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# Kształtowanie się zbiorowisk fauny dennej zbiornika Goczałkowice

# Formation of bottom fauna in the Goczałkowice dam reservoir

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Abstract — The formation of bottom fauna in the Goczałkowice reservoir has been observed since 1955. According to published works and to the author's own inwestigation, there were three stages in the formation of bottom fauna. The first stage (1955—1957) was characterized by the escape and death of land forms and the appearance of new ones; the second (1958—1961) was characterized by a mass development of *Chironomidae*; and the third (1962—1964) and last period, showed a general decrease in the number of bottom fauna and an increase in the number of pelophilous forms. In the *Chironomidae* group some forms disappeared while new ones appeared. There was also an increased development of such forms as *Procladius*, *Chironomus plumosus*, and various species of the genus *Cryptochironomus*.

The dam reservoir at Goczałkowice was built on the river Vistula in a flat area, where the river crosses a wide marshy valley.

The reservoir is 12 km long and 2—4 km wide, its longitudinal gradient varying from 0.5 to 0.8‰. The submersed area in exploitation is 29.5 q. km at its maximum, while the volume of the reservoir is 150 000 000 cub. m. The maximum depth is 13 m., the average depth 5 m.

The area the future reservoir was to cover, was flooded for the first time in mid-January 1955. It was afterwards drained and refilled several times to scour the bottom and to test the dam for technical purposes. The final filling of the reservoir began on the 13th July 1955.

The reservoir is intended mainly for the taking in and retention of water for water-supply purposes. The water economy in this type of reservoir has to take into account the biological processes occurring in

it, hence hydrochemical, bacteriological, hydrobiological, and pedological investigations were started from the very beginning, even before the reservoir was filled.

The aim of the present work was to characterize the bottom fauna in the years 1962—1964. However, in order to describe exactly the changes in bottom fauna, the results of previous investigations on different small waters (fish ponds, canals, ditches) situated on the area of the future reservoir before its flooding (Grzybowska 1957) have been included in the chapters dealing with the characteristics of particular groups of bottom fauna.

According to these results, the formation of bottom fauna may be divided into three stages.

At the first stage (1955—1957) the land species and the species unable to adapt themselves to the new conditions (rheophilous species from the river Vistula) escaped in masses from the filled reservoir and died. New animal communities, first *Chironomidae* then *Oligochaeta,* began to populate the reservoir. The average number of bottom fauna was 2520 individuals/sq. m. in 1955, 2661 individuals/sq, m. in 1956 and 2520 individuals/sq. m. in 1957 (Kysela 1958).

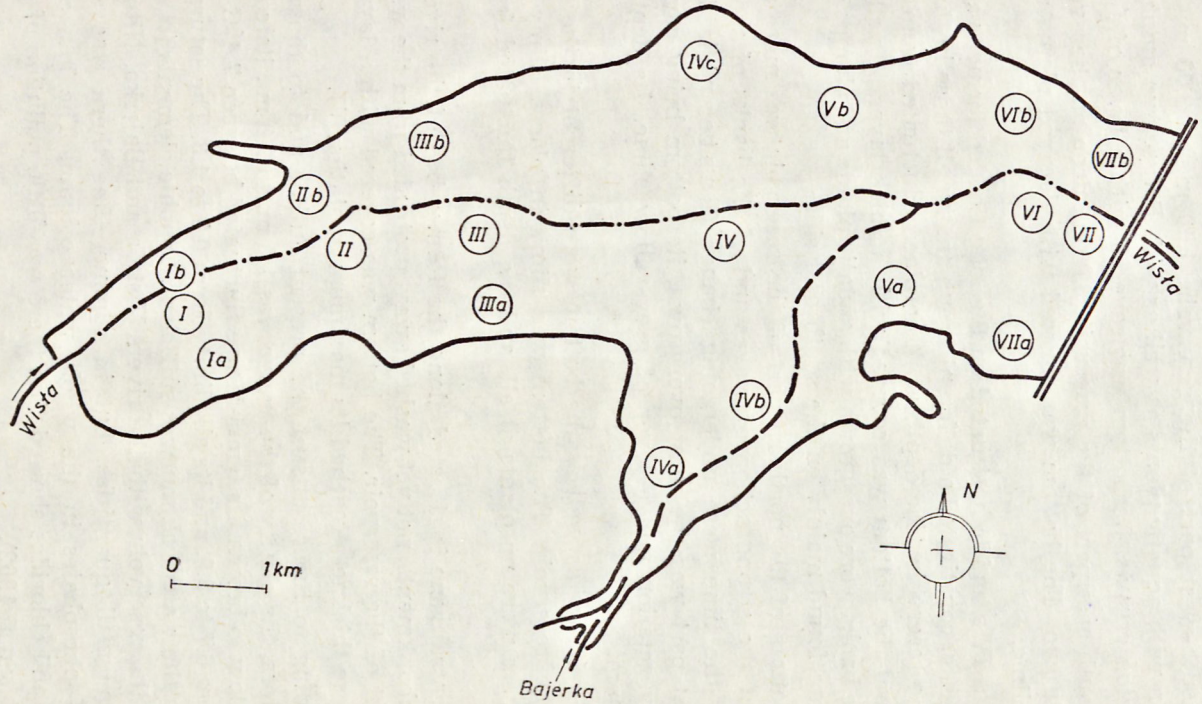
The second stage (1958—1961) was characterized by an intense growth of *Chironomaidae,* mainly *Glyptotendipes gripekoveni, Paratendipes albimanus,* and *Cryptochironomus fuscimanus* in the outer littoral zone of the reservoir, and *Procladius* and *Chironomus semireductus* in the central zone. At the same time the development of other groups of bottom fauna was observed, mainly *Ephemeroptera, Trichoptera,* and *Mollusca.* The average number of individuals of bottom fauna in the whole reservoir was 2723/sq. m. in 1958—1959, 2662/sq. m. in 1960 (Zaćwilichowska 1965), and 2739/sq. m. in 1961 (Krzyżanek 1965).

The third stage is the subject of the present work.

## Methods of investigations and characteristics of stations

The Goczałkowice reservoir embraces various environments, from luxuriantly overgrown ones to sandbanks. On this account, the stations where the samples were taken during the period 1962—1964 were situated in the central as well as in the littoral zones of the reservoir (fig. 1). In the central zone there were six stations and in the littoral ten stations in 1962, twelve in 1963, and thirteen in 1964.

The samples were taken twice with an Ekman-Birge dredge with an aperture of 225 sp. cm. and calculated relatively to a superficies of 1 sq. m. The contents were rinsed in a net 0.5 mm. mesh and preserved in formalin. At the same time the atmospheric conditions (wind, insolation) were noted




Ryc. 1. Rozmieszczenie stanowisk na zbiorniku Goczałkowice.
Fig. 1. Disposition of stands on the Goczałkowice reservoir.

at each station and the temperature of the water, its clarity and colour, pH and alkalinity were measured and the water level determined. In winter the samples were taken through an air-hole at station VII twice in 1962 and 1964 and three times in 1963.

The south-west part of the reservoir, 1.50 m. — 3.00 m. deep, was overgrown with aquatic plants as well as with *Polygonum amphibium* and *Potamogeton crispus*. Its bottom was covered with a layer of dead plants.

The south-east part of the reservoir, 3.00 m. deep on the average, was less overgrown. The bottom was covered with decayed plants and a thin layer of slime.

Stations IV a and IVb, situated on the long flooded former valley of the river Bajerka, constituted a different group among all those in the southern part of the reservoir. The depth at these places fluctuated from 1.50 m. to 4.50 m. and the bottom was covered with a thick layer of yellow-brown slime. The banks were overgrown with aquatic plants and clumps of floating plants were found mainly on the south-east side.

The bottom of the northern part of the reservoir was more variegated because of the strong action of waves and of the banks of the reservoir which at the time were undergoing change (P a s t e r n a k 1964). The north-west part was the most overgrown, its bottom being covered with decayed vegetation and a layer of grey-yellow slime. Its depth did not exceed 2.5 m.

The conditions as well as the bottom were different in the north-east part of the reservoir. The bottom was slimy in places, slimy-sandy, or sandy. There were no plants at all, and the depth fluctuated from 2.0 m. to 6.0 m.

The central zone is situated along the former bed of the river Vistula, whose embankments, not yet washed away, protruded from the water in the upper part of the reservoir. The bottom was covered with a layer of grey slime whose thickness reached its maximum at station VI.

According to the results of the present author and to those of other investigators, the clarity of the water was 1.0 m. to 2.0 m., its colour from green-yellow to brown, its temperature fluctuated between 7.4°C to 26.5°C, its pH from 6.7 to 8.9, and its alkalinity from 0.8 to 1.3. The saturation with oxygen in the water column was sufficient. Trophic elements (N, P, K) flowed into the reservoir with the rivers Vistula and Bajerka. Nitrates were present in small quantities, but in summer-time there was sometimes a lack of phosphates in the whole water column. The low content of ammonia and chlorides showed that there was little pollution of the water (B o m b ó w n a 1962).

It results from the above that the physico-chemical characteristics of the water were similar in different years as well as at the different stations of the reservoir.

## Characteristics of bottom fauna in 1962

In 1962 the bottom fauna was investigated at 16 stations situated both in the central and littoral zones.

The littoral zone of the southern part of the reservoir was the most overgrown with aquatic plants, especially on its western side. Bottom fauna in this group of stations (I a, III a) amounted on the average to 1970 individuals/sq. m. at station III a and to 2351 individuals/sq. m. at station I a. At the latter the number of *Chironomidae* and *Oligochaeta* was almost equal, but with maxima in different periods: *Oligochaeta* were the most frequent in July (1430 individuals/sq. m.), while *Chironomidae* larvae reached their maximum in September (1628 individuals/sq. m.). Other groups occurred in small numbers. At station III a there was a predominance of *Oligochaeta* (average number 910 individuals/sq. m.).*Chironomidae* were less numerous (637 individuals/sq. m.). Other groups of bottom fauna occurred in numbers not exceeding 30 individuals/sq. m. (fig 2).

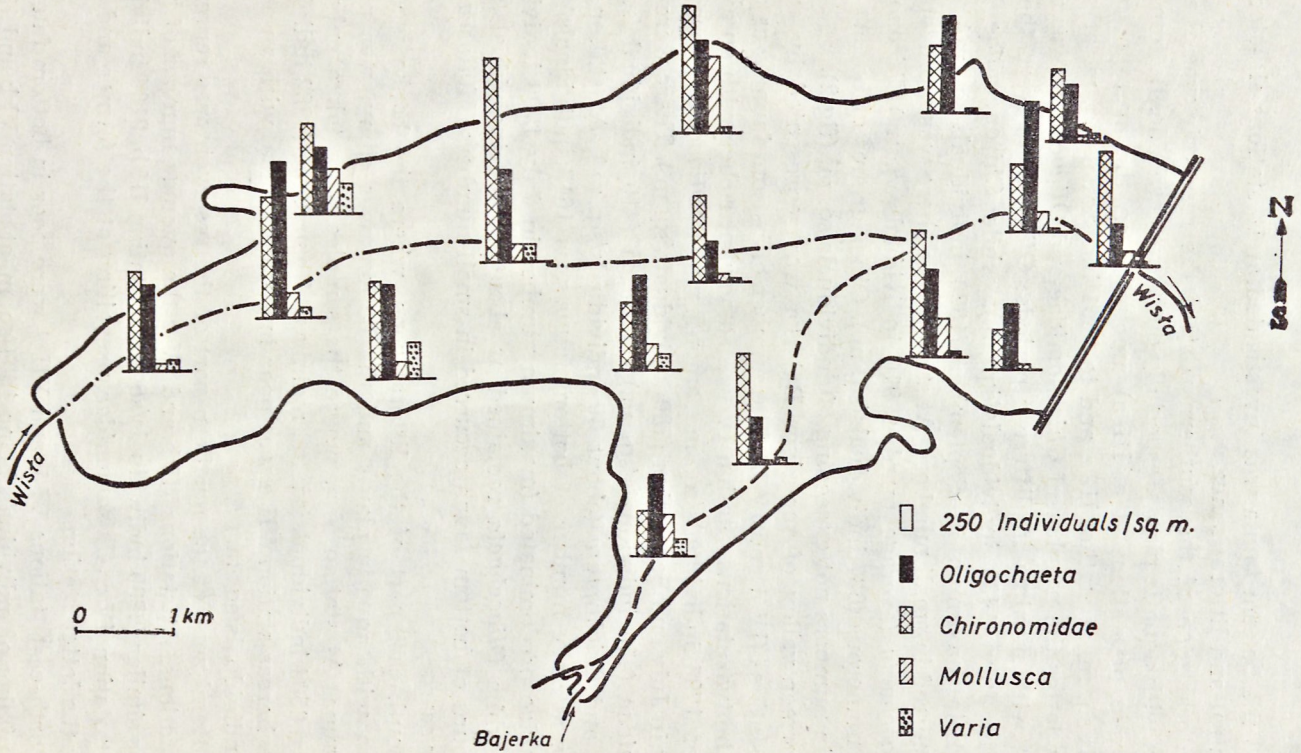
The former valley of the river Bajerka was represented by another group of stations (IV a and IV b). The number of bottom fauna was almost equal at the two stations. Station IV was somewhat richer with an average number of 1795 individuals/sq. m., among which *Oligochaeta* prevailed, especially in July and September (780 individuals/sq. m.). There were fewer *Chironomidae* (450 individuals/sq. m.), *Mollusca* (419 individuals/sq. m.), *Heleidae,* and *Trichoptera* (about 50 individuals/sq. m.). At station IV b, where the average number of bottom fauna was 1613 individuals/sq. m., *Chironomidae* predominated (maximum number in July 1790 individuals/ /sq. m.), while *Oligochaeta* remained at about of 500 individuals/sq. m. Other groups of bottom fauna occurred in small numbers, *Mollusca* being especially scarce.

The south-east part of the littoral zone, where the banks were less overgrown with aquatic plants and the bottom was slimy, was poor in bottom fauna. At station V a, where the samples were taken only once, there were 2504 individuals/sq. m., mainly *Chironomidae* (1232 individuals/ /sq. m.), whereas station VII a was poor in bottom fauna, with an average of 1122 individuals/sq. m.

The littoral zone of the northern part of the reservoir was represented by four stations. At stations III b and IV c the average number of bottom fauna was similar (2289 indiwiduals/sq. m. at station III b, 2184 individuals/ /sq. m. at station IV c, *Chironomidae* prevailing at the former and *Oligochaeta* at the latter station.

The north-east stations VI b and VII b were poor in bottom fauna, the average number of individuals being 1584/sq. m. at station VI b and 1379/sq. m. at station VII b. *Chironomidae* predominated at both places.

The central zone of the reservoir, where samples were taken at six stations, runs along the former bed of the river Vistula. The number




Ryc. 2. Fauna denna zbiornika Goczałkowice w 1962 roku.
Fig 2. The bottom fauna of the Goczałkowice reservoir in 1962.

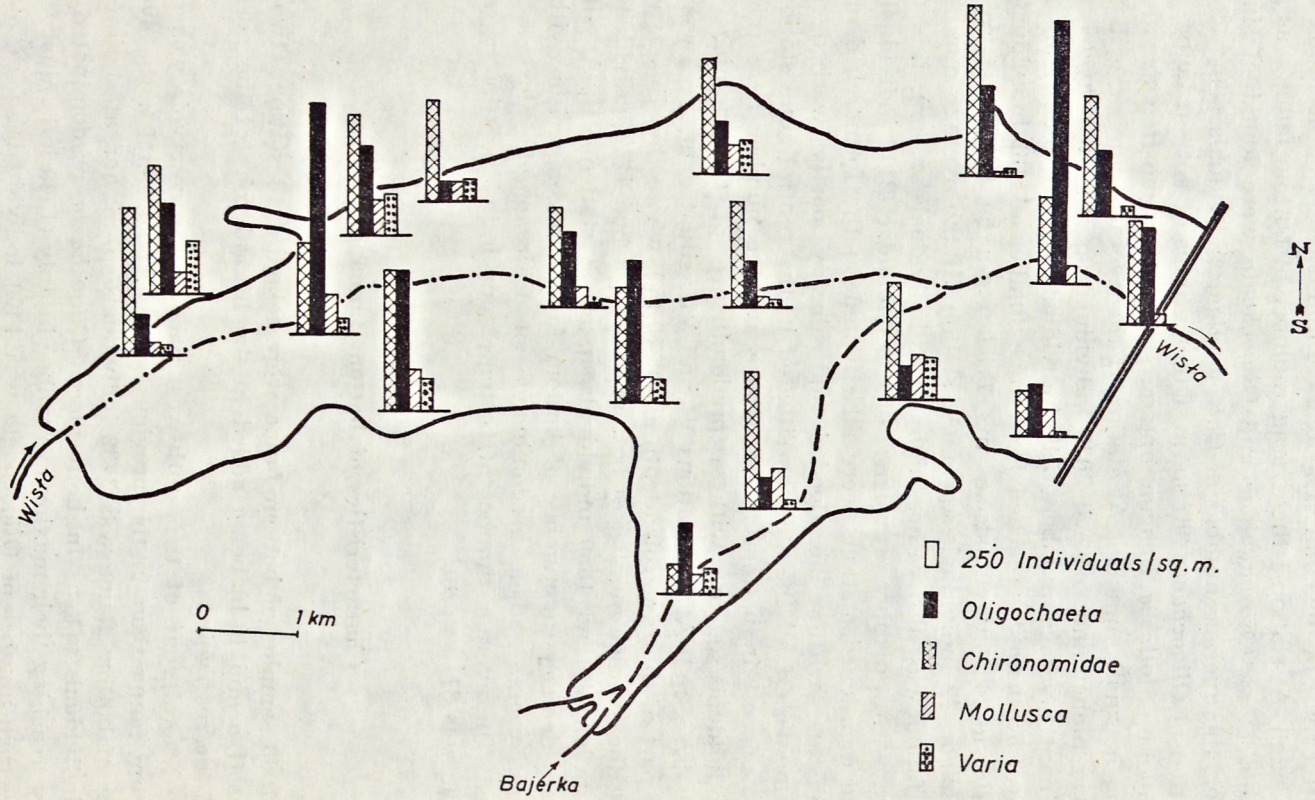
and distribution of animals depended on the characteristics of the bottom and the thickness of the slime. The average numbers of bottom fauna were not very high. At station I the average number of bottom fauna was 2061 individuals/sq. m. *Chironomidae* and *Oligochaeta* were found in similar quantities, the average number of *Chironomidae* individuals being 994/sq. m. and that of *Oligochaeta* 867/sq. m. Other groups of bottom fauna were represented by *Mollusca, Ephemeroptera, Trichoptera,* and *Heleidae* always occurring in small numbers. At station II the average number of bottom fauna was higher and reached 3037 individuals/sq. m. *Oligochaeta* being predominant (average number 1547 individuals/sq. m.), mainly in July. However, *Chironomidae* reached an average number of 1188 individuals/sq. m., *Mollusca* 242 individuals/sq. m., *Trichoptera* 59 individuals/sq. m., and *Heleidae 22* individuals/sq. m. At station III the average number of bottom fauna was also rather high (3168 individuals/sq. m.), this time, however, with a distinct prevalence of *Chironomidae* (2112 individuals/sq. m.). The mentioned stations were all situated on the former bed of the river Vistula, within the flooded and already partly washed away embankments. Of all the stations situated in the central zone station IV was the poorest in bottom fauna, whose average number here reached 1379 individuals/sq. m., with a predominance of *Chironomidae* (865 individuals/sq. m.). At the stations VI and VII, situated in the lower and deepest part of the reservoir (depth about 10 m.), where the slime was the thickest, the average number of bottom fauna reached 2122 individuals/sq. m. at station VI and 1650 individuals/sq. m. at station VII. At all the stations a decrease in number of bottom fauna, in comparison with the preceding years, and a predominance of *Chironomidae* larvae were observed. The average number of bottom fauna individuals in the whole reservoir was 2115/sq. m.

## Characteristics of bottom fauna in 1963

In 1963 samples of bottom fauna were taken at 18 stations, two new stations (I a and II b) being added in the littoral zone of the northern part of the reservoir.

The littoral zone of the south-west part of the reservoir was richer in bottom fauna than in the previous years. At station I a the average number of bottom fauna was 3432 individuals/sp. m. and at station III a 3021 individuals/sq. m. In both places *Oligochaeta* predominated very slightly, reaching their maximum number in July (1540 individuals/sq. m. The average number of *Oligochaeta* was 1408 individuals/sq. m. at both stations, while that of *Chironomidae* was 1386 individuals/sq. m. at station I a and 1159 individuals/sq. m. at station III a (fig.3).

In the valley of the river Bajerka at stations IV a and IV b bottom




Ryc. 3. Fauna denna zbiornika Goczałkowice w 1963 roku.
Fig. 3. The bottom fauna of the Goczałkowice reservoir in 1963.

fauna was approximately similar to that of 1962. The average number of individuals was 1503/sq. m. at station IV a and 2082/sq. m. at station IV b. *Oligochaeta* prevailed at the former, particularly in May, their average number being 755 individuals/sq. m., while that of *Chironomidae* was 286 individuals/sq. m. At station IV b *Chironomidae* again predominated with an average number of 1364 individuals/sq. m., while *Oligochaeta* were decidedly less numerous (average number 279 individuals/sq. m.).

In the south-east part of the reservoir there was also a great similarity in the number of bottom fauna between the years 1962 and 1963. At station V a the average number of bottom fauna individuals was 2118/sq. m. and at station VII a 1144/sq. m. This similarity was also shown by a distinct predominance of *Chironomidae* at station V a and a slight prevalance of *Oligochaeta* at station VII a.

In the littoral zone of the northern part of the reservoir samples were taken at six stations, while in 1962 they were taken at four stations. Both the new stations, I b and II b, were situated in the north-west part of the reservoir in the zone overgrown with aquatic plants, both emergent and with floating leaves. The quantity of bottom fauna was similar at the two places, the average number being 2952 individuals/sq. m. at station I b and 2838 individuals/sq. m. at station II b. Also similar were the quantitative proportions of particular groups of bottom fauna. The average number of the predominant *Chironomidae* was 1320 individuals/sq. m. at station I b and 1173 individuals/sq. m. at station II b, the average numbers of *Oligochaeta* being 924 and 887 individuals/sq. m., *Mollusca* 220 and 154 individuals/sq. m., respectively. At station III b quantity of bottom fauna was smaller than in 1962. Its total number reached 1584 individuals/sq. m. (*Chironomidae* 1012 individuals/sq. m., *Oligochaeta* 176 individuals/sq. m., *Mollusca* 176 individuals/sq. m., *Trichoptera* 132 individuals/sq. m., and *Ephemeroptera* 88 individuals/sq. m.). At station IV c the total number of bottom fauna was higher than in 1962 (2552 against 2184 individuals/sq. m.). The quantitative proportions between the two main groups, *Oligochaeta* and *Chironomidae*, also differed. The average number of *Chironomidae* was 1305 individuals/sq. m., and that of *Oligochaeta* 718 individuals/sq. m. (in 1962 it was the reverse).

At the stations situated in the north-east part of the reservoir (VI b and VII b) the amount of bottom fauna was greater than in the previous year, reaching an average of 2656 individuals/sq. m. at station VI b and of 1898 individuals/sq. m. at station VII b. *Chironomidae* prevailed in both places, their average number being 1687 individuals/sq. m. at station VI b (*Oligochaeta* 880 individuals/sq. m.), and 1173 individuals/sq. m. at station VII b (*Oligochaeta* 653 individuals/sq. m.).

In the central zone at stations I and II the quantity of bottom fauna was similar to that in the previous year. At station I the average amounted to 2047 individuals/sq. m. and at station II to 3784 individuals/sq. m. At

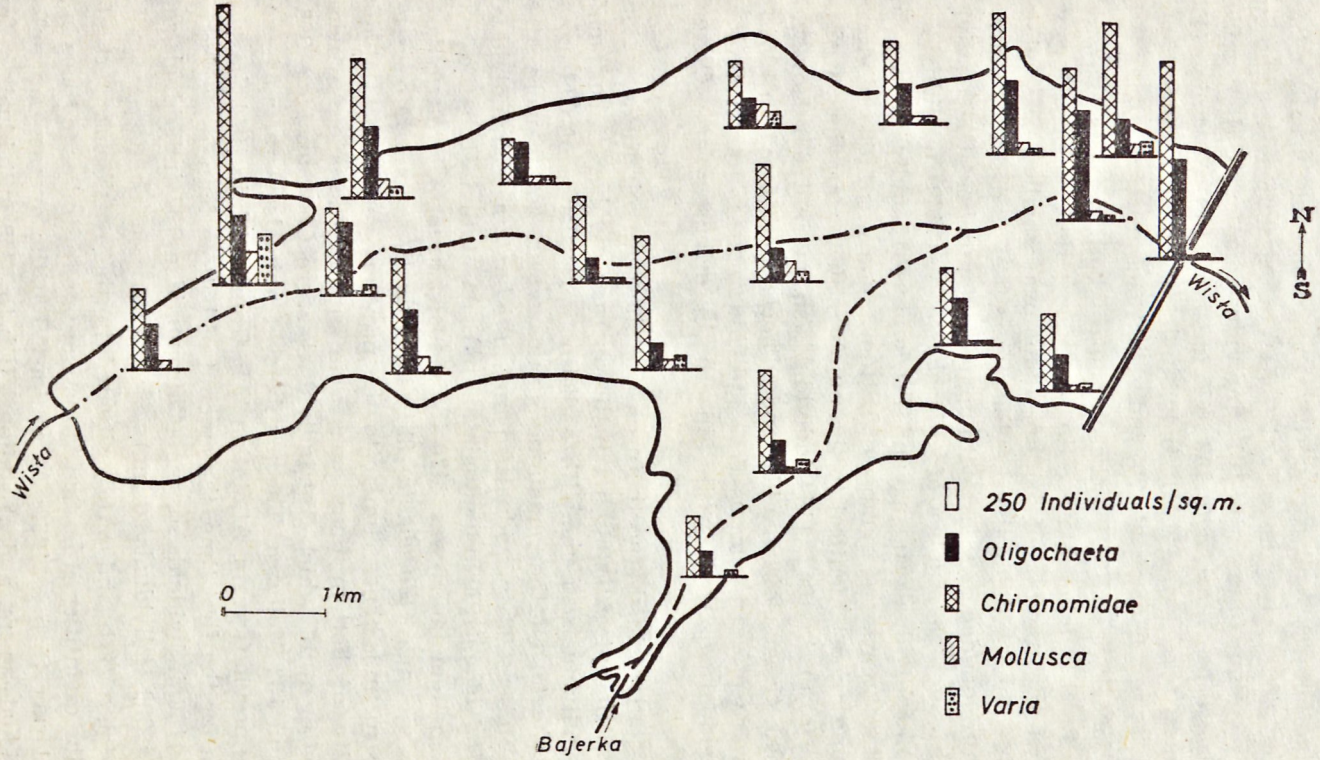
station I there was a predominance of *Chironomidae* (1398 individuals/sq. m., *Oligochaeta* amounting to 421 individuals/sq. m.), while at station II *Oligochaeta* again prevailed with 2332 individuals/sq. m. over the 902 *Chironomidae* individuals/sq. m. *Mollusca* were more numerous at station II (average number 396 individuals/sq. m.) than at station I (137 individuals/sq. m.). Of the remaining groups only *Trichoptera* were worth noting, although they appeared in small numbers. At station III the average quantity of bottom fauna differed greatly from that in the previous years as it amounted to 1980 individuals/sq. m. with a predominance of *Chironomidae* (997 individuals/sq. m. while *Oligochaeta* amounted to 734 individuals/sq. m.). The next station (IV) was also poor in bottom fauna, whose average number amounted to 1657 individuals/sq. m. (*Chironomidae* 1027 individuals/sq. m., *Oligochaeta* 469 individuals/sq. m. and *Mollusca* 103 individuals/sq. m.). On the other hand, station VI was richer than in 1962, its bottom fauna averaging 3638 individuals/sq. m. (*Chironomidae* 873 individuals/sq. m., *Oligochaeta* 2589 individuals/sq. m.). At station VII, situated next to the dam, the quantity of bottom fauna also increased slightly. Its average was 2068 individuals/sq. m. with a prevalence of *Chironomidae* (1026 individuals/sq. m.) over *Oligochaeta* (964 individuals/ /sq. m.).

In summing up the above results, a general increase in the amount of bottom fauna was observed in the whole reservoir, especially in the littoral zone. In 1963 the average number of animals was 2398 individuals/sq. m. while in 1962 it was 2015 individuals/sq. m. Nevertheless, it was still smaller than in 1961 (2739 individuals/sq. m.).

## Characteristics of bottom fauna in 1964

In 1964 investigation of bottom fauna was carried out in the same way as in the previous years. The number of stations increased to 19, owing to the addition of a new one, V b in the northern part of the reservoir, where the bottom was slimy and the banks lacking in aquatic plants (fig. 4).

In the south-west part of the littoral zone of the reservoir (stations I a and III a) there was a distinct and striking decrease in the number of bottom fauna (at station I a 1863 individuals/sq. m. and at station III a 1745 individuals/sq. m. on the average). *Chironomidae* predominated in both places, especially in July, when their average reached 1085 individuals/sq. m. at station I a and 1291 individuals/sq. m. at station III a. *Oligochaeta* occurred in small numbers, averaging 572 individuals/sq. m. at station I a and 235 individuals/sq. m. at station III a. Other groups of bottom fauna were represented only in small quantities. At both these stations the amount of bottom fauna was smaller in comparison not only with that in the previous year, but also with that in 1962. *Oligochaeta* underwent the




Ryc. 4. Fauna denna zbiornika Goczałkowice w 1964 roku.

Fig. 4. The bottom fauna of the Goczałkowice reservoir in 1964.

greatest reduction, although both *Chironomidae* and *Mollusca* also occurred in considerably smaller numbers.

The situation was similar, or perhaps even worse, at the stations situated in the valley of the river Bajerka (IV a, IV b). At station IV a the average number of bottom fauna was 1017 individuals/sq. m. (*Chironomidae* 652 individuals/sq. m., *Oligochaeta* 293 individuals/sq. m.). At station IV b the average occurrence was 1441 individuals/sq. m. (*Chironomidae* 1001 individuals/sq. m., *Oligochaeta* 297 individuals/sq. m.).

At stations V a and VII a the amount of bottom fauna showed more similarity to the data obtained in the years 1962—1963. However, at station V a the number of bottom fauna was smaller, averaging 1276 individuals/sq. m., while in the previous years it exceeded 2000 individuals/ /sp. m., *Chironomidae* prevaled with an average number of 777 individuals/ /sq. m. The average number of *Oligochaeta* was 469 individuals/sq. m., *Mollusca* 15 individuals/sq. m., and *Trichoptera* 15 individuals/sq. m. At station VII a the average number of bottom fauna was 1166 individuals/sq. m. this being almost identical to the numbers in the previous years (1122 individuals/sq. m. in 1962, 1144 individuals/sq. m. in 1963). However, the proportions between *Chironomidae* and *Oligochaeta* differed. In 1964 *Chironomidae* were more numerous (739 individuals/sq. m.) than *Oligochaeta* (319 individuals/sq. m.) while in the previous years *Oligochaeta* predominated.

At the stations in the northern part of the reservoir the situation was somewhat different. At station I b the average number of bottom fauna was 4106 individuals/sq. m. with a distinct prevalence of *Chironomidae* over *Oligochaeta*. Of the remaining groups worth noting were *Mollusca* (average number 293 individuals/sq. m.), *Trichoptera* (235 individuals/sq. m.), and *Heleidae* (161 individuals/sq. m.). At station II b the average number of bottom fauna was 2420 individuals/sq. m. (*Chironomidae* 1335 individuals/sq. m., *Oligochaeta* 881 individuals/sq. m., *Mollusca* 161 individuals/sq. m.), hence similar to the previous years. At station III b the quantity of bottom fauna was very small. The average was 946 individuals/sq. m. of which 374 individuals were *Chironomidae*, 308 *Oligochaeta* and 132 *Mollusca*. The numbers of animals were much smaller than in the previous years. At station V b, from which in 1964 the samples were taken for the first time, the amount of bottom fauna was also small, averaging 1188 individuals/sq. m., (*Chironomidae* 792 individuals/sq. m., *Oligochaeta* 308 individuals/sq. m.).

At stations VI b and VII b situated in the north-east part of the reservoir, the quantities of bottom fauna were more similar to those in 1963 and were larger than in 1962. At station VI b the average amounted to 2188 individuals/sq. m. and at station VII b to 1859 individuals/sq. m. In both cases *Chironomidae* predominated, at station VI b reaching an average of 1342 and at station VII b 1312 individuals/sq. m., while *Oligochaeta*

occurred in smaller numbers (704 individuals/sq. m. at station VI b, 352 individuals/sq. m. at station VII b. The remaining groups occurred in small numbers, only *Mollusca* being slightly more numerous, especially the large *Anodonta cellensis* and *Unio pictorum.*

In the central zones, starting from the upper part (stations I to IV), the quantities of bottom fauna distinctly decreased. At station I the average number of bottom fauna was 1364 individuals/sq. m., while in 1962 it was 2061 individuals/sq. m. and in 1963 2047 individuals/sq. m. *Chironomidae* prevailed at stations I and II, averaging 814 and 836 individuals/sq. m respectively, the average number of *Oligochaeta* being 440 individuals/sq. m. at station I and 671 at station II. Stations III and IV were poor in bottom fauna, especially station III, where the average was 1174 individuals/sq. m., while at station IV the average number was 1452 individuals/sq. m. *Chironomidae* predominated (836 individuals/sq. m. at station III, 979 individuals/sq. m. at station IV) over *Oligochaeta* (231 individuals/sq. m. at station III, 319 individuals/sq. m. at station IV). At station VI the average number of bottom fauna was also somewhat lower (2615 individuals/sq. m.) with a slight prevalence of *Chironomidae* (1467—1075 individuals/sq. m.); at station VII, however, the average quantity of bottom fauna was 2828 individuals/sq. m., hence greater than in the previous years. *Chironomidae* averaged 1657, *Oligochaeta* 865, *Mollusca* 74 and *Heleidae* 77 individuals/sq. m. In general, a considerable decrease in the number of bottom fauna was observed throughout the reservoir. The average amounted to 1708 individuals/sq. m.

In the nine-years period of the reservoir's existance the greatest number of bottom fauna was observed from the 5th to 7th years, after which there was a slight and gradual decrease.

Thus, in the period 1955—1964 there were no great quantitative differences, changes observed being rather in the species composition. The distribution and composition of the bottom fauna depended mainly on the character of the bottom and the occurrence and composition of the aquatic vegetation.

### Characteristics of the species composition of *Chironomidae*

*Procladius* in the Goczałkowice reservoir occurred previously to its flooding in small fishing ponds within its area. After the filling of the reservoir it occurred rarely (Grzybowska 1957). In the years 1958—1960 it occurred in small numbers in the littoral zone (Zaćwilichowska 1965 a), but in the central zone it dominated in the whole reservoir (Zaćwilichowska 1965 c). In the years 1961—1964 it was found at

all of the sampling stations both in the central and littoral zones and amounted to an average of 50 per cent of the whole group of *Chironomidae*.

*Chironomus* f. l. *plumosus* was the second most numerous group representing *Chironomidae* in the Goczałkowice reservoir. Before the filling of the reservoir the occurrence of this species had been observed in all the existing small waters of the area (Grzybowska 1957). After the flooding it appeared in the whole reservoir, its best development taking place in different months and at different stations (Kysela 1958). In the years 1958—1960 it occurred in small numbers in the littoral zone, giving place to *Chironomus* f.l. *semireductus*. In the central zone, however, it occurred numerously, especially in the eastern part of the reservoir (Zaćwilichowska 1965 c). In 1961 it appeared numerously throughout the reservoir, and formed 34 per cent of the total number of *Chironomidae*. Also in the years 1962—1964 it was numerous, especially in 1963 when it formed 40 per cent of the total number. In 1962 it constituted 35 and in 1964 — 20 per cent of *Chironomidae*.

*Chironomus* f.l. *semireductus* occurred in small numbers in the years 1961—1964, but in the years 1958—1960 it was sometimes very numerous /sq. m., *Chironomidae* prevaled with an average number of 777 individuals/ both the deeper and the littoral zones (Zaćwilichowska 1965).

*Cryptochironomus* ex grege *conjugens* occurred at almost all the stations in 1961. In the years 1962—1964 it occurred in considerably smaller numbers.

*C.* ex grege *defectus* already occurred in the first year of the reservoir's existance. In the years 1958—1960 it did not appear either in the central or in the littoral zones (Zaćwilichowska 1965), but it was observed in the river Bajerka (Sowa 1961) flowing into the reservoir from the south. In 1961 it occurred in small quantities but fairly frequently at all the stations. In the years 1962—1964 its appearance was more numerous and in larger communities, especially in 1964.

*C.* ex grege *pararostratus* was found everywhere near the banks in the years 1959—1960 (Zaćwilichowska 1965). In 1961 it was most numerous at the station next to the dam, where it constituted 9 per cent of the total number of *Chironomidae*. In the years 1962—1963 it still occurred in smaller numbers but in 1964 it was not encountered anywhere.

*C. fuscimanus* occurred in the samples throughout the reservoir in the years 1958—1960, with maxima in July and October. In 1961 single individuals were found only at the station in the upper part of the reservoir (Krzyżanek 1965), while in the years 1962—1964 it occurred at different places but in small numbers.

*Glyptotendipes* ex grege *gripekoveni* occurred from the beginning of the reservoir's existence, though at first in small numbers. In the years 1958—1960 it occurred in large numbers, sometimes reaching 5830 individuals/sq. m., at all the stations in the central as well as the littoral zones (Zaćwilichowska 1965). In 1961 it averaged 8 per cent of the

*Chironomidae* group (Krzyżanek 1965). In the years 1962—1964 it occurred exclusively in the upper littoral zone of the reservoir, being most numerous at station I b.

*Endochironomus* ex grege *tendens* was not reported in the years 1958—1960 (Zaćwilichowska 1965) but in 1961 this species was found at three stations, with the largest number in the valley of the river Bajerka (Krzyżanek 1965). In the years 1962—1964 it occurred in the upper north-west and south-west parts of the reservoir, reaching the greatest number in 1963, while in 1964, with only a few exceptions, it hardly appeared at all.

*Polypedilum* Kieff. The most numerous species of this genus was *P.* ex grege *nubeculosum*. In the Goczałkowice reservoir it appeared from the beginning, sometimes in large quantities (Grzybowska 1957). In the years 1958—1960 it was present in small numbers in the central and the littoral zones. Also in the years 1961—1964 it occurred in fairly large numbers. The remaining species of this genus (*P. convictum, P. brevian-tennatum*) occurred more rarely and only singly.

*Ablabesmyia* ex grege *monilis* usually occurred in small quantities. In the years 1958—1960 it appeared most numerously in the Bajerka valley (Zaćwilichowska 1965). Sowa found it in 1961 in the river Bajerka, where it was caught particularly on aquatic plants. In 1961 it was encountered, in small quantities in the old Bajerka valley (Krzyżanek 1965). In the years 1962—1964 it hardly occurred at all.

*Tanytarsus Wulp.* In the first years some species belonging to this genus, especially *Tanytarsus* ex grege *gregarius*, occurred in the reservoir but in small numbers. In the years 1958—1960 it was still less frequent and only sigle individuals were encountered (Zaćwilichowska 1965). It was found in larger numbers in 1961, both in the central and the littoral zones (Krzyżanek 1965). A further increase in the number of larvae of this genus was observed in the years 1962—1964.

Among the remaining *Chironomidae* species *Cricotopus silvestris* and *Psectrocladius psilopterus* are worth mentioning. They occurred from the first existence of the reservoir, though rather rarely and only singly. Other species played a minor role in the bottom fauna, usually occurring in small numbers and rarely.

The detailed species composition of *Chironomidae* found in the years 1962—1964 is given in Table I.

*Chironomidae* constitute the most numerous group of bottom fauna and the first to populate the reservoir. At the outset they were forms growing in masses on the flooded and decaying land vegetation or ubiquitous ones. Pelophilous forms appeared with the formation of bottom sediments. In the years 1963—1964 the investigation revealed not only the appearance of new forms such as *Stictochironomus* ex grege *histrio, S. psammophilus* hitherto not encountered in the reservoir, but also an increased development

Tabela I. Skład procentowy poszczególnych gatunków Chironomidae w zbiorniku Goczałkowice w latach 1962 - 1964

Table I. Percentage of individual species of Chironomidae of the Goczałkowice Reservoir in 1962–1964

| Nazwa gatunku / Name of species | Ujście potoku Mouth of Bajerka stream | | | Południowa część zbiornika Southern section of reservoir | | | Północna część zbiornika Northern section of reservoir | | | Centralna część zbiornika Central section of reservoir | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rok Year | 1962 | 1963 | 1964 | 1962 | 1963 | 1964 | 1962 | 1963 | 1964 | 1962 | 1963 | 1964 |
| Ablabesmyia ex grege mobilis | | | | | | | 0.5 | 1 | 0.5 | | | |
| Clinotanypus nervosus | | | | 3 | 25 | | | | | | | |
| Pelopia kraatzi | | | | | 6 | | | 0.5 | | | 1 | |
| - puncipennis | 7 | | | 1 | | | | | | 1 | | 2 |
| Procladius | 36 | 34 | 52 | 44 | 24 | 63 | 59 | 33 | 51 | 41 | 52 | 55 |
| Anatopynia varia | | | | | | | | | 0.5 | | | |
| Diamesa prolongata | | | | 0.5 | | | | 0.5 | | | | |
| Diamesinae non det. | | | | 0.5 | | | | | | 0.5 | | |
| Cricotopus algarum | | | | | 1 | | | 1 | | | | |
| - silvestris | 2 | | | 0.5 | 2 | | 8 | 2 | 0.5 | 3 | | 2 |
| - versidentatus | | | | | 1 | | | | | | | |
| Cricotopus sp. | | | | | | | | 0.5 | | 0.5 | | |
| Psectrocladius psilopterus | 8 | 2 | | | 1 | | 2 | 1.5 | | 1 | 4 | |
| Psectrocladius non det. | | | | | | | | 0.5 | | | | |
| Orthocladinae non det. | 1 | | | 0.5 | | 0.5 | | 1 | | 2 | | |
| Endochironomus ex gr. tendens | 6 | | | 2 | 5 | | | 9 | 0.5 | 2 | | |
| - ex grege dispar | | | | | | | | 2 | | | | |
| Glyptotendipes gripekoveni | 7 | | | 2 | | | 3 | 2 | 4 | 1 | | 3 |
| Tendipes f.l. plumosus | 1 | 7 | 8 | 11 | 9 | 16 | 5 | 7 | 12 | 15 | 15 | 16 |
| - f.l. semireductus | 10 | | 7 | 1 | | 1 | 0.5 | | | 2 | 1 | 2 |
| - f.l. thummi | | | | | | | | | | 0.5 | | |
| Limnochironomus tritomus | | 1 | | 0.5 | | 1 | | | 0.5 | 0.5 | | |
| - ex grege nervosus | | | | 1 | 4 | | 1 | | 1 | 1 | 1 | |
| Cryptochironomus fuscimanus | | 3 | 1 | | | 0.5 | 0.5 | | 1 | 3 | 0.5 | |
| - ex grege defectus | 1 | 3 | 9 | 0.5 | 4 | 3 | 2 | 6 | 7 | 4 | 4 | 10 |
| - ex grege conjugens | 6 | 2 | 1 | 8 | | 1 | 3 | 5 | 2 | 3 | 0.5 | 2 |
| - ex grege viridulus | | 8 | | | | | 2 | | | 1 | 0.5 | 0.5 |
| - ex grege pararostratus | | | | 0.5 | 3 | | 3 | 2 | | 0.5 | | |
| - ex grege vulnaratus | | | | | | 1 | | | | 0.5 | 1 | 1 |
| Microtendipes ex grege chloris | 4 | 1 | | 5 | | 1 | 6 | 4 | 6 | 3 | 3 | 1 |
| Stictochironomus psammophilus | | | | | | 0.5 | | | 0.5 | | | |
| - ex grege histrio | | | | 0.5 | | 1.5 | | | | | | |
| Polypedilum breviantennatum | | | | | | | 3 | | | | 0.5 | |
| - ex grege pedestre | | | | | 1 | | 0.5 | 2 | | 1 | 0.5 | 0.5 |
| - ex grege nubeculosum | 3 | 4 | 6 | 1 | 0.5 | 1.5 | 1.5 | 0.5 | 1 | 1 | 3 | 0.5 |
| - ex grege nonvictum | | | | | | | 2 | | 0.5 | 2 | | 1 |
| - ex grege scalaenum | | | | | 0.5 | 0.5 | | | 0.5 | | | |
| Pentapedilum ceciliae | | | | 0.5 | | | | | 0.5 | | | |
| Tanytarsus lobatifrons | | | | 1 | | 1 | | | | 1 | 0.5 | |
| - ex grege gregarius | 6 | 35 | 16 | 3 | | 2 | 7 | 9 | 9 | 6 | 4 | 3 |
| - ex grege mancus | 2 | | | 12 | 13 | 6 | 8 | 8 | 0.5 | 2 | 7 | |
| - ex grege lauterboni | | | | | | | 0.5 | 1 | 0.5 | | | |
| Chironomidae non det. | | | | 0.5 | | 1 | 2 | 1 | 0.5 | 1 | 1 | 0.5 |

of such forms as *Procladius, Chironomus plumosus* or *Tanytarsus gregarius,* previously found in smaller quantities. Apart from this, the disappearance was observed of some forms as *Cryptochironomus pararostratus, Paratendipes albimanus,* and particularly *Chironomus thummi,* a form living in polluted waters, resistant to a lack of oxygen and even withstanding strong

processes of decay. In the years 1962—1964 a decrease in number was observed of *Chironomus semireductus, Glyptotendipes gripekoveni* and *Cryptochironomus fuscimanus.*

## Characteristics of particular groups of bottom fauna

*Oligochaeta* are, next to *Chironomidae,* the most numerously represented group in dam reservoirs. Flooding led to the extermination of the land forms among the *Oligochaeta* bottom fauna. In the Goczałkowice reservoir, as early as three weeks after flooding, dead worms were observed in the water and washed up in masses on the banks. During a period of about two months after flooding of the land *Oligochaeta* only a few forms of *Enchytreidae* were observed which then altogether disappeared (K y s e l a 1958). The land group of *Oligochaeta* died out and they were replaced by aquatic forms, mainly *Tubificidae.* In the years 1955—1957, as the bottom sediments formed, their number gradually increased, the main role being played by *Limnodrilus, Tubifex, Nais* sp., and *Stylaria lacustris.* In the first years of the reservoir's existence *Oligochaeta* populated the bottom after *Chironomidae.* In some dam reservoirs an especially rapid increase of *Tubificidae* was observed in the second year of the reservoir's existence (Z e l i n k a 1962). In the years 1958—1960 the number of *Oligochaeta* continued to increasing. In the littoral zone of the reservoir *Limnodrilus sp.,* particularly numerous in May and June 1958 and in August 1959. *Nais* sp. were encountered in varying quantities at all the stations and also *Stylaria lacustris,* mainly on a bottom covered with a thin layer of slime. In the deeper zone mainly *Nais* sp. and *Limnodrilus* occurred although in varying quantities, constituting 21.3 per cent of all individuals caught (Z a ć w i l i c h o w s k a 1965). In 1961 *Oligochaeta* occurred at some stations in even greater numbers than *Chironomidae,* similarly as in the years 1962—1964, especially in the deepest parts of the reservoir (stations VI and VII). The maximum number of *Oligochaeta* was: in 1961, 2728 individuals/sq. m. (station I) and 2420 individuals/sq. m. (station VI); in 1962, 2480 individuals/sq. m. (station VI); in 1963, 3322 individuals/sq. m. (station VI); in 1964, 1650 individuals/sq. m. (station VI). Thus the largest quantities were encountered at the station situated in the deepest part (average depth 10 m.) of the reservoir and on slimy bottom.

*Mollusca.* In the first year of the reservoir's existence, *Mollusca,* especially various species of snails were encountered in the littoral zone. Among those most frequently found were *Lymnea stagnalis, Radix limosa, Physa fontinalis* and *Gyraulus albus.* In the second year *Pisidium amnicum* appeared (K y s e l a 1957), later increasing in number. In the years 1958—1960 snails predominated in the littoral zone of the reservoir and molluscs — mainly *Pisidium amnicum* and *P. casertanum* — in the central

one. *Anodonta cellensis* also appeared for the first time, its numbers increasing particularly in the last years. In 1961 the maximum number of molluscs was 572 individuals/sq. m.; in 1962, 638 individuals/sq. m.; in 1963, 1056 individuals/sq. m.; in 1964, 792 individuals/sq. m. In the years 1962—1964 snails, chiefly *Radix auricularia, R. limosa,* and *Anisus vortex,* stayed in the littoral zone, especially in the Bajerka valley and in the south-west part of the reservoir. Molluscs, especially various species of *Pisidum,* were found mainly in deeper water. The north-east part of the reservoir was more and more frequently populated by *Anodonta cellensis.* This is one of the commonest species of Polish molluscs, occurring in stagnant or slowly flowing waters, on slimy or sandy-and-slimy bottom. In the Goczałkowice reservoir it was first noted in 1958, when a single specimen was found by Zaćwilichowska on the sandy bottom of the north-east part of the reservoir. In 1960 four individuals were found near the banks of the reservoir. In 1959—1960 this mollusc was encountered in larger quantities in the deeper zone of the reservoir especially in the middle and the eastern parts (Zaćwilichowska 1965). A gradual increase in number was mainly observed, however, in the years 1961—1964.

These three groups of bottom fauna, *Chironomidae, Oligochaeta,* and *Mollusca,* played a decisive role in the reservoir, the remaining ones, especially *Heleidae* and *Culicidae* in the deeper parts of the reservoir, and *Ephemeroptera, Trichoptera,* and *Hirudinea* in the littoral zone, being less frequent.

*Heleidae* were encountered in the years 1961—1964 mainly at stations VII, V a, and I b, where in 1962 their maximum number was 132 individuals/sq. m.; in 1963 616 individuals/sq. m., and in 1964, 440 individuals/sq. m., while in the previous years they had been found in very small quantities and chiefly near the banks (*Stilobezia* sp.).

*Ephemeroptera.* In the years 1955—1957 they were found at various stations and in various, usually small quantities. The main role was played by *Cloeon dipterum* and *Baetis rhodani.* In the years 1958—1960 they constituted from 0.3—8.9 per cent of the bottom fauna, while in the years 1961—1964 their quantity decreased to 0.1—2.1 per cent. They were most numerous at stations III b and IV, where their maximum number was 132 individuals/sq. m. Most frequent were *Caenis moesta* and *Caenis* sp. occurring nearly everywhere in the littoral zone, as well as *Cloeon dipterum* mainly in the south-west and north-west parts of the reservoir.

*Trichoptera* occurred in small numbers in the first years of the reservoir's existence. In the years 1958—1960 their number constituted 10 per cent of the total bottom fauna, but in the years 1961—1964 it decreased to 4.3 per cent. The main role was played by *Mystacides azurea, M. nigra, Polycentropus flavimaculatus, Phrygenea grandis, Oecetis ochracea,* and *Limnophilus* sp.

*Hirudinea.* Leeches played a certain role in the bottom fauna of the

southern littoral zone as well as in the Bajerka valley. In the first years they occurred at some stations only, but in the years 1958—1960 they constituted from 0.2 to 3.7 per cent of the bottom fauna. In the years 1961—1964 their number considerably decreased, falling to 0.1—2.1 per cent. *Helobdella stagnalis*, *Glossiphonia complanata* and *Herpobdella octoculata* played the most important role.

*Coleoptera*, mainly *Berosus* sp. and *Haliplus* sp., were worth noticing among the remaining groups of bottom fauna. *Berosus* sp. the most numerous, especially in the years 1958—1960, although it occurred only as single specimens and not in the whole littoral zone. In the 1961—1964 it appeared constantly in the Bajerka valley, but it reached its largest numbers at stations I b and II b.

*Crustacea*. *Asellus aquaticus* appeared as early as 1956. at some stations even in fairly large quantities. In the next years it was encountered more and more rarely and in very small numbers, mainly in the north-west part of the reservoir at stations I b and II b.

*Odonata* (*Caenagrion* sp.), *Megaloptera* (*Sialis lutaria*), and *Culicidae* (*Chaoborus cristallinus*) played a smaller role. This last reached a greater density of population in the Bajerka valley in the years 1958—1960, and in the years 1962—1964 at stations I a, III a, I b and II b.

The remaining groups of bottom fauna occurred rarely and in small quantities, hence their role in the bottom fauna was insignificant.

The investigation showed that in the years 1962—1964 chiefly *Oligochaeta* increased in number, the remaining groups decreasing, with the exception of *Chironomidae* which remained at the same quantitative level.

The species composition of particular groups of bottom fauna is given in Table II.

## Winter investigation

In winter of the years 1961—1964 samples were taken five times through an air-hole at station VII. The bottom fauna at this station showed great variation, from 1056 individuals/sq. m. on the 23rd January 1964 to 4532 individuals/sq. m. on the 3rd February 1962, with an average of 2835 individuals/sq. m. *Chironomidae* were decidedly the most numerous group (from 528 to 2068 individuals/sq. m.). *Oligochaeta* occurred in numbers from 264 to 1782 individuals/sq. m. and *Mollusca* from 44 to 528 individuals/sq. m. Other particular groups were represented exclusively by *Heleidae* (average number 44 individuals/sq. m.) and once by *Culicidae* (*Chaoborus*, 44 individuals/sq. m.). Among *Chironomidae* group *Procladius* was the most numerous (average 52 per cent), *Chironomus* f.l. *plumosus* (19 per cent), *Cryptochironomus defectus* (10 per cent), *C. conjugens* (10 per

Tabela II. Skład procentowy poszczególnych gatunków fauny dennej zbiornika Goczałkowice w latach 1962-1964
Table II. Percentage of individual species in the bottom fauna of the Goczałkowice Reservoir in 1962-1964

| Nazwa gatunku / Name of species | Ujście potoku Mouth of Bajerka stream | | | Południowa część zbiornika Southern section of reservoir | | | Północna część zbiornika Northern section of reservoir | | | Centralna część zbiornika Central section of reservoir | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rok / Year | 1962 | 1963 | 1964 | 1962 | 1963 | 1964 | 1962 | 1963 | 1964 | 1962 | 1963 | 1964 |
| Mollusca | 13.1 | 12.5 | 5.6 | 6.8 | 10.4 | 3.2 | 9.2 | 8.3 | 10.6 | 7.0 | 5.1 | 3.5 |
| Pisidium amnicum | 0.1 | | | 0.5 | | 0.1 | 0.1 | 0.1 | | 5.0 | 3.6 | 2.5 |
| - subtruncatum | 0.1 | | 0.1 | | | | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| - casertanum | | | | 0.1 | 0.2 | 0.2 | | 0.1 | | | 0.2 | 0.1 |
| Anodonta cellensis | 0.1 | 0.5 | 0.2 | 0.4 | 2.2 | 0.6 | 1.8 | 3.2 | 3.7 | 0.1 | 0.1 | 0.1 |
| - anatina | | 0.1 | | 0.1 | 0.1 | 0.1 | 1.2 | 0.8 | 1.2 | 0.2 | 0.1 | |
| Unio pictorum | 0.2 | 0.3 | 0.2 | | | 0.1 | 3.0 | 1.4 | 2.6 | 0.2 | | 0.1 |
| Musculium lacustre | 0.1 | | | | | | 0.1 | | | | | |
| Radix limosa | 6.2 | 4.2 | 2.8 | 0.8 | 3.2 | 0.4 | 0.3 | 1.0 | 1.0 | | | |
| - auricularia | 1.8 | 4.6 | 1.5 | 2.4 | 2.6 | 0.5 | 1.2 | 0.2 | 0.4 | | | |
| Valvata piscinalis | 0.1 | | 0.1 | 0.4 | 2.0 | 1.0 | 0.3 | 0.2 | 0.6 | 1.0 | 0.4 | 0.2 |
| - pulchella | | 0.1 | | 0.1 | | 0.1 | | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| Planorbis planorbis | 1.1 | 1.3 | | 1.2 | | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Planorbarius corneus | 1.0 | | | 0.6 | | | 0.3 | 0.1 | 0.2 | 0.1 | 0.1 | |
| Anisus vortex | 2.0 | 1.2 | 0.6 | 0.1 | 0.1 | | 0.1 | | 0.3 | | 0.1 | |
| - spirorbis | | 0.1 | | | | | 0.2 | 0.7 | 0.1 | | | |
| Gyraulus albus | 0.2 | 0.1 | 0.1 | | | | 0.3 | 0.1 | 0.1 | | | |
| Viviparus viviparus | 0.1 | | | 0.1 | | | | | | | | |
| Ephemeroptera | 0.6 | 2.0 | 0.3 | 1.5 | 1.8 | 0.5 | 1.5 | 2.1 | 1.2 | 0.7 | 0.3 | |
| Caenis moesta | 0.1 | 0.8 | 0.1 | 0.2 | 0.5 | 0.2 | 0.2 | 0.2 | 0.2 | 0.5 | 0.2 | |
| Caenis sp. | 0.3 | 0.4 | 0.1 | 0.1 | 0.5 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |
| - horaria | 0.1 | | | 0.1 | | | 0.1 | 1.5 | 0.9 | 0.1 | | |
| Cloëon dipterum | 0.1 | 0.4 | | 0.8 | 0.2 | | 0.8 | 0.1 | | | | |
| Ephemerella ignita | | 0.2 | | 0.1 | 0.4 | | 0.1 | 0.1 | | | | |
| Heptagenia sp. | | 0.2 | 0.1 | 0.2 | 0.2 | | 0.2 | 0.1 | | | | |
| Trichoptera | 1.4 | 0.5 | 0.4 | 2.6 | 3.1 | 1.2 | 2.0 | 2.4 | 2.3 | 1.0 | 1.6 | 1.2 |
| Holocentropus picicornis | 0.4 | 0.2 | 0.2 | 0.6 | 0.8 | 0.3 | 0.2 | 0.1 | 0.2 | 0.1 | | |
| Polycentropus flavimaculatus | 0.2 | 0.1 | 0.1 | 0.1 | 0.3 | 0.1 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 |
| Mystacides azurea | 0.6 | 0.2 | | 0.6 | 0.9 | 0.6 | 0.5 | 0.8 | 0.6 | 0.2 | 0.4 | 0.1 |
| - nigra | | | | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Phryganea grandis | | | | 0.4 | 0.4 | | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 |
| Oecetis ochracea | 0.2 | | | 0.3 | 0.4 | | 0.8 | 0.9 | 1.0 | | 0.6 | 0.5 |
| Limnophilus sp. | | | | 0.4 | 0.1 | | | | | 0.1 | 0.1 | 0.2 |
| Mollanodes sp. | | | 0.1 | | | | | | | 0.1 | 0.1 | |
| Hirudinea | 0.4 | 1.1 | 0.5 | 2.1 | 1.1 | 0.1 | 0.5 | 0.1 | 0.6 | 0.1 | 0.1 | |
| Glossiphonia complanata | 0.1 | 0.4 | 0.2 | 0.4 | 0.2 | | 0.2 | | 0.1 | | | |
| Boreobdella verrucata | 0.2 | 0.1 | | | | | | | | | | |
| Helobdella stagnalis | | 0.6 | 0.2 | 0.9 | 0.6 | | 0.3 | 0.1 | 0.3 | | | |
| Hemiclepsis marginata | 0.1 | | | | | | | | | | | |
| Herpobdella octocullata | | | 0.1 | 0.2 | 0.2 | | | | 0.2 | | | |
| Glossiphonia heteroclita | | | | 0.6 | 0.1 | | | | | | | |
| Crustacea (Asellus aquaticus) | | | | | 0.5 | 0.2 | 0.2 | 0.2 | 0.4 | | | |
| Coleoptera | 0.2 | 0.3 | 0.2 | 0.6 | 0.2 | | 0.4 | 0.8 | | 0.1 | 0.2 | |
| Berosus sp. | 0.1 | 0.3 | 0.1 | 0.4 | 0.1 | | 0.3 | 0.6 | | | | |
| Haliplus sp. | 0.1 | | 0.1 | 0.2 | 0.1 | | 0.1 | 0.2 | | | | |
| Odonata (Caenagrion sp.) | | 1.2 | | 0.5 | 0.6 | | | | | | | |
| Megaloptera (Sialis lutaria) | | | | | 0.1 | | | | 0.5 | | | |
| Lepidoptera (Pyralidinae) | | 0.2 | | | | | | | | | | |
| Tipulidae (Tipula sp.) | | | 0.1 | | | | | | | | | |
| Heleidae | 2.4 | 1.3 | 5.3 | 1.2 | 0.8 | 3.6 | 2.5 | 2.8 | 4.7 | 0.6 | 1.5 | 2.1 |
| Chironomidae | 41.6 | 45.4 | 64.1 | 41.8 | 42.7 | 64.8 | 43.7 | 46.4 | 52.8 | 39.3 | 44.5 | 54.7 |
| Culicidae | | | | | 0.7 | 0.2 | 0.2 | 0.6 | | | | |
| Diptera alia | | 0.1 | | 0.3 | 0.1 | | 0.1 | | 0.4 | | | |
| Oligochaeta | 40.0 | 33.4 | 23.0 | 41.0 | 36.9 | 25.8 | 39.4 | 35.2 | 25.8 | 51.0 | 46.5 | 38.5 |
| Hymenoptera (Corixa sp.) | | 0.1 | | 0.1 | | | | | | | | |
| Hydracarina | 0.3 | 1.9 | 0.5 | 0.5 | 1.0 | 0.4 | 0.3 | 0.5 | 0.7 | 0.2 | 0.2 | |

cent) and *Tanytarsus gregarius* (6 per cent). Among *Mollusca Pisidium amnicum, P. caesertanum*, and small numbers of *Unio pictorum* occurred almost exclusively.

## Conclusion

In every newly built reservoir biological phenomena arise in stages. In the Goczałkowice reservoir three such stages could be observed.

The first (1955—1957) was when, after the area had been flooded with its land fauna and the fauna small waters, the escape and dying out of land forms followed by the aquatic forms adapted to the new conditions (mainly rheophilous forms) were observed. The earliest inhabitants of the bottom of the new reservoir were the larvae of *Chironomidae*, at first forms feeding on decaying aquatic plants and ubiquitous ones. The next to appear were *Oligochaeta* in ever increasing numbers, and in the littoral zone also *Ephemeroptera, Trichoptera,* and *Mollusca.*

In the second stage (1958—1961) *Chironomidae*, mainly their pelophilous forms, reached their maximum development. *Oligochaeta* also occurred in greater numbers. Other groups mainly populated the littoral zone.

In the third stage (1962—1964) further changes in the bottom fauna were observed. There was a constant increase of *Oligochaeta* which began to compete with and sometimes quantitatively dominated over *Chironomidae.* In the latter group the predaceous forms *Procladius* and *Cryptochironomus* played a gradually increasing role. Great changes were observed in the *Mollusca* group, where the hitherto rare *Anodonta cellensis* was found in ever great quantities.

In the Goczałkowice reservoir it was difficult to grasp exactly all the phenomena taking place during the formation of bottom fauna and observed in other reservoirs, such as in the Gorkovsky or Kuybyshevsky reservoirs (USSR) or in the Wir reservoir (Czechoslovakia). The general characteristics of the formation of bottom fauna were similar, however, although in the first years there was not such a sudden quantitative increase in the Goczałkowice reservoir as in the others (Morduchaj-Boltovskij 1961, Joffe 1961, Zelinka 1962). This increase occurred more slowly and gradually, with its greater intensity between the fourth and the seventh years. The population process itself was similar to that in other reservoirs: *Chironomidae* appeared first, followed by *Oligochaeta* and other organisms. Also the species composition of bottom fauna in the reservoirs investigated was often similar. The main characteristics of bottom fauna in the years 1962—1964 may be given as follows:

1. As the formation of bottom sediments underwent change so did there occur changes in bottom fauna.

2. The number of bottom fauna varied between 1500 and 2300 individuals/sq. m.

3. *Chironomidae* and *Oligochaeta* distinctly predominated over other groups of bottom fauna.

4. In the *Chironomidae* group the predaceous forms, especially *Procladius* genus, were the most numerous.

5. Pelophilous biocoenoses populated the central part of the reservoir, pelophilous and phytophilous the littoral zone of the southern and north-west part, and pelophilous and psammophilous ones the north-east part of the reservoir.

6. In the *Mollusca* group an increase in the number of the large molluscs *Anodonta cellensis* and *Unio pictorum* was observed.

7. The number of species in the remaining groups of bottom fauna, as well as their quantity, decreased in 1964.

Investigations on the bottom fauna of the reservoir are still being continued. In connection with other investigations they may add many interesting data to the study of the formation of biocoenoses in the Goczałkowice dam reservoir.

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## STRESZCZENIE

Badania nad fauną denną prowadzone są na zbiorniku w Goczałkowicach od początku jego istnienia. Pierwszy etap kształtowania się fauny dennej w zbiorniku obejmował lata 1955—1957. Pod wpływem zalania obserwowano masową ucieczkę i wymieranie form lądowych, następnie zasiedlanie zbornika przez nowy zespół organizmów, najpierw *Chironomidae*, następnie *Oligochaeta*. Średnia ilość fauny dennej w 1955 roku wynosiła 2520 okazów/m², w 1956 r. 2661 okazów/m², a w 1957 r. 2520 okazów/m². Drugi etap obejmował badania w latach 1958—1961. Obserwowano wtedy masowy już rozwój *Chironomidae*, głównie *Glyptotendipes gripekoveni, Paratendipes albimanus* w strefie przybrzeżnej, zaś *Procladius* i *Chironomus semireductus* w strefie głębszej. Obserwowano także rozwój innych grup, głównie *Oligochaeta, Ephemeroptera* i *Trichoptera*. Średnia ilość fauny dennej wynosiła w latach 1958—1959, 2723 okazów/m² i 2662 okazów/m² w roku 1960, a w 1961 r. 2739. Zasadniczym tematem niniejszej pracy były badania nad fauną denną w latach 1962—1964, obejmujące trzeci etap jej formowania się. W roku 1962 próby pobierano na szesnastu stanowiskach. Bogatą faunę stwierdzono w południowo-zachodniej części zbiornika, ze średnią ilością 2450 okazów/m². W północnej części strefy przybrzeżnej więcej zwierząt posiadały stanowiska położone w górnej części zbiornika przy średniej ilości 2100 okazów/m². Na stanowiskach położonych w północno-wschodniej części fauna była uboższa, wynosząc średnio 1328 okazów/m². W strefie centralnej obfitszą fauną odznaczały się stanowiska położone w górnej części zbiornika, ze średnią ilością 2700 okazów/m². Średnia ilość fauny z całego zbiornika wynosiła 2015 okazów/m². W 1963 r. próby pobierano na osiemnastu stanowiskach. W strefie przybrzeżnej południowej części zbiornika (górnej), najbogatsza była fauna ze średnią ilością 3200 okazów/m². Wzrost ilości fauny dennej obserwowano także w północnej części zbiornika, zwłaszcza w północno-zachodniej,

gdzie średnia jej ilość wynosiła 2990 okazów/m². W strefie centralnej najbogatsze były stanowiska położone w górze zbiornika o średniej ilości fauny 3780 okazów/m². Średnia ilość fauny z całego zbiornika wynosiła 2380 okazów/m². W 1964 r. w południowej części zbiornika ilość fauny dennej była niższa wynosząc średnio 1400 okazów/m² W północnej części największe ilości fauny występowały w górze zbiornika dochodząc do 4000 okazów/m². W strefie centralnej obserwowano wzrost ilości *Chironomidae*. Ogólnie stwierdzono obniżenie ilościowe fauny w całym zbiorniku, a średnia jej ilość wynosiła 1705 okazów/m². Największy wzrost fauny obserwowano między czwartym a siódmym rokiem istnienia zbiornika. Zmiany zachodziły także w składzie gatunkowym. Wśród *Chironomidae* przeważały *Procladius* i *Chironomus plumosus*. W ostatnich latach obserwowano także obok zaniku pewnych gatunków, jak *Chironomus thummi, Paratendipes albimanus*, pojawienie się nowych gatunków, jak *Stictochironomus histrio* i *S. psammophilus*. W porównaniu do lat poprzednich, w mniejszych ilościach występowały inne grupy fauny dennej, z wyjątkiem *Heleidae*, których ilość w ostatnich latach nawet wzrosła. Wzrosła też ilość dużych małży *Anodonta cellensis* i *Unio pictorum*.

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