of *Chironomidae,* especially numerous in 1974 and 1977 were the dominating group. The genus *Procladius,* similarly as at other stations, dominated overwhelmingly and the whole dynamics of the number of the benthos depended on that genus. This form and *Polypedilum nubeculosum* seem to be most tolerant to increased temperature.

Figs 4 and 5 present the course of changes in the number of *Chironomidae* larvae in particular years at station I and in the central part of the reservoir. Basing upon the number of the larvae the time of emergence of the adults can be approximately determined.

On these bases it can be assumed that in 1974 the first and the last emergence of imagines took place at station I in March and November, respectively. In the central part the first emergence took place in May and the last in October.



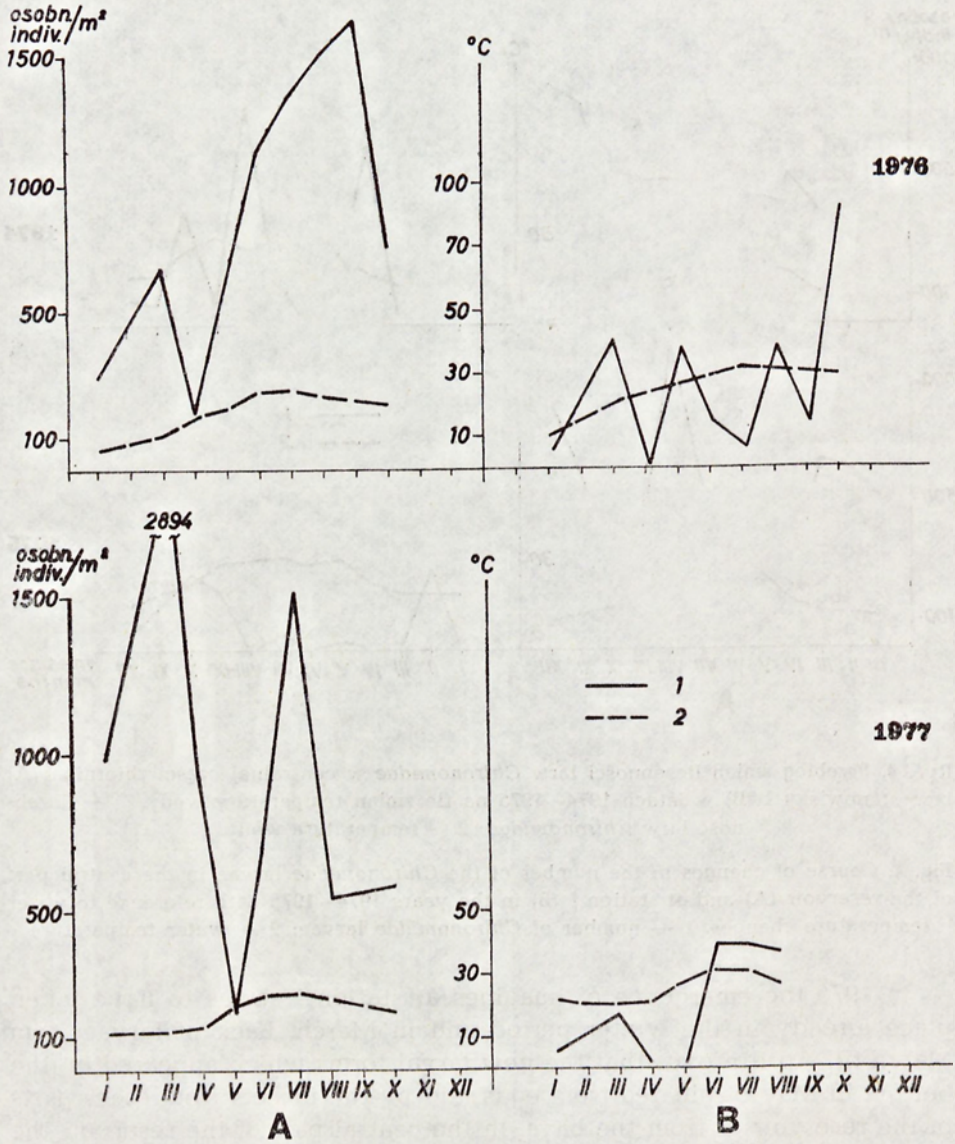
Ryc. 4. Przebieg zmian liczebności larw *Chironomidae* w centralnej części zbiornika (A) i na stanowisku I (B) w latach 1974—1975 na tle zmian temperatury wody. 1 — liczebność larw *Chironomidae*; 2 — temperatura wody

Fig. 4. Course of changes in the number of the *Chironomidae* larvae in the central part of the reservoir (A) and at station I (B) in the years 1974—1975 with reference to water temperature changes. 1 — number of *Chironomidae* larvae; 2 — water temperature

In 1975 the emergence of imagines at station I seems to have taken place already in the winter period and in March. Lack of larvae from March till April proves that the new larval forms which appeared on the bottom in May originated from eggs laid by the insects from other parts of the reservoir or from the bays. In the central part of the reservoir the first emergence took place in April.

Similarly as in 1975 so also in 1976 and 1977 the first emergences of adult forms could have also taken place in the winter period, the next one in the years 1976 in May, and in 1977 in April. In 1976 and 1977 the first emergence took place in the central part most probably in April and May respectively.

A higher water temperature than that at the other stations caused an earlier beginning of the development cycle and its considerable extension by 2 months on the average. Seasonal variations depend in fact



Ryc. 5. Przebieg zmian liczebności larw *Chironomidae* w centralnej części zbiornika (A) i na stanowisku I (B) w latach 1976—1977 na tle zmian temperatury wody. 1 — liczebność larw *Chironomidae*; 2 — temperatura wody

Fig. 5. Course of changes in the number of the *Chironomidae* larvae in the central part of the reservoir (A) and at station I (B) in the years 1976—1977 with reference to water temperature changes. 1 — number of *Chironomidae* larvae; 2 — water temperature

on climatic conditions. An important role is played, however, by local environmental conditions including the biocenotic ones.

Oligochaeta occurred more numerously only in 1974. In the successive years their number decreased and in some periods when the water temperature increased above 30°C they disappeared completely from the benthos.

Mollusca were represented at that station by *Gastropoda,* with maximum number in 1975.

In 1974 the warm stenotherm species, *Physa acuta,* whose mean number increased in 1977 to 32 individuals/m² occurred for the first time.

Characteristics of particular groups of the bottom macrofauna

Larvae of *Chironomidae* (Table I) were a dominating group among the bottom zoocenosis. At stations I, II, and Va they dominated during the whole time, whereas, at station III only in 1976 and 1977. In 1974, 1975, and 1976 they dominated at station V and in 1977 at station IIIa. 31 taxonomic units were identified in the reservoir (Tables II, III) and 17 in the tributaries and bays (Table IV). The subfamily *Chironominae,* the tribe *Chironomini* were dominant. In this subfamily dominated: *Cryptochironomus* ex gr. *defectus* and *Polypedilum* ex gr. *nubeculosum.* In the reservoir at Rybnik the occurrence of *Cryptochironomus* ex gr. *defectus* was especially numerous in the litoral zone and at station I. At that station and at the others in the litoral zone *Polypedilum nubeculosum* was a frequent component of the bottom macrofauna. It is very popular in Western Europe. B r u n d i n (after Š i l o v a 1976) called that species a southern one. Periodically *Chironomus* f. l. *plumosus* was found mainly at stations III, V, and Va, while *Chironomus* f.l. *thummi,* typical of polluted waters, was found at stations I and Va.

The tribe *Tanytarsini* was represented by three species, mainly *Tanytarsus* ex gr. *gregarius* and *T.* ex gr. *mancus.*

The subfamily *Tanypodinae* was represented by five species where the genus *Procladius* markedly dominated.

The dynamics of the number of the *Chironomidae* always depended on that genus. It is a predatory form often mentioned as a rival of fish feeding on the bottom fauna. Its food consists mainly of *Chironomidae* and *Oligochaeta* (L u f i e r o v 1961). An analysis of the alimentary canal of the larvae of that genus originating from various reservoirs showed that bottom crustaceae (I z v e k o v a 1973) constituted its

Tabela II. Średnia liczebność Chironomidae centralnej strefy w zbiorniku Rybnik w latach 1974-1977 w przeliczeniu na 1 m^2 powierzchni dna
Table II. Mean number of Chironomidae of the central zone in the reservoir Rybnik in the years 1974-1977 in re-counting per 1 m^2 of bottom area

Taksony - Taxons / Rok-Year	Stanowisko - Station															
	I				II				III				V			
	1974	1975	1976	1977	1974	1975	1976	1977	1974	1975	1976	1977	1974	1975	1976	1977
Ablabesmyia ex gr. monilis L.		2				14										
Procladius Skuse	138	39	156	87	712	397	310	463	129	271	377	392	104	186	176	294
Cricotopus ex gr. silvestris F.								11			14					
Prodiamesa bathyphila Kieff.		5														
- olivacea Mg.						9										
Orthocladinae non. det.							7					15				
Chironomus f. l. plumosus L.					18				24	5		14	198	49		12
Cryptochironomus ex gr. defectus Kieff.	50	14		42	88		45	7		9		18				12
- ex gr. pararostratus Lenz.	16								18							
- ex gr. fuscimanus Kieff.				7												
Cryptochironomus sp.		4														
Kinfeldia sp.							15					11				
Endochironomus tendens F.					38								4	2		
Glyptotendipes ex gr. gripekoveni Kieff.		1			36		11		8	12						
Limnochironomus ex gr. nervosus Staeg.			17	11			56	14	12	26						
- tritomus Kieff.							21	11	8		46					
Microtendipes ex gr. chloris					34											
Pentapedilum exsectum Kieff.					23											
Polypedilum convictum Walk.				7												
- ex gr. nubeculosum Mg.		9	7	42			49	18	20		11	7	8	5		
- ex gr. scalaenum Schr.	8				36		49		8			4				22
Sergentia coracina Zett.					28											
Tanytarsus ex gr. gregarius Kieff.	14													23	17	
- ex gr. mancus Wulp.	4	5														
Poczwarki Chironomidae / Pupae of					54				8			7	8			
Suma - Sum total	230	79	180	196	1067	420	564	524	235	323	448	468	322	265	193	340

Tabela III. Średnia liczebność Chironomidae strefy przybrzeżnej w zbiorniku Rybnik w latach 1974-1977 w przeliczeniu na 1 m^2 powierzchni dna

Table III. Mean number of Chironomidae of the litoral zone of the reservoir Rybnik in the years 1974-1977 in re-counting per 1 m^2 of bottom area

Taksony - Taxons / Rok - Year	Stanowisko - Station										
	Ia			IIIa				Va			
	1975	1976	1977	1974	1975	1976	1977	1974	1975	1976	1977
Ablabesmyia ex gr. monilis L.											20
Procladius Skuse	189	786	96	470	273	382	389	647	922	707	1915
Tanypus kraatzi Kieff.											8
- punctipennis Mg.							6				
Cricotopus ex gr. algarum Kieff.											39
- ex gr. silvestris F.											47
Psectrocladius ex gr. psilopterus Kieff.					21		3			32	179
Chironomus f. l. plumosus L.				11	2		9	37		235	368
- semireductus Lenz.									64		
- thummi Kieff.		28									67
Cryptochironomus ex gr. defectus Kieff.		59	31	11	23		11	56	127	612	622
- ex gr. conjugens Kieff.								19			
- ex gr. pararostratus Lenz.						6	6				
- ex gr. fuscimanus Kieff.							16	28			
Cryptochironomus sp.									5		
Glyptotendipes ex gr. gripekoveni Kieff.								47	209	315	204
- polytomus Kieff.											40
Limnochironomus ex gr. nervosus Staeg.				11	7	11		37	20		75
- tritomus Kieff.									20		
Microtendipes ex gr. chloris					16					20	26
Polypedilum breviantennatum Tsh.											22
- convictum Walk.										45	
- ex gr. nubeculosum Mg.		291	34	50	33	22	40	112	109	428	140
- ex gr. scalaenum Schr.		57			7	34	12	28	31	300	209
Polypedilum sp.							3		5		
Tanytarsus ex gr. gregarius Kieff.					14		6	19	56	17	51
- ex gr. mancus Wulp.			25		5		25		74	92	98
- ex gr. lobatifrons Kieff.											25
Tanytarsus sp.											19
Chironomidae non. det.		39			16		6			6	
Poczwarki Pupae of Chironomidae			10								19
Suma - Sum total	189	1260	196	553	417	455	532	1030	1642	2809	4193

content. Similar observations were made by the author. This proves that at an abundant microbenthos and bottom plankton larvae of that species develop well in spite of the lack of any larvae of other animals and of *Oligochaeta* which usually are the main nutrient compound. Its great developmental possibilities are also pointed to by the body sizes usually exceeding those obtained in reservoirs in natural conditions, which has been also corroborated by other investigations (P i d g a j k o 1971).

The subfamily *Orthocladinae* was represented by five species occurring, however, sporadically and at few stations only.

In the bottom the larvae of *Chironomidae* are the main nutrient compound for fish. The summer number minima were caused by emergences of imagines and a more intensive feeding of fish. The higher

Tabela IV. Średnia liczebność Chironomidae w dopływach i zatokach zbiornika Rybnik z terminów badań 1977 r. w przeliczeniu na 1 m^2 powierzchni dna

Table IV. Mean number of Chironomidae in the tributaries and gulfs of the reservoir Rybnik for the investigation dates in 1977 in re-counting per 1 m^2 of bottom area

Taksony - Taxons	Stanowiska - Stations			
	Ruda	Nacyna	Pniowiec	Grabownia
Ablabesmyia lentiginosa Fries.	434	-	-	252
Procladius Skuze	406	-	-	84
Cricotopus ex gr. algarum Kieff.	721	-	28	-
- ex gr. silvestris F.	238	224	-	-
- laticentatus Tsh.	74	-	-	-
- brevipalpis Kieff.	60	-	-	-
- versodentatus Tsh.	154	-	-	-
Prodiamesa bathyphila Kieff.	147	-	-	-
Psectrocladius ex gr. psilopterus Kieff.	61	252	140	308
Syndiamesa nivosa	-	42	-	-
Cryptochironomus ex gr. defectus Kieff.	-	182	-	-
Chironomus f.l. thummi Kieff.	25	-	-	-
Endochironomus ex gr. dispar Mg.	238	-	-	-
- ex gr. tendens F.	98	-	-	-
Limnochironomus ex gr. nervosus Staeg.	-	182	140	504
Pentaneurum exsectum Kieff.	172	-	-	-
Polypedilum convictum Walk.	168	-	-	-
Poczwarki Pupae of Chironomidae	98	42	-	-
Suma - Sum total	3094	924	308	1148

water temperature caused accelleration of the development rate, hence, a higher number of developmental cycles. Emergences of imagines took possibly place already in the winter period. The air temperature they were exposed to was too low and all of them perished. In the samples from December to January there were only few *Chironomidae* larvae. In spring an increase in their number took place. They developed probably also from eggs laid by adult forms from the bays.

The second faunistic group in the reservoir as to the number and biomas were the *Oligochaeta*. They occurred most numerously in 1974 mainly at stations III and IIIa. In a number of reservoirs with heated water they constituted a dominating group (P i d g a j k o 1971, S k a l s k a j a 1975). Increased water temperature causes acceleration and extension of the development cycle by 1 to 2 months. A too high temperature, however, limits the occurrence of those animals in the reservoir at Rybnik. Attention was also drawn to the absence of *Oligochaeta* in the discharge zone where the temperature exceeded 30°C (station I). The investigations carried out in 1977 showed exceptional abundance of *Oligochaeta* in the bay Grabownia and in the tributaries Ruda and Nacyna.

A very important group of the bottom macrofauna was constituted by *Mollusca*, with *Lamellibranchia* and *Gastropoda dominating* in the central and littoral zone, respectively. *Lamellibranchia* were represented by the family *Sphaeridae*, genus *Pisidium* (*P. amnicum, P. subtruncatum, P. nitidium, P. pulchellum* and *Pisidium* sp.) and *Sphaerium lacustre*.

Gastropoda were represented by the family *Planorbidae* (*Planorbarius corneus, Gyraulus albus, Anisus vortex, A. spirorbis* and *Anisus* sp.), *Physidae* (*Physa fontinalis* and *P. acuta*), and *Lymneidae* (*Radix limosa, R. peregra*).

In 1974 a warm stenotherm species, *Physa acuta*, was caught at station I. It became much more numerous in the following years. In 1975 it was found both at station I and station Ia in a number not exceeding 5 individuals/m². In 1976 its mean number was 7 individuals/m² and in 1977 32 individuals/m². At the same time *Physa fontinalis*, of a mean number 3 individuals/m² and 8 individuals/m² in 1976 and 1977 respectively was found at station Va. Occurrence of *Physa acuta* in the region of hot water discharge from the power station and of *Physa fontinalis* in the zone less exposed to the influence of heated waters was already mentioned by Koops (after Soszka 1976).

This species is one of the most characteristic ones of the reservoir at Rybnik.

The other groups of the bottom macrofauna: *Ephemeroptera*, *Trichoptera*, *Hirudinea*, and *Crustacea* were represented in the littoral zone and *Ceratopogonidae* in the central zone, but in negligible numbers only.

Conclusions

Some changes are also observed in the bottom macrofauna communities in the reservoir at Rybnik which constitutes a particular thermal environment. Investigation results indicate to a very poor bottom macrofauna. This is caused by:

— a complete absence of macrophytes,
— a considerable amount of toxic components brought in by the Rivers Ruda and Nacyna which accumulate in the reservoir,
— a high temperature of discharged water, especially at station I which influences some faunistic populations in a negative way.

Macrophytes, which have perished in the recent years in the whole reservoir are an important substrate for the multiplying fauna. A great influence is exerted on the bottom fauna by the waters of the Rivers Ruda and Nacyna. The water temperature, especially high at the discharge point (station I) where it often exceeds 30°C, is an important factor limiting the development of the bottom fauna. In that region that factor is specially important. *Oligochaeta* react to hot water discharges more intensively. At certain periods they were completely absent at station I. More tolerant to higher water temperatures proved to be the larvae of *Chironomidae*, mainly of the genus *Procladius* and *Polypedilum nubeculosum*. The water temperature also caused changes in the entogenesis and larger body dimensions; this was found in the case of *Procladius* at station I in the years 1975 to 1976.

The mollusc *Physa acuta*, occurring constantly at station I since 1974 was a characteristic representative of the warm stenotherm forms in that reservoir.

STRESZCZENIE

W pracy przedstawiono wyniki badań nad makrofauną denną zbiornika Rybnik, będącego pod wpływem ciepłych wód zrzutowych z elektrowni. Badania przeprowadzone w latach 1974—1977 wykazały bardzo ubogą makrofaunę denną o średniej dla całego zbiornika liczebności w 1974 r. 1338 osob./m², w 1975 r. 909 osob./m², w 1976 r. 1236 osob./m² i w 1977 r. 1448 osob./m². Uboga makrofauna denna spowodowana była:

— całkowitym brakiem makrofitów w zbiorniku;
— znaczną ilością składników toksycznych;
— wysoką temperaturą wody zrzutowej wpływającą niekorzystnie na wiele populacji zwierzęcych.

Dominowały larwy *Chironomidae* (31 jednostek taksonomicznych), szczególnie rodzaj *Procladius*. Obok niego częstymi komponentami były *Cryptochironomus defectus* i *Polypedilum nubeculosum*. Drugą pod względem liczebności grupą były *Oligochaeta*, najliczniej występujące w 1974 r. (677 osob./m²). Ważną grupę stanowiły *Mollusca*. Wśród *Gastropoda* była *Physa acuta*, charakterystyczny składnik fauny ciepłolubnej. Na stanowisku I stwierdzono limitujące działanie podwyższonej temperatury wody zrzutowej na poszczególne populacje. Wysoka temperatura wody (ponad 30°C) była szczególnie uciążliwa dla *Oligochaeta*. Bardziej tolerancyjne były larwy *Chironomidae*, zwłaszcza *Procladius* i *Polypedilum nubeculosum*. Podwyższona temperatura wody powodowała ponadto wcześniejsze rozpoczęcie cyklu rozwojowego larw *Chironomidae* i jego przedłużenie o 1—2 miesiące.

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