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# Zoobenthos of the small rheolimnic Wisła-Czarne dam reservoir (Southern Poland) in the period 1975—1984*

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Abstract — The characteristics of the zoobenthos and the process of its formation in a rheolimnic dam reservoir, with a special consideration of *Chironomidae*, are described. In the central zone of the reservoir (Station I) the most numerous zoobenthos appeared in the second year after filling, followed by a constant decrease in its number and biomass. In the bay zone of the reservoir (Stations II and III) the largest numbers of zoobenthos were noted in the eighth year. *Oligochaeta* predominated quantitatively at all stations (70—98%).

Key words: dam reservoir, zoobenthos, abundance, succession.

## 1. Introduction

The Wisła-Czarne dam reservoir was built in 1974 and since 1975 complex hydrobiological investigations have been carried out there. They included the study of the zoobenthos, a synthesis of results from the period 1975—1984 being given in the present paper. The aim of the work was to observe the process of zoobenthos formation in a rheolimnic reservoir and to compare it with the zoobenthos of other dam reservoirs, chiefly with the limnic reservoir at Goczałkowice, located 60 km away in the lower course of the River Vistula.

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* The investigation was carried out within Project No MR.II-15.

## 2. Study area

The Wisła-Czarne dam reservoir was constructed at the confluence of the Biała Wisełka and Czarna Wisełka streams, which then flow on as the River Vistula (figs 1, 2). The Czarna Wisełka stream, 9.3 km in

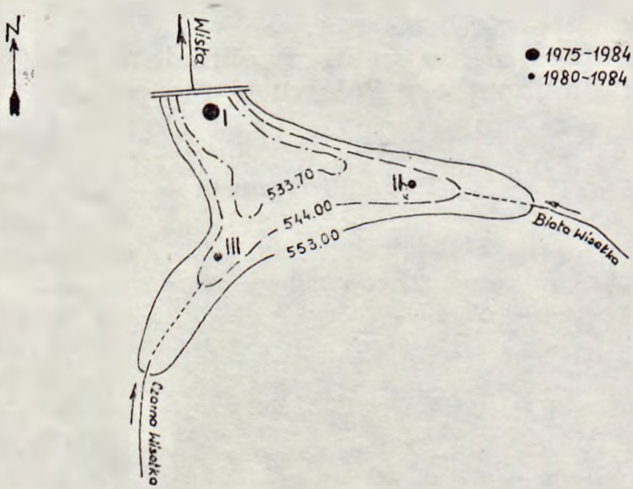


Fig. 1. The distribution of sampling stations in the Wisła-Czarne reservoir

length, drains the southwestern slopes of Mount Barania Góra, while the Biała Wisełka stream (6.7 km) flows from its northwestern ones. The Czarna Wisełka valley is the narrower, with a fairly uniform gradient of the bottom, and slopes entirely covered with forest. The upper part of the Biała Wisełka valley is fairly deep and closed with steep walls, the stream here forming several waterfalls, while in its lower course it flows through a wide asymmetrical valley. In 1973 an experimental filling of the reservoir was carried out and the water was damned up to the datum level of 533 m above sea level. The final filling was begun on January 1, 1974. In March of that year the reservoir reached the functional datum of damning of 547.50 m above sea level, with a surface area of 30 ha and volume of 2817 thousand $m^3$. The largest area of the reservoir amounts 50 ha, the volume to 5 million $m^3$, and the depth at the dam to 30 m. The western bank of the reservoir is more gently sloped, that on the eastern side being steeper (fig. 2). The reservoir is of the gutter type, rheolimnic, with a water exchange frequency of 9—14 times annually (K a s z a 1986).

From 1975—1980 samples were collected at one station (station I) in the central zone near the dam (fig. 1), where the depth varied from 15—20 m and the bottom was covered with a layer of mud. The period 1981—1984, however, sampling was carried out at 3 stations: the central

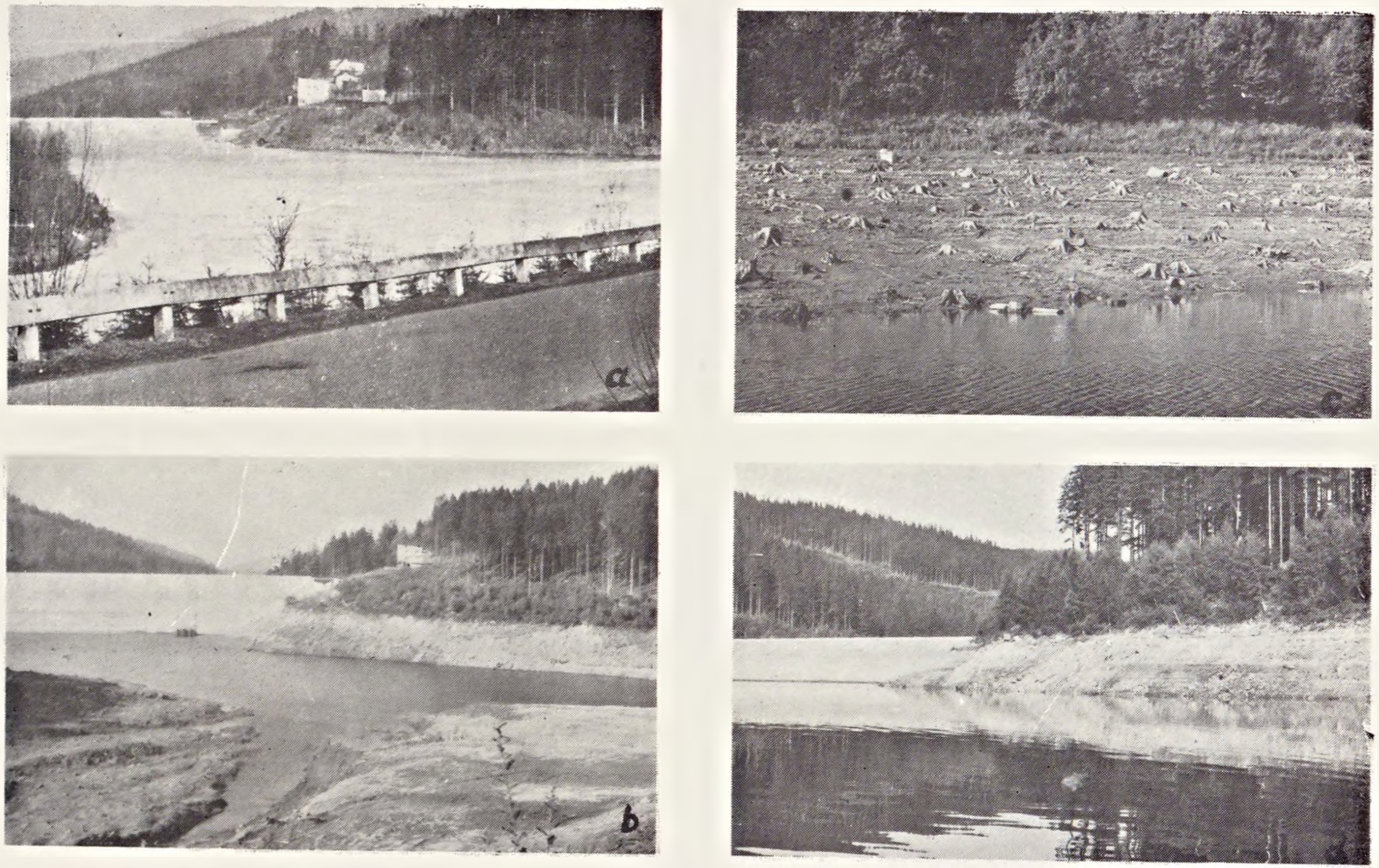

Fig. 2. The Wisła-Czarne reservoir at the bay of the Czarna Wisełka stream. a — high water level; b — low water level; c — a fragment of the western bank; d — a fragment of the eastern bank

one (station I) and in the bays of the Biała Wisełka (station II) and Czarna Wisełka (station III) streams. The two last stations were 3—6 m in depth, their bottom being stony and muddy with an admixture of detritus.

## 3. Material and methods

Samples were taken 4—5 times annually in the period May-October. The sampling was performed with a Ekman-Birge type bottom grab, its sampling area being 22 $cm^2$, or with a scraper with sides 20 cm in length and a sampling area of 2000 $cm^2$ (20 × 100). The collected samples were washed on a sieve covered with 0.5 mm mesh bolting cloth. Immediately after bringing the samples from the reservoir, animals were selected live and fixed in 4% formalin. The biomass was determined by weighing different groups and also selected *Chironomidae* taxa, using a torsion balance. The chief attention was paid to *Chironomidae* larvae, though unfortunately it was not always possible to identify them as to species. In some cases, therefore, the differentiated taxa were marked with successive Roman numbers. A similar system was used by L e h m a n n (1971) among others.

## 4. Results

### 4.1. Characteristics of the zoobenthos at station I

In 1975 large numbers and an abundant biomass of *Oligochaeta*, which constituted over 90% of the zoobenthos, were recorded. The dominant species was *Limnodrilus hoffmeisteri* C l a p., its numbers reaching 50% of this population (Table I). The highest values were noted on August 20 (41 244 specimens $m^{-2}$; 91.5 g $m^{-2}$) and the lowest on October 6 (1176 specimens $m^{-2}$; 4 g $m^{-2}$). *Chironomidae* constituted only 1.5% of the zoobenthos, the dominant species being *Prodiamesa olivacea* (M g.) and *Ablabesmyia* sp. The former constituted 22% and the latter 18% of the *Chironomidae* population. In the biomass of *Chironomidae Chironomus* sp. (? *Ch. plumosus* L.) showed the greatest participation (29%).

In 1976 the numbers and biomass of *Oligochaeta* were reduced to $^1/_3$. However, they still decisively prevailed. Among them *Limnodrilus hoffmeisteri* constituted 30% and *Tubifex tubifex* (O.F. M ü l l.) 20% of the population. The number of *Chironomidae* approximated that noted in 1975. In this group *Chironomus* sp. (? *Ch. plumosus*) predominated both with regard to number and to biomass.

In 1977 still fewer zoobenthos animals occurred in the reservoir, their

Table I. Zoobenthos at stations I, II, and III of the Wisła-Czarne reservoir in the period 1975-1984. N - number of specimens $m^{-2}$; B - biomass g $m^{-2}$

| Station | Year | Total | | Chironomidae | | Oligochaeta | | Others | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | B | N | B | N | B | N | B |
| I | 1975 | 16170 | 35.6 | 233 | 0.8 | 15806 | 33.9 | 131 | 0.9 |
| | 1976 | 6062 | 12.0 | 238 | 1.4 | 5656 | 9.4 | 168 | 1.2 |
| | 1977 | 3542 | 5.8 | 182 | 0.5 | 2709 | 4.5 | 651 | 0.8 |
| | 1978 | 2072 | 5.1 | 28 | 0.1 | 2016 | 3.3 | 28 | 1.7 |
| | 1979 | 2478 | 6.0 | 168 | 0.4 | 2296 | 5.5 | 14 | 0.1 |
| | 1980 | 2972 | 6.0 | 364 | 0.9 | 2396 | 4.6 | 112 | 0.5 |
| | 1981 | 1557 | 4.2 | 269 | 0.8 | 1277 | 3.3 | 11 | 0.1 |
| | 1982 | 5376 | 7.7 | 224 | 0.7 | 5075 | 6.8 | 77 | 0.2 |
| | 1983 | 1645 | 3.5 | 119 | 0.4 | 1512 | 2.1 | 14 | 1.0 |
| | 1984 | 1715 | 4.5 | 224 | 1.3 | 1494 | 3.1 | 7 | 0.2 |
| II | 1981 | 15237 | 37.7 | 1893 | 12.7 | 13210 | 24.5 | 134 | 0.5 |
| | 1982 | 6713 | 12.8 | 637 | 2.6 | 5866 | 10.5 | 210 | 0.7 |
| | 1983 | 8741 | 17.1 | 1050 | 3.4 | 7684 | 13.6 | 7 | 0.1 |
| | 1984 | 5161 | 12.0 | 420 | 3.9 | 4741 | 8.1 | - | - |
| III | 1981 | 17035 | 30.8 | 983 | 5.7 | 16019 | 24.5 | 33 | 0.6 |
| | 1982 | 9377 | 20.3 | 1407 | 6.0 | 8379 | 13.8 | 91 | 0.5 |
| | 1983 | 1463 | 4.7 | 546 | 2.5 | 903 | 1.7 | 14 | 0.5 |
| | 1984 | 1649 | 5.0 | 448 | 1.4 | 1183 | 3.4 | 18 | 0.2 |

biomass and numbers being half those found in 1976. *Oligochaeta* constituted 75% and *Chironomidae* 5% of zoobenthos. In the *Oligochaeta* group *Limnodrilus hoffmeisteri* and *Tubifex tubifex* reached the same percentages as in 1976. In the *Chironomidae* group *Procladius* species began to prevail quantitatively (30%), while *Chironomus* sp. (? *Ch. plumosus*) still constituted the largest part of the biomass (47%).

In the years 1978—1980 the abundance and qualitative composition of the zoobenthos were fairly uniform and approximated the values found in 1977. Among *Oligochaeta* the share of *Tubifex tubifex* increased from 20 to 30% while that of *Limnodrilus hoffmeisteri* decreased from 40% in 1978 to 30% in 1980. In 1978 the smallest numbers and biomass of *Chironomidae* larvae were noted. However, the percentages of the different taxa were similar to those recorded in other years.

The period 1981—1984 was one of unusual hydrological conditions. In 1982 and 1983 the drought led to a fall in the water level of more than 5 m (fig. 2). Among *Oligochaeta* further reductions in number and biomass were found. Only in the year 1982 did the animals occur more abundantly, in August reaching the number of 17 472 specimens $m^{-2}$ and biomass of 22 g $m^{-2}$. In the other three years the annual number of these organisms varied from 1277—1512 specimens $m^{-2}$ and their biomass from 2.1—3.3 g $m^{-2}$ (Table I). The share of *Limnodrilus hoffmeisteri* rose considerably in this group: it was 44% in 1981 and 60% in 1984 (Table II). In the family *Chironomidae* 14 taxa were identified, among which *Procladius* sp. became the dominant, constituting 50—60% of their number and 30—50% of their biomass (Tables III, IV).

In the whole 10-year period 17 taxa of *Chironomidae* were identified and the pattern of succession in this family ran from the community with

Table II. Numbers of the predominating Oligochaeta taxa (specimens $m^{-2}$) at stations I, II, and III in the Wisła-Czarne reservoir in the period 1981-1984

| Taxa / Year | Station I | | | | Station II | | | | Station III | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 |
| Limnodrilus hoffmeisteri Clap. | 557 | 2675 | 693 | 671 | 8152 | 3464 | 5227 | 3275 | 9280 | 6027 | 651 | 810 |
| Tubifex tubifex (O. F. Müll.) | 485 | 870 | 305 | 352 | 1585 | 1173 | 1229 | 759 | 2723 | 1173 | 72 | 118 |
| Others | 235 | 1530 | 314 | 251 | 3473 | 1024 | 1229 | 707 | 4016 | 1179 | 180 | 255 |

Table III. Taxonomic composition of Chironomidae, which reached a number exceeding 50 specimens $m^{-2}$, at stations I, II, and III in the Wisła-Czarne reservoir in the period 1981-1984.
◆ - a taxon whose numbers did not reach the value of 50 specimens $m^{-2}$

| Taxa / Year | Station I | | | | Station II | | | | Station III | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 |
| Procladius sp. | 151 | 112 | 69 | 137 | 246 | 102 | 126 | ◆ | 226 | 225 | 109 | 81 |
| Cladotanytarsus sp. (? C. mancus W.) | | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | | 70 | 127 | 65 | ◆ |
| Tanytarsus spp. | | | | | 76 | ◆ | ◆ | ◆ | 90 | 56 | ◆ | ◆ |
| Chironomus sp. (? Ch. plumosus L.) | 54 | 54 | ◆ | ◆ | 397 | 127 | 232 | 110 | 157 | 254 | 65 | 62 |
| Dicrotendipes sp. I (? D. nervosus Staeg.) | ◆ | | | | 170 | ◆ | 63 | ◆ | ◆ | 56 | ◆ | ◆ |
| Endochironomus spp. | | | | | 113 | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| Microchironomus sp. (? M. tener K.) | ◆ | ◆ | ◆ | ◆ | | ◆ | ◆ | ◆ | 90 | 169 | 87 | ◆ |
| Polypedilum sp. I (? P. convictum Walk.) | | | | | 170 | 83 | 157 | 72 | ◆ | 56 | ◆ | ◆ |
| P. sp. II (? P. nubeculosum Mg.) | | | | | 265 | 70 | 126 | ◆ | | ◆ | ◆ | ◆ |
| Cricotopus sylvestris (Fabr.) | | | | | 76 | ◆ | ◆ | | 60 | 99 | ◆ | ◆ |

Others: Ablabesmyia sp. (stations I, II, III); Anatopynia spp. (II); Tanypus sp. I (? T. punctipennis Mg.) (I, II, III); Tanypus sp. II (? T. Kraatzi Kieff. (II, III); Cladotanytarsus sp. II (I); Demicryptochironomus vulneratus (Zett.) (I, II, III); Dicrotendipes sp. II (? D. tritomus K.) (I, II, III); Harnischia sp. (?. H. curtilamellata (Maloch.)) (I); Polypedilum sp. III (? P. bicrenatum K.)(II, III); Sergentia sp. (II, III); Cricotopus spp. (I, II, III); Psectrocladius spp. (I, II, III); Eukiefferiella sp. (II, III)

Table IV. Biomass of different Chironomidae taxa characterized by mean annual values exceeding 0.15 g $m^{-2}$, at stations I, II, III in the Wisła-Czarne reservoir in the period 1981-1984.
◆ - a taxon whose biomass did not reach the value of 0.15 g $m^{-2}$

| Taxa / Year | Station I | | | | Station II | | | | Station III | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 |
| Procladius sp. | 0.26 | 0.32 | 0.25 | 0.45 | 1.27 | 0.25 | 0.33 | 0.62 | 0.90 | 1.13 | 0.52 | 0.25 |
| Cladotanytarsus sp. (? C. mancus Walp.) | | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | | ◆ | 0.18 | ◆ | ◆ |
| Tanytarsus spp. | | | | | 0.38 | ◆ | ◆ | ◆ | 0.29 | ◆ | ◆ | ◆ |
| Chironomus sp. (? Ch. plumosus L.) | 0.46 | 0.40 | ◆ | | 7.60 | 1.62 | 1.75 | 2.33 | 3.09 | 3.05 | 1.25 | 0.68 |
| Microchironomus sp. (? M. tener K.) | ◆ | ◆ | ◆ | ◆ | | ◆ | ◆ | ◆ | ◆ | 0.18 | 0.15 | ◆ |
| Polypedilum sp. I (? P. convictum Walk.) | | | | | 0.51 | ◆ | 0.24 | 0.31 | ◆ | ◆ | ◆ | 0.15 |

Others: Ablabesmyia sp. (stations I, II, III); Anatopynia spp. (II); Tanypus sp. II (T. Kraatzi Kieff.) (II, III); Cladotanytarsus sp. II (I); Tanytarsus spp. (II, III); Demicryptochironomus vulneratus (Zett.) (I, II, III); Dicrotendipes sp. I (? D. nervosus Staeg.)(I, II, III); Dicrotendipes sp. II (? D. tritomus K.)(I, II, III); Endochironomus spp. (II, III); Harnischia sp. (? H. curtilamellata Maloch)(I); Polypedilum sp. II (? P. nubeculosum Mg.) (II, III); Polypedilum sp. III (? P. bicrenatum K.) (II, III); Cricotopus sylvestris Fabr.(II, III); Cricotopus spp. (I, II, III); Psectrocladius spp. (I, II, III); Eukiefferiella sp. (II, III)

the dominance of *Ablabesmyia* sp. — *Procladius* sp. — *Prodiamesa olivacea* — *Chironomus* sp. (? *Ch. plumosus*) in the years 1975—1977, through the community with the dominance of *Procladius* sp. — *Chironomus* sp. (? *Ch. plumosus*) — *Harnischia* sp. (? *H. curtilamellata* Maloch.) in 1978—1979, to the community *Procladius* sp. — *Chironomus* sp. (? *Ch. plumosus*) in 1980—1984. The investigations showed tendencies characteristic for the zoobenthos of dam reservoirs, i.e., the constantly growing share of *Procladius* sp. larvae (fig. 3a), a high percentage of

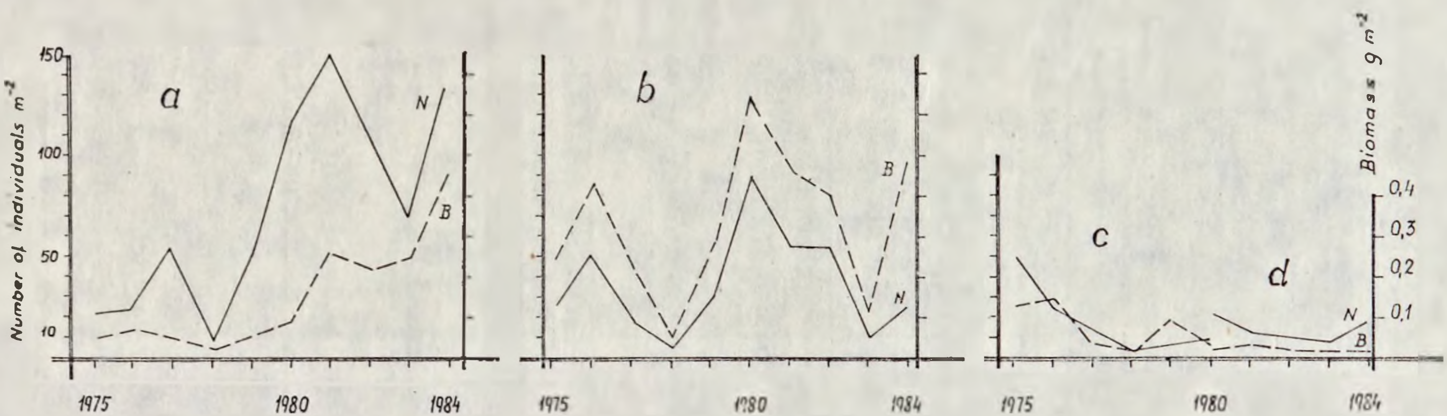


Fig. 3. Changes in mean annual numbers (N) and biomass (B) of larvae: a — *Procladius* sp.; b — *Chironomus* sp. (? *Ch. plumosus* L.); c — *Prodiamesa olivacea* (M g.); d — *Microchironomus* sp. at station I

*Chironomus* sp. (? *Ch. plumosus*) larvae (especially in the biomass) (fig. 3b), and the replacement of some taxa by others (figs 3c, 3d).

#### 4.2. Characteristics of the zoobenthos at stations II and III

In the bays of the Biała Wisełka (station II) and Czarna Wisełka (station III) the zoobenthos has been under a constant observation since 1981. Earlier samplings (in 1975 and 1976) showed that the stony bottom of these stations, covered with very poor sediments, was settled with small numbers of bottom animals. In 1981 in the two bays the sediments were deeper than in 1975 and 1976 and the rich zoobenthos approximated the numbers and biomass noted at station I in 1975 (Table I). At station II *Oligochaeta* constituted 86% and *Chironomidae* 12%. In the *Oligochaeta* group the predominating species were *Limnodrilus hoffmeisteri* (60%) and *Tubifex tubifex* (12%). In the family *Chironomidae* 17 taxa were identified with the predominance of *Chironomus* sp. (? *Ch. plumosus*), which constituted 21% of the number and 60% of the biomass. *Procladius* sp. reached 13% and 10%, respectively (Tables III, IV). At station III *Oligochaeta* constituted 94% with a decisive predominance of *Limnodrilus hoffmeisteri* (70%). *Chironomidae* constituted only 5% of the zoobenthos, with *Procladius* sp. (28% of the number and 17% of the biomass) and *Chironomus* sp. (? *Ch. plumosus* 16% and 54%) as dominants. Seasonal changes in the *Chironomidae* group are presented in a graph (fig. 4). In the Biała Wisełka bay (station II) the number of zoobenthos was double that in the Czarna Wisełka bay and six times larger than those found in the central zone (station I). The seasonal dynamics of numbers and biomass varied at the different stations. At station I the greatest number of *Chironomidae* appeared in June, and the smallest in May, July, and August. At station II the greatest number was observed in May and June and the smallest in July, while at station II the largest number of *Chironomidae* larvae was found in October and the smallest in May and July. At the last station a gradual increase in number and biomass occurred from May to October. In 1982 a decrease in the number and biomass of zoobenthos was found, in particular the number of *Oligochaeta* being reduced by 50%. At station II *Chironomidae* larvae were less abundant than in 1981 but at station III they were more numerous. In 1983 and 1984 the numbers and biomass of zoobenthos, chiefly of the *Oligochaeta* group, were reduced still further. This was particularly evident at station III where the number fall to $^1/_7$ and the biomass to $^1/_4$.

In the period of investigation (1981—1984) 23 taxa of the family *Chironomidae* were identified, the number varying from 16—18 in the different years. *Chironomus* sp. (? *Ch. plumosus*) predominated at station II and *Procladius* sp. at station III. In spite of the decreasing number and biomass in the successive years, the percentages of the different taxa in the *Chironomidae* family did not greatly change.

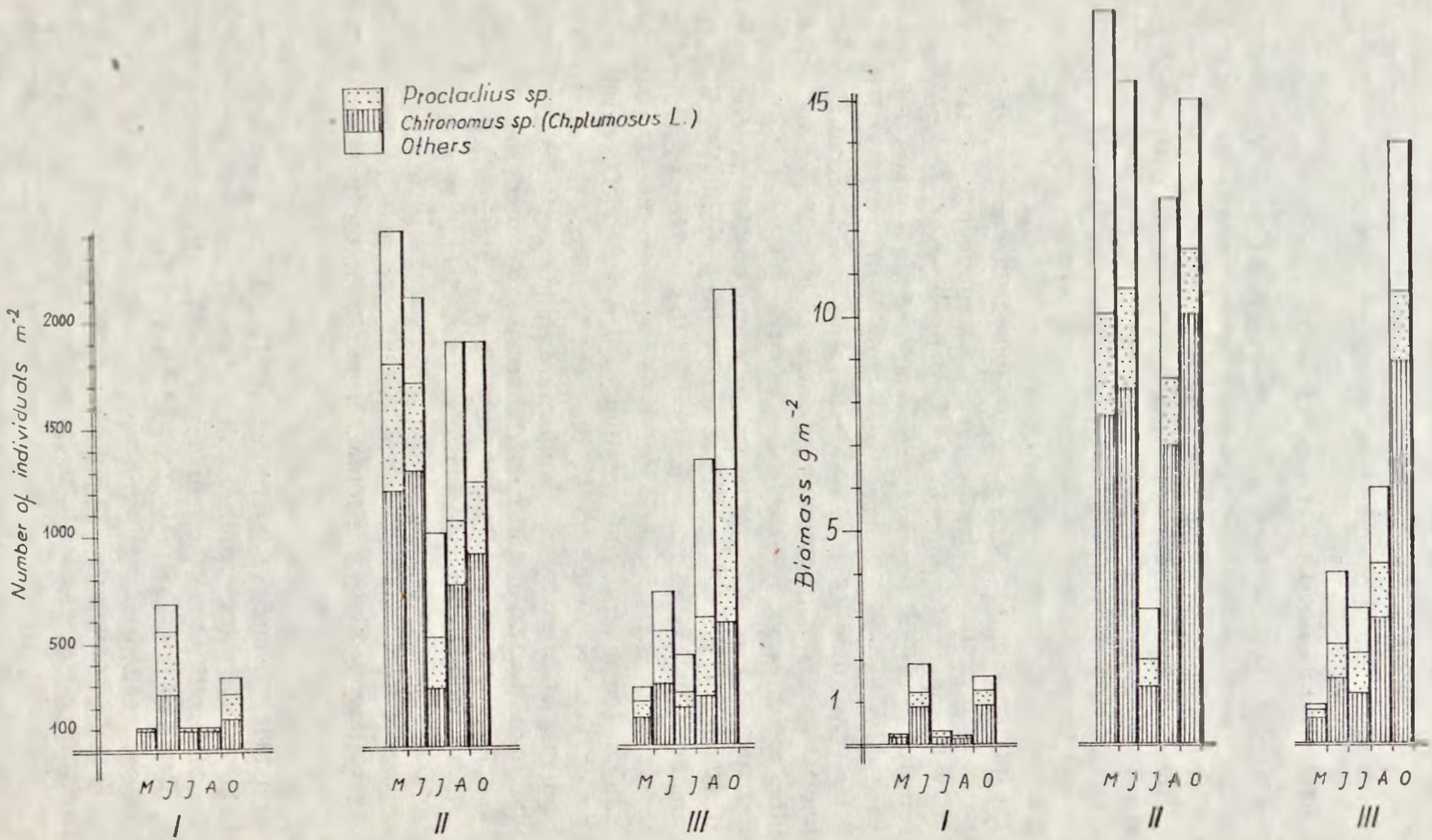


Fig. 4. Seasonal changes in numbers and biomass of *Chironomidae* at stations I, II, and III in the period May-October 1981

## 5. Discussion

The zoobenthos of the Wisła-Czarne reservoir and the process of its development differed from that in the Goczałkowice reservoir and many other small limnic ones. Bottom sediments in the investigated reservoir were formed from allochtonous components great amounts of which were constantly transported from the forest drainage basin. During the whole period of the investigation no macrophytes were observed in the reservoir. Immediately after its establishment, great amounts of organic and inorganic matter were rapidly brought in to the zone near the dam and an exceptionally abundant development of detritophages, chiefly of *Oligochaeta* (*Limnodrilus hoffmeisteri* and *Tubifex tubifex*), began.

*Chironomidae*, usually the predominating components of dam reservoirs, constituted a very small part of the zoobenthos (1.5%) and in most cases were forms which had probably lived in the river before the reservoir was filled (*Prodiamesa olivacea*, *Pothastia* sp., *Harnischia* sp.). After some years the number and biomass of *Oligochaeta* in the zone near the dam decreased while the numbers of *Chironomidae* did not greatly change, their share in the zoobenthos remaining small (±5%). They were mainly pelophilous forms, especially *Chironomus* sp. (? *Ch. plumosus*) and predators of the genus *Procladius*.

At stations II and III an increased development of *Oligochaeta* was noted in the eighth year after the filling, after which, as at station I, the number and biomass of these animals constantly decreased. At these stations (II, III) the share of *Chironomidae* in the zoobenthos was larger than at station I and rose as time went on. In 1981 they constituted 5—12% and in 1984 8—28%. Over the entire period *Procladius* sp. and *Chironomus* sp. (? *Ch. plumosus*) prevailed.

On the basis of the 10-year study it is difficult to define distinct stages in the formation of the zoobenthos. Nevertheless, with a great simplification, two periods can be differentiated:

— the first stage covered the year 1975 when a mass development of *Oligochaeta*, chiefly *Limnodrilus hoffmeisteri*, was observed. The share of *Chironomidae* larvae in the zoobenthos was minimal, while the predominating forms had probably lived in the river before the reservoir was filled;

— the second stage covered the years 1976—1984. The number and biomass of the zoobenthos, chiefly of *Oligochaeta*, constantly decreased while the numbers of *Chironomidae* changed slightly.

On the basis exclusively of taxonomic changes in the family *Chironomidae* two sub-stages can be differentiated in the second stage:

a — the first sub-stage covered the years 1976—1980 when at first *Chironomus* sp. (? *Ch. plumosus*) predominated (especially in biomass), to be replaced later by *Procladius* sp. The numbers of a few forms constantly

decreased (*Ablabesmyia* sp., *Harnischia* sp., and *Cricotopus* sp.). Two forms (*Prodiamesa olivacea* and *Pothastia* sp.) disappeared.
b — the second sub-stage covered the period 1981—1984. *Procladius* sp. distinctly prevailed and its numbers constantly rose. The taxonomic composition was poorer, while a new form, *Microchironomus* sp. (? *M. tener K.*), appeared in 1981.

In 1955 the dam reservoir at Goczałkowice was constructed at the 67th kilometre of the River Vistula. Greater attention was paid to this water body and the process of zoobenthos formation was compared with that occurring in the Wisła-Czarne reservoir.

The Goczałkowice reservoir is a limnic (4—5 water exchanges annually), large (3200 ha, 168 million m³ of water), and shallow (average depth is 5 m, maximum being 14 m) water body of the flood-water type. Bottom sediments here accumulated under different conditions. Also, different factors affected development of the zoobenthos. The bottom sediments were of autochtonous origin and macrophytes usually grew on 8% of the water surface (Krzyżanek 1970). The process of zoobenthos development followed the typical pattern (Krzyżanek 1970, 1977, Krzyżanek in press) observed in most dam reservoirs (Morduchaj-Boltovskoj 1961, 1972, Jankovič 1972, Hruška 1973). During the first ten years both in the central and in the littoral zone the number varied between 2000 and 3000 specimens $m^{-2}$. In the entire discussed period *Chironomidae* prevailed, first *Chironomus* sp. (? *Ch. plumosus*) and then *Procladius* sp. (fig. 5).

In some dam reservoirs, e.g., in the Tresna reservoir (fig. 6) on the River Soła (Krzyżanek 1971, Krzyżanek unpubl.) and in the Moravian reservoirs (Zelinka 1962), changes in the formation of the zoobenthos were similar to those observed in the Wisła-Czarne one. Such reservoirs of this type can be defined as "*Oligochaeta-Tubificidae*" type, differing from other reservoirs, e.g., that Goczałkowice, which may be determined as a "*Chironomidae*" type.

Marked similarities, not only within the "*Oligochaeta-Tubificidae*" type, can be observed in the changes of the taxonomic composition of the family *Chironomidae*, especially in the constantly increasing domination of the genus *Procladius* (fig. 5). This was shown by the results of Polish studies (Kownacki 1963, Grzybowska 1965, Krzyżanek 1970, 1971, 1977, 1979, Giziński, Wolnomiejski 1982) but also by works published in the Soviet Union (Morduchaj-Boltovskoj 1961, Morduchaj-Boltovskoj et al. 1972), Yugoslavia (Jankovič 1972), Czechoslovakia (Hruška 1973), and Spain (Prat 1980). Only in the Rybnik reservoir (Krzyżanek 1979), which received warm waste waters from a power plant, was a decrease noted in the number of *Procladius* sp. and in its percentage share in the family *Chironomidae* with the passage of time (fig. 5).

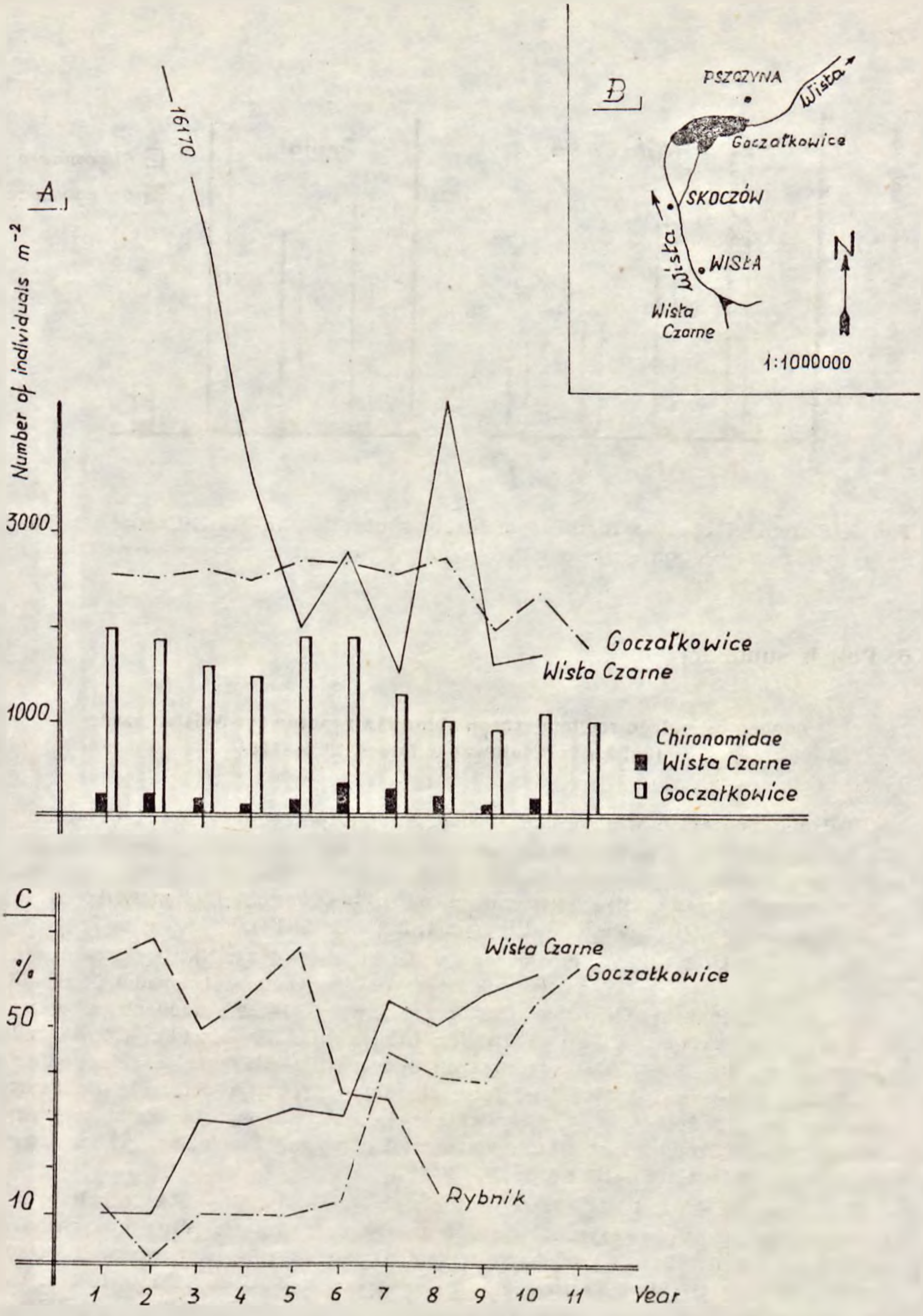


Fig. 5. Pattern of changes in the total number of zoobenthos and of *Chironomidae* larvae in the reservoirs Wisła-Czarne (station I) and Goczałkowice in the Upper Vistula (A) with a situation sketch of the reservoirs (B), and the percentage share of *Procladius* larvae in the *Chironomidae* population in the reservoirs Wisła-Czarne (station I), Goczałkowice, and Rybnik (C) during the first years after filling

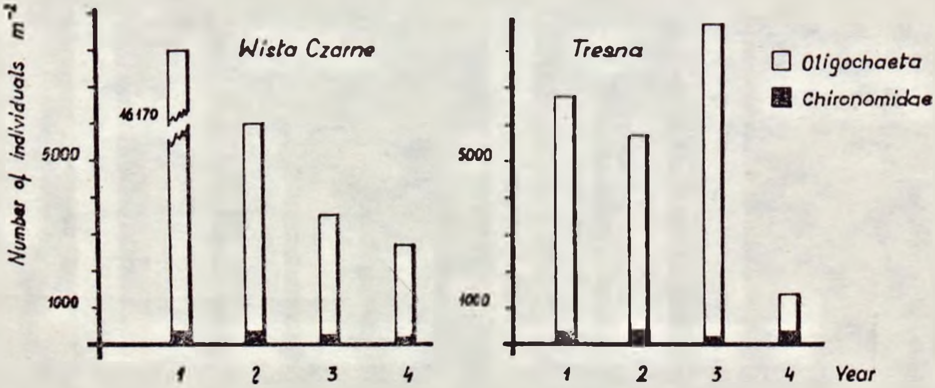


Fig. 6. Pattern of changes in the numbers of zoobenthos in Wisła-Czarne (station I) and Tresna (station at the dam) reservoirs in the first four years after filling

## 6. Polish summary

**Zoobentos małego reolimnicznego zbiornika zaporowego Wisła-Czarne (Polska Południowa) w latach 1975—1984**


Badania zoobentosu w zbiorniku Wisła-Czarne rozpoczęto w 1975 r., tj. w drugim roku po napełnieniu i kontynuowane są systematycznie do chwili obecnej. W pracy przedstawiono syntezę rezultatów badań za okres 1975—1984. W osobnych rozdziałach przedstawiono charakterystykę zoobentosu w strefie centralnej (stanowisko I) oraz w strefie zatokowej (stanowisko II, III) (ryc. 1, 2, tabele I—IV).

Na stanowisku I badania prowadzono w latach 1975—1984. Najwięcej zoobentosu było w 1975 r. (tabela I). W następnych latach obserwowano stały spadek liczebności i biomasy. Dominowały *Oligochaeta*, które stanowiły 70—90% zoobentosu, głównie *Limnodrilus hoffmeisteri* Clap. i *Tubifex tubifex* (O. F. Müll.), *Chironomidae* stanowiły zaledwie 1,5—5%. W pierwszych latach (1975—1977) skład taksonomiczny tej rodziny wykazywał duży udział form charakterystycznych dla rzek (*Prodiamesa olivacea* Meig., *Pothastia* sp., *Harnischia* sp.), następnie wyraźną dominację uzyskały najpierw *Chironomus sp.* (? *Ch. plumosus* L.), później *Procladius* sp. Ten ostatni szczególnie w latach 1980—1984 (ryc. 3).

Na stanowiskach II i III badania prowadzono w latach 1981—1984. Najwięcej zoobentosu notowano w pierwszym roku badań na obu stanowiskach. W następnych latach nastąpił spadek liczebności i biomasy, szczególnie wyraźny na stanowisku III. *Oligochaeta* stanowiły zwykle 80% zoobentosu. *Chironomidae* od 5 do 12% w 1981 r. i od 8 do 28% w 1984 r. Przez cały czas w rodzinie tej dominowały *Procladius* sp. i *Chironomus* sp. (? *Ch. plumosus*). Dynamikę zmian sezonowych *Chironomidae* przedstawiono na przykładzie roku 1981 (ryc. 4). Mimo różnic w formowaniu się zoobentosu zbiornika Wisła-Czarne, w porównaniu z innymi zbiornikami, zwłaszcza z położnym 60 km poniżej, także na rzece Wiśle, zbiornikiem Goczałkowice, wykazano podobieństwa (ryc. 5, 6), które dotyczyły zmian taksonomicznych w rodzinie *Chironomidae*, zwłaszcza w stałym wzroście dominacji rodzaju *Procladius*.

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