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DEVELOPMENT AND STRUCTURE OF THE GOCZAŁKOWICE RESERVOIR ECOSYSTEM IX. ZOOPLANKTON

ABSTRACT: Zooplankton of the Goczałkowice dam reservoir was investigated as regards its species composition, quantitative occurrence and changes between 1955 and 1982. Species composition was abundant, zooplankton occurred quantitatively but with a decreasing tendency in successive years of the reservoir's existence. Two stages in its development were distinguished. The inflowing flood waters and considerable drawdowns of water level affected greatly the zooplankton development.

KEY WORDS: Reservoir, ecosystem, zooplankton, vertical distribution, surface distribution, the influence of flood.

1. INTRODUCTION

This is a fragment of complex hydrobiological investigations conducted on Goczałkowice dam reservoir on the Vistula. At first studies on the zooplankton of this reservoir were not conducted systematically and by several authors (R u m e k 1957, K y s e l a 1958, M a r c z e k 1958, M l e c z k o 1965, 1968). Different methods of sampling and elaborating the material make it difficult to compare and interpret results from that period. Since 1964 I have investigated systematically the zooplankton of this reservoir as regards its species composition, quantitative occurrence, both on particular sites and in the vertical arrangement, and changes during the period examined.

2. METHODS

At first the material was sampled according to the accepted from the beginning of investigations network of sites (Fig. 1). The sites were evenly distributed on the whole surface area of the reservoir, and the material collected there allowed to characterize in detail the species composition and quantitative relations of planktonic animals on the surface area of the whole reservoir. Surface samples were taken there 4 – 5 times per season. On site 18, in the pelagial, samples were taken every week and vertically every 1 m of depth. This site was in the deepest part of the reservoir, unaffected by negative sources and water pipe intake. In the nineteen-seventies only 4 sites (Fig. 1) characterized the whole reservoir.

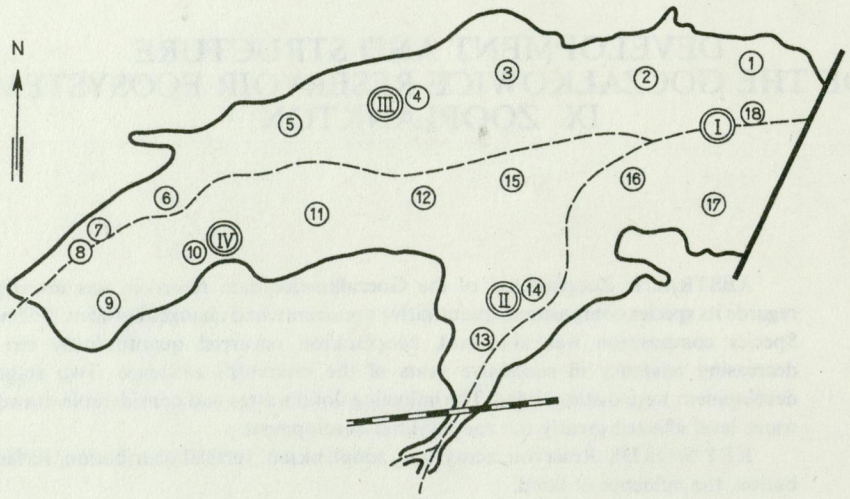

Fig. 1. Map of zooplankton sampling sites on Goczałkowice reservoir
Arabic numerals (1 – 18) – sites till 1970. Roman numerals (I – IV) – sites after 1970

A 5 dm^3 Patalas sampler was used. The material for a quantitative analysis was obtained concentrating 10 dm^3 of water to 0.1 dm^3 by means of a plankton net made of bolting-cloth No 25 (55 μm mesh diameter). Quantitative results were obtained by counting the number of individuals in the Kolkwitz chamber and then per 1 dm^3 of water. Each time when sampling, a surface draw was made to determine precisely the zooplankton species composition at a given date, investigating the live material. This method is not precise for the group of protozoans, because some of them pass through the plankton net, not allowing for a precise quantitative characteristics.

3. RESULTS

3.1. SPECIES COMPOSITION OF ZOOPLANKTON

Apart from main groups of zooplankton such as Protozoa, Rotatoria, Cladocera and Copepoda the material sampled contained representatives of Nematoda, Acanthocephali, Oligochaeta, Hydracarina. The material examined had also freely floating eggs of the majority of these groups, also eggs of snails, larvae of mussels of the family Unionidae, exuviae of Chironomidae larvae, statoblasts of Bryozoa, sponge needles, pollen, plant and animal remains.

Zooplankton of Goczałkowice reservoir showed great species differentiation in the period examined. Between 1964 and 1966, having the greatest species differentiation, 25 Protozoa species, 61 Rotatoria species, 29 Cladocera species and 7 species from the Copepoda group were found in the plankton.

The list of zooplankton in this reservoir consists of species occurring during the entire period of investigations, such as, e.g., protozoan *Tintinnopsis lacustris* Entz, rotifers *Polyarthra vulgaris* (Carlin), *Synchaeta pectinata* Ehrenberg, *Keratella cochlearis* Gosse, summer form of *Brachionus angularis* Gosse or planktonic crustaceans *Daphnia cucullata* Sars, *Cyclops strenuus* (Fischer) and *Eudiaptomus gracilis* Sars (Figs. 2, 3). There are also species occurring during almost the entire time of period examined but with breaks of few years, i.e., crustaceans *Daphnia longispina* Müller, *Bosmina*

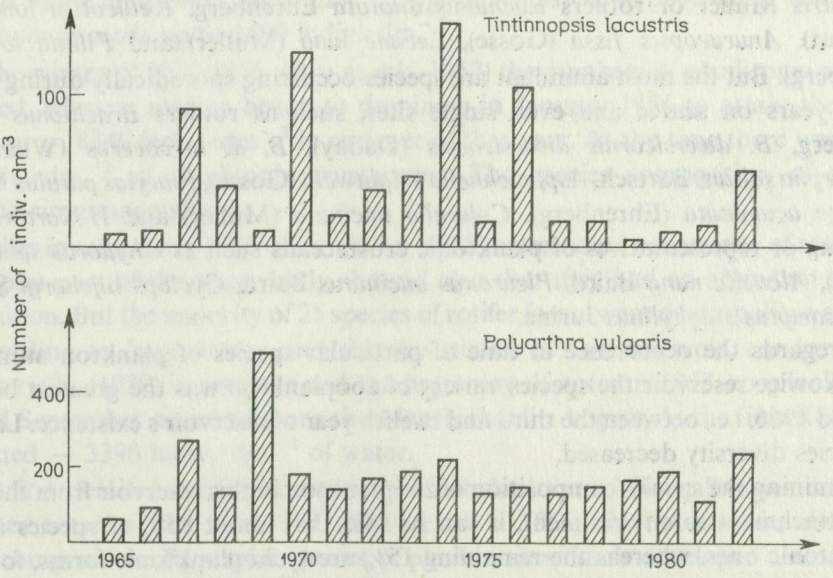

Fig. 2. Occurrence of *Tintinnopsis lacustris* and *Polyarthra vulgaris* in Goczałkowice reservoir between 1965 and 1982

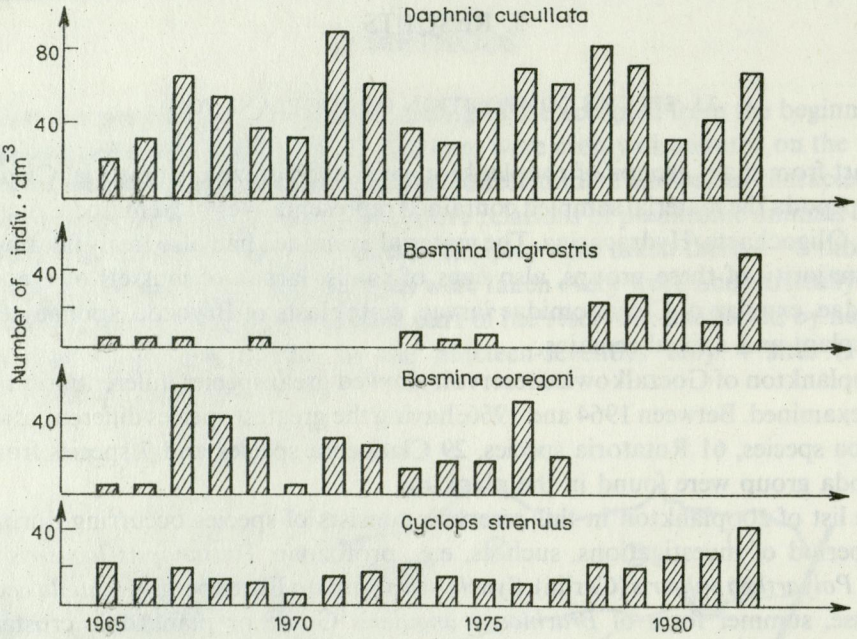

Fig. 3. Occurrence of *Daphnia cucullata, Bosmina longirostris, B. coregoni* and *Cyclops strenuus* in Goczałkowice reservoir between 1965 and 1982

longirostris Müller or rotifers *Euchlanis dilatata* Ehrenberg, *Kellicottia longispina* (Kellicott), *Anuraeopsis fissa* (Gosse), *Lecane luna* (Müller) and *Filinia longiseta* (Ehrenberg). But the most abundant are species occurring sporadically during one or several years on scarce and even single sites, such as rotifers *Brachionus rubens* Ehrenberg, *B. diversicornis diversicornis* (Daday), *B. d. homoceros* (Wierzejski), *Ascomorpha saltans* Bartsch, *Asplanchnella brightwelli* (Gosse), *Platyias patulus* Müller, *Notholca acuminata* (Ehrenberg), *Colurella uncinata* (Müller) and *Hexarthra mira* (Hudson), or representatives of planktonic crustaceans such as *Chydorus sphaericus* (Müller), *Alonella nana* Baird, *Pleuroxus uncinatus* Baird, *Cyclops liljeborgi* Sars or *Canthocamptus staphylinus* Jurine.

As regards the occurrence in time of particular species of plankton animals in Goczałkowice reservoir the species variety of zooplankton was the greatest between 1957 and 1966, i.e., between the third and twelfth year of reservoir's existence. Later on the species diversity decreased.

Examining the species composition of zooplankton in this reservoir from the point of its attachment to environment, it can be said that about 85% of species are the euplanktonic ones, whereas the remaining 15% are tychoplanktonic forms, found in plankton as a result of mechanical or biological factors which bring them either from periphyton or benthos. Intensive wave action in the reservoir frequently causes total mixing of water column, from the bottom to the surface, and affects badly the formation of typical zooplankton communities. This should explain why in surface plankton there

are numerous typical benthic species such as the rotifer *Rotatoria rotatoria* (Pallas) or cladoceran *Ilyocryptus agilis* Kurz.

Fluctuations of water level in the reservoir enrich the species composition of plankton with ubiquitous species, especially in its southern and south-western part. Vast shallows, frequently greatly overgrown by submerged and emergent vegetation, the tributaries supplying the reservoir, many ponds and other small water bodies in the close neighbourhood affect considerably the character of zooplankton of the reservoir itself, increasing its species variety.

About 80% of planktonic animals there are heleoplanktonic and potamoplanktonic animals, only 20% are the typical eulimnoplanktonic species occurring more abundantly in the central and near dam parts of the reservoir.

3.2. SUCCESSION OF ZOOPLANKTONIC COMMUNITIES

The first observations (R u m e k 1957) of experimental inundations or the accidental one due to heavy rainfall in 1955 did not confirm the existence of typical planktonic forms. Only some cosmopolitan species of rotifers were found. Since the constant impoundment changes had taken place. The initial group of plankton species: 73% of plant forms and 27% of animal forms changed into: 99% of animal forms and only 1% of plant forms. In this system, especially along the concrete dam, monospecific groups of Cladocera dominated. There was an abundant growth of *Polyphemus pediculus* Linne up to 3600 indiv.$\cdot$dm^{-3}, *Daphnia longispina* to 2400 indiv.$\cdot$dm^{-3} and *Bosmina longirostris* up to 1600 indiv.$\cdot$dm^{-3}.

In the winter of 1955/1956 (R u m e k 1957) the numbers of planktonic animals decreased, whereas rotifers began to dominate in January 1956 to attain their first maximum – 8340 indiv.$\cdot$dm^{-3} in summer of that year. At the time there were only 400 indiv.$\cdot$dm^{-3} of planktonic crustaceans. The species composition of rotifers increased simultaneously.

Studies in autumn of 1956 (K y s e l a 1958) on seasonal occurrence of rotifers in the deepest part of the water body showed also that they had an abundant species composition. But the majority of 25 species of rotifer forms were cosmopolitan species.

According to fragmentary and sketchy studies in this reservoir, conducted by M a r c z e k (1958) in summer and the beginning of autumn 1957, zooplankton in July and September occurred more abundantly than in August. At the time Rotatoria dominated – 3390 indiv.$\cdot$dm^{-3} of water.

The first detailed investigations on the zooplankton of Goczałkowice reservoir conducted between 1957 and 1959 (M l e c z k o 1965, 1968) showed its abundant species composition. Particular species of planktonic animals developed abundantly. In the third year Rotatoria developed abundantly, especially *Keratella cochlearis* with a maximum development of 21000 indiv.$\cdot$dm^{-3}. Rotatoria also dominated distinctly, their percentage being 55.3 – 97.4% of all animals, depending on the season of the year.

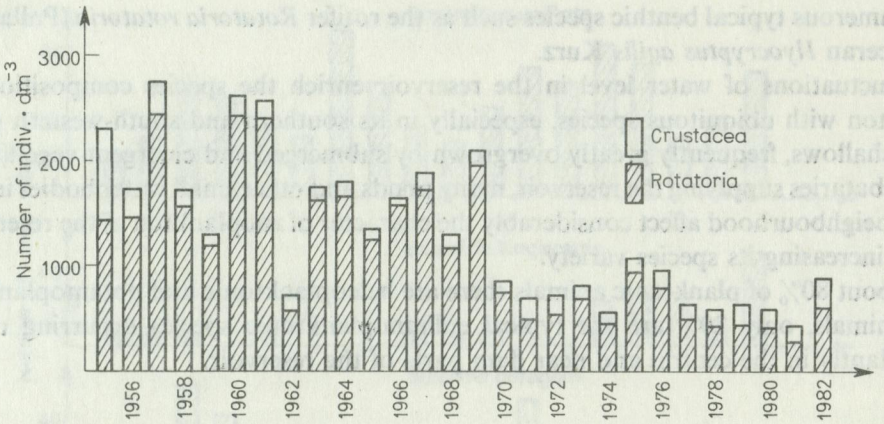

Fig. 4. Occurrence of zooplankton on sites 18 and I (cf. Fig. 1) in Goczałkowice reservoir between 1955 and 1982

The second group as regards the numbers were Crustacea 2.2 – 39.6%, whereas Protozoa were 0.4 – 28% of total numbers of plankton animals.

In 1960 and 1961 (Fig. 4), in the sixth and seventh year of the reservoir, besides 1957, zooplankton developed most abundantly; its mean annual being 3358 – 4080 indiv. · dm^{-3}. In 1962, their density rapidly decreased to an average of 918 indiv. · dm^{-3}. At the same time the number of species of the genus *Brachionus* decreased, which is considered as a beginning of stabilization of biological processes in the reservoir.

In the seven next years (1963 – 1969) zooplankton was quite abundant (Fig. 4) (annual mean values 1620 – 2607 indiv. · dm^{-3}). At the beginning of this period zooplankton was also qualitatively most abundant (122 species) during the entire period of the reservoir's existence.

In 1970, the numbers of zooplankton in Goczałkowice reservoir decreased again to remain such till the end of investigations (Fig. 4). Mean annual density of zooplankton in 1981 was 500 indiv. · dm^{-3} and in 1975 – 1100 indiv. · dm^{-3}. More species disappeared from its composition, the dominance of Rotatoria over other groups of zooplankton increased.

3.3 CHARACTERISTICS OF SURFACE ZOOPLANKTON

This subject is based on material obtained between 1964 and 1966. The results show an uneven distribution of surface zooplankton in particular regions or groups of sites of Goczałkowice reservoir (Figs. 5 – 7). Zooplankton is much more numerous in the southern and south-western part of the reservoir. The sites in this part of the reservoir are rather shallow (not exceeding 2 – 3 m in depth), frequently well overgrown with vegetation, and resemble ponds by their physico-chemical properties of water and bottom. This creates suitable conditions for the development of zooplankton in this

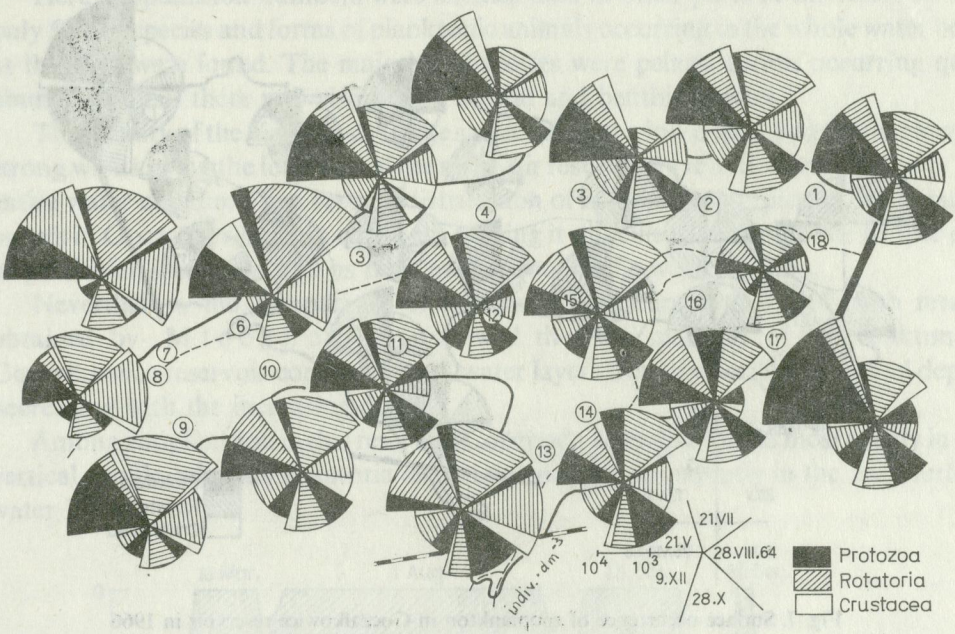

Fig. 5. Surface occurrence of zooplankton in Goczałkowice reservoir in 1964
1 – 18 – numbers of sites

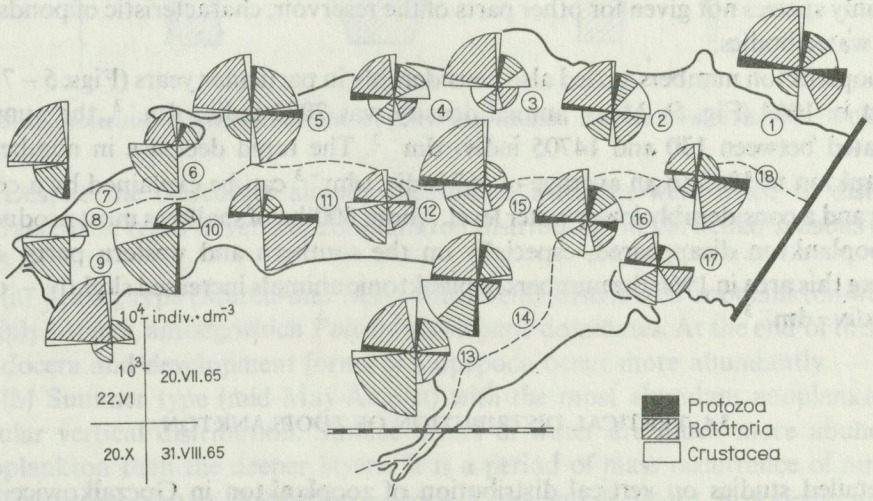

Fig. 6. Surface occurrence of zooplankton in Goczałkowice reservoir in 1965
1 – 18 – numbers of sites

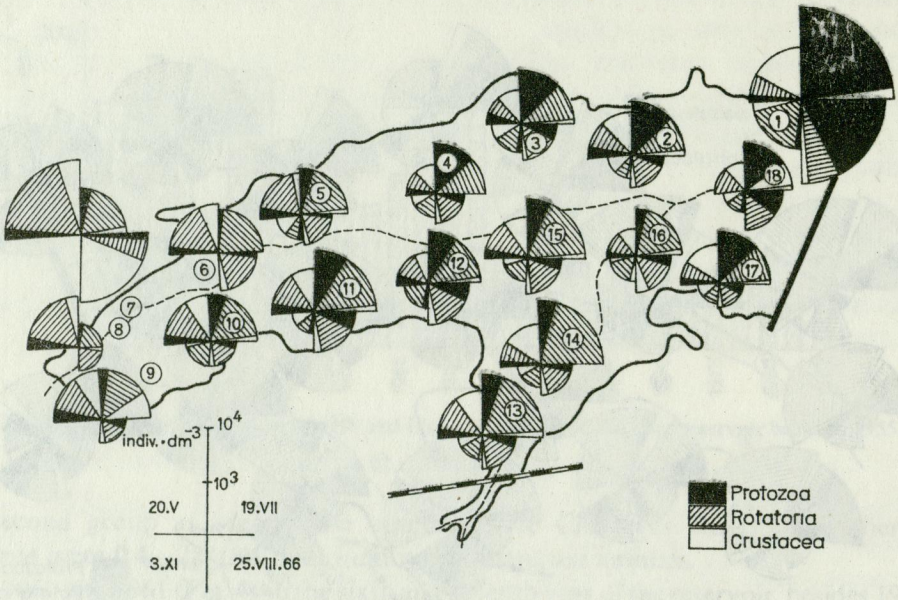

Fig. 7. Surface occurrence of zooplankton in Goczałkowice reservoir in 1966
1 – 18 – numbers of sites

part of the reservoir. In 1964, the average occurrence of zooplankton in the whole reservoir was 2072 indiv. · dm^{-3} and in its upper part 2787 indiv.·dm^{-3}, in 1965: 567 and 677 indiv.·dm^{-3}, respectively, and in 1966: 756 and 910 indiv.·dm^{-3}, respectively.

The species differentiation was also the greatest in the upper part of the reservoir; 95% of all zooplankton species recorded from this reservoir occurred there. Recorded were only species not given for other parts of the reservoir, characteristic of ponds and small water bodies.

Zooplankton numbers varied also considerably in particular years (Figs. 5 – 7); the highest in 1964 (Fig. 5). Mean annual density was 2072 indiv.·dm^{-3}, the numbers fluctuated between 130 and 14705 indiv.·dm^{-3}. The rapid decrease in numbers of zooplankton in 1965 to an average of 567 indiv.·dm^{-3} can be explained by a colder spring and a considerably lower water level. About 800 ha of shallows most productive for zooplankton disappeared, especially on the southern and western parts. After flooding this area in 1966 the numbers of planktonic animals increased slightly – up to 765 indiv.·dm^{-3}.

3.4. VERTICAL DISTRIBUTION OF ZOOPLANKTON

Detailed studies on vertical distribution of zooplankton in Goczałkowice dam reservoir were conducted in the years 1965 – 1967 on site 18 in the central part beyond the negative source and water pipe intake (Fig. 1).

Here zooplankton numbers were smaller than in other parts of the reservoir and only 58% of species and forms of planktonic animals occurring in the whole water body at the time were found. The majority of species were pelagic forms, occurring quite abundantly, but there was also plenty littoral and benthic species.

The locality of the water body, large surface area at a low depth, frequently blowing strong winds along the long axis of the reservoir result in wave action and mixing of the entire water column. Thus vertical distribution of zooplankton typical in lakes rarely occurs in Goczałkowice dam reservoir, making it difficult to recognize the proper one of particular species as well as their movements in the water column.

Nevertheless, the comparison of material from years 1965–1967 with results obtained by M l e c z k o (1968) showed that the majority of zooplankton in Goczałkowice reservoir concentrates in water layers from the surface to 5 m of depth, decreasing with the increasing depth.

Among zooplankton in this reservoir Copepoda were distributed most evenly in the vertical profile, whereas Rotatoria accumulated more abundantly in the near surface water layers.

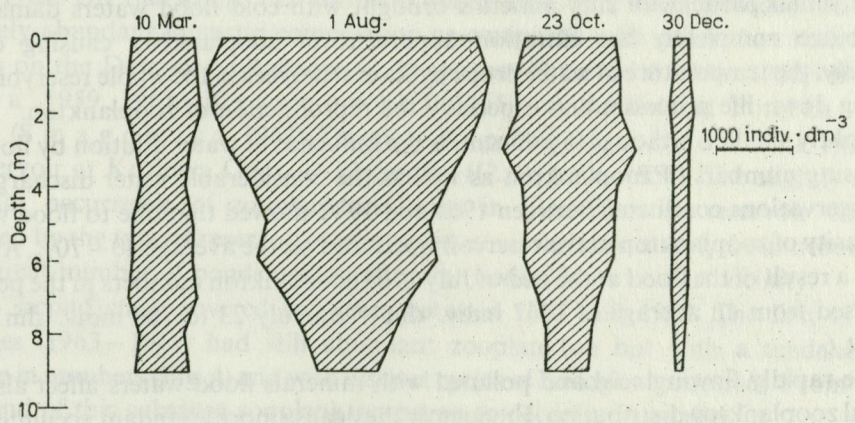

Fig. 8. Characteristic seasonal vertical distribution of zooplankton in Goczałkowice reservoir on the example of 1967

Despite the difficulties already mentioned, attempts were made to distinguish characteristic types of vertical zooplankton distribution in particular seasons (Fig. 8). And so:

(a) Spring type (March-mid May) with evenly distributed zooplankton numbers, mainly rotifers, among which *Polyarthra vulgaris* dominates. At the end of this period Cladocera and development forms of Copepoda occur more abundantly.

(b) Summer type (mid-May-August) with the most abundant zooplankton and regular vertical distribution. Surface layers of water are much more abundant in zooplankton than the deeper layers. It is a period of mass occurrence of numerous rotifer species such as *Polyarthra vulgaris, Synchaeta pectinata, Brachionus angularis* and *Filinia longiseta.* Cladocera occur abundantly and also genus *Carchaesium* among protozoans.

(c) Autumn type (September-November) has a rather evenly distributed numerous zooplankton. Frequently in September or October there are smaller maxima of zooplankton and especially of planktonic crustacean numbers. From November zooplankton numbers gradually decrease and only some species are recorded. Rotatoria still dominate.

(d) Winter type (December-February) with a qualitatively and quantitatively poor and evenly distributed zooplankton. Rotatoria continue to dominate with species *Polyarthra dolichoptera* Idelson and *P. vulgaris*.

3.5. INFLUENCE OF FLOOD WATERS ON ZOOPLANKTON DEVELOPMENT

The rapidly inflowing to the reservoir colder flood waters of a higher turbidity caused by high contents of silty minerals (K r z y ż a n e k 1963) are responsible for decreasing numbers of zooplankton.

There are two kinds of negative effect of flood waters on zooplankton growth. Firstly, small particles of silty minerals brought with cold flood waters damage or immobilize completely the filtration apparatus of zooplankton causing death. Secondly, the temperature of water drops by several degrees in the whole reservoir thus slowing down life processes and especially the reproduction of zooplankton.

Slightly smaller, although significant, is the influence of water dilution by flood on decreasing numbers of zooplankton as well as the considerable water discharges.

Observations conducted between 1965 and 1972 showed that due to flood waters the density of zooplankton in the reservoir decreased on the average 40 – 70%. And so, e.g., as a result of the flood at the end of July 1968 zooplankton numbers in the pelagial decreased from an average of 1267 indiv. $\cdot$ dm^{-3} on July 23 to 780 indiv. $\cdot$ dm^{-3} on August 6.

The rapidly flowing cold and polluted with minerals flood waters affect also the vertical zooplankton distribution. Frequently they cause more abundant accumulation of zooplankton in surface water layers when slightly warmer and with less suspensions. Observations show that all groups of plankton animals affected by flood waters decrease their numbers by a similar per cent, i.e., all are equally sensitive and react identically to flood waters.

After each flood period zooplankton numbers increase gradually. As plenty of organic and inorganic matter is brought into the reservoir, increasing its trophic state, the bacterial flora and phytoplankton – food supply for the majority of zooplankton – develop.

4. DISCUSSION

The material from Goczałkowice dam reservoir shows two stages of formation of zooplankton community.

The first stage covered the years from experimental floods to 1962, when zooplankton numbers decreased rapidly four times. Cladocerans developed abundantly, especially along the concrete dam, during the experimental flooding. A similar situation has been observed by Ž a d i n and G e r b (1961) in new dam reservoirs and by Š i r o k o v a (1936) and S k o r b a t o v (1954) in new or fallow ponds. The bacterial flora growing well on the substrate of decomposing vegetation provides best trophic conditions for this group of filtrators (M a n u i l o v a 1958, R o d i n a 1959).

As an artificial reservoir it was characterized in its first years by unbalanced biological phenomena expressed, amongst other things, by local abundant growth of particular zooplankton species (R u m e k 1957, M l e c z k o 1965, 1968). Similar observations have been made on new dam reservoirs such as Ivankovskoe (N e j v e s t n o v a - Ž a d i n a 1941), Učinskoe (R y l o v 1941) and other.

The first stage is the period of most abundant occurrence of zooplankton in the Goczałkowice reservoir with an average annual density in 1960 of 4080 indiv. $\cdot$ dm^{-3}. Species composition becomes more varied, attaining the highest diversity in the years 1964–1966. On the whole 122 zooplankton species were then recorded. It is an extremely abundant faunistic composition as compared with other dam reservoirs, such as on the Dunajec at Rożnów – 80 species (S i e m i ń s k a 1952, B i e r n a c k a 1959, 1963, K r z a n o w s k i 1965), on the Soła at Porąbka – 40 species (S m a g o w i c z 1963), Tresna – 40 species (K r z a n o w s k i 1971) or the reservoir at Kozłowa Góra – 32 species (C z a p i k 1958). The slightly more abundant occurrence of zooplankton forms in Goczałkowice reservoir can be explained by the type of reservoir, variety of its environments, supply from tributaries and a great number of ponds and small water bodies in its nearest vicinity.

The second stage covered the years between 1963 and 1982. The first of two substages (1963–1969) had still abundant zooplankton but with a tendency to decrease in numbers (Fig. 4) and with distinct cycles of biological processes. From 1967 to the end of this substage zooplankton began to decrease in quality.

The second substage (1970–1982) showed further decrease in zooplankton density and further losses in species composition.

The material on surface distribution of zooplankton in Goczałkowice reservoir shows its uneven occurrence. Zooplankton in the south-western part of the reservoir is more numerous than in other parts and has the greatest species differentiation.

During the entire period of investigations Rotatoria dominate with indicator species *Polyarthra vulgaris, Synchaeta pectinata, Keratella cochlearis* and *Conochilus unicornis* Rousselet and *Brachionus angularis* – abundant only in summer.

Cladocera are abundant in species in the upper part of the reservoir, whereas they are most numerous in the open – pelagic part with dominant species *Daphnia cucullata* and *Bosmina longirostris*. Other zooplankton groups such as Protozoa and Copepoda are of no greater significance in the reservoir.

In the annual cycle there are two maxima of zooplankton development: at the turn of May and at the turn of August. As regards the vertical distribution of zooplankton

the majority concentrates in water layers to the depth of 5 m, decreasing with the increasing depth. Similar vertical distribution has been observed in many shallow dam reservoirs (Nejvestnova-Žadina 1941, Rylov 1941, Czapik 1958, Zelinka 1960, Žadin and Gerb 1961).

Flood waters influence greatly the zooplankton in Goczałkowice reservoir causing rapid reduction in zooplankton numbers (even 70%) and frequently their greater concentrations in cleaner at the time near surface water layers. The destructive effect of flood waters has been observed on other dam reservoirs: at Rożnów (Siemińska 1952, Żurek 1980), Porąbka (Smagowicz 1963), Tresna (Krzanowski 1971), Rożnów and Czchów (Krzanowski 1965).

The considerable decrease of water level affects greatly the zooplankton numbers, which decrease distinctly because of uncovering of the most productive for zooplankton shallows in the upper parts of the reservoir.

The zooplankton there is also reduced in numbers due to water outflowing from the reservoir. Between June 5 and August 3, 1972 the 56132 thous. m^3 of discharged water contained about 185810 kg of zooplankton (Krzanowski 1977).

Recent investigations on the biomass of zooplankton of Goczałkowice reservoir have shown that its average annual one ranges from 2 to 4 $mg \cdot dm^{-3}$, an average value as compared with other dam reservoirs.

5. SUMMARY

Studies on zooplankton of Goczałkowice reservoir have been conducted since its construction, i.e., its species composition, quantitative occurrence, vertical distribution and in the whole lake. Two stages of zooplankton development have been distinguished. The first one covered the 7 first years characterized by unbalanced biological phenomena. During impoundments monospecific cladoceran groups developed, whereas from the spring of next year Rotatoria developed abundantly and began to dominate. This was a period of most abundant zooplankton occurrence (Fig. 4) and enrichment of its qualitative composition. The first stage ended by a rapid four-fold drop in zooplankton numbers in 1962.

The second stage (1963 – 1982) had two substages. At first zooplankton was quite numerous and had the greatest species variety (122 species between 1964 and 1966) tending to decrease towards the baginning of the second substage. The second substage (1970 – 1982) showed a further reduction in the zooplankton density (Fig. 4) and its species composition. Rotatoria dominated all the time with dominant species *Polyarthra vulgaris, Synchaeta pectinata, Conochilus unicornis* and *Keratella cochlearis* and the summer form of *Brachionus angularis*. Cladocera occurred more abundantly in the central and near dam part of the reservoir with dominant *Daphnia cucullata* and *Bosmina longirostris*. Protozoa and Copepoda were of no greater significance in the zooplankton of Goczałkowice reservoir. Figures 2 and 3 illustrate the occurrence of dominant species in the years 1965 – 1982. As regards surface distribution zooplankton was more abundant in the south-western part of reservoir (Figs. 5 – 7). In the annual cycle there were two maxima of zooplankton development.

The zooplankton biomass in Goczałkowice reservoir was 2 – 4 $mg \cdot dm^{-3}$ being an average value as compared with other dam reservoirs.

The zooplankton in its vertical distribution concentrated mostly in water layers to the depth of 5 m. Characteristic types of vertical distribution of zooplankton (Fig. 8) in particular seasons were distinguished.

Flood waters influence greatly the zooplankton of Goczałkowice reservoir reducing rapidly (to 70%) its numbers and causing more frequent concentration in near-surface water layers.

The decrease in water level (2 – 3 m) reduces greatly the colonization of waters by zooplankton as the most productive shallows in the reservoir are uncovered. Considerable losses in zooplankton are also due to outflows.

6. POLISH SUMMARY

Badania nad zooplanktonem zbiornika goczałkowickiego prowadzono od początku jego istnienia do chwili obecnej i miały one na celu poznanie jego składu gatunkowego, występowania ilościowego i rozmieszczenia tak w pionie, jak i na obszarze całego zbiornika. Wyróżniono 2 etapy w rozwoju zooplanktonu w tym zbiorniku. Etap pierwszy obejmował 7 pierwszych lat jego istnienia. Zbiornik w tym czasie charakteryzował się niezrównoważonymi zjawiskami biologicznymi. W czasie piętrzenia zbiornika rozwijają się w nim jednogatunkowe roje *Cladocera*, a od wiosny drugiego roku istnienia zbiornika zaczynają masowo rozwijać się i dominować *Rotatoria*. Jest to okres najliczniejszego występowania zooplanktonu (rys. 4) oraz wzbogacania się jego składu jakościowego. Etap pierwszy kończy gwałtowny 4-krotny spadek liczebności zwierząt planktonowych w 1962 r.

W etapie drugim (1963 – 1982) wyróżniono 2 podetapy. Pierwszy z nich cechował się jeszcze dość licznym zooplanktonem o najbogatszym zróżnicowaniu gatunkowym (122 gatunki w latach 1964 – 1966). Pod koniec tego podetapu zaznacza się tendencja do zubożenia jakościowego zooplanktonu w zbiorniku, pogłębiająca się w miarę upływu lat. W podetapie drugim (1970 – 1982) nastąpił dalszy spadek zagęszczenia zwierząt planktonowych w zbiorniku (rys. 4), jak też dalszy ubytek gatunków z jego składu. Grupą dominująca przez cały okres badań były *Rotatoria* z gatunkami dominującymi *Polyarthra vulgaris, Synchaeta pectinata, Conochilus unicornis* i *Keratella cochlearis* oraz letnią formą *Brachionus angularis*. *Cladocera* liczniej występowały w centralnej i przyzaporowej części zbiornika i tu dominowały *Daphnia cucullata* i *Bosmina longirostris*. *Protozoa* i *Copepoda* nie odgrywały większej roli w zooplanktonie zbiornika goczałkowickiego. Na rysunkach 2 i 3 zilustrowano występowanie dominujących gatunków w latach 1965 – 1982. W swym rozmieszczeniu powierzchniowym stwierdzono liczniejsze występowanie zooplanktonu po południowo-zachodniej stronie zbiornika (rys. 5 – 7). W cyklu rocznym obserwuje się 2 maksima rozwoju zwierząt planktonowych.

Biomasa zooplanktonu zbiornika goczałkowickiego wynosi 2 – 4 $mg \cdot dm^{-3}$ wody i stanowi średnią wielkość w porównaniu z innymi zbiornikami zaporowymi.

Większość zooplanktonu w swym pionowym rozmieszczeniu w zbiorniku goczałkowickim grupuje się w warstwach wody do 5 m głębokości. Wyróżniono typy charakterystyczne pionowego rozmieszczenia zooplanktonu (rys. 8) w tym zbiorniku dla poszczególnych sezonów.

Silne oddziaływanie na zooplankton tego zbiornika mają wody powodziowe, powodując gwałtowne spadki (do 70%) liczebności zwierząt planktonowych oraz częste liczniejsze gromadzenie się ich w przypowierzchniowych warstwach wody.

Duży wpływ na zasiedlenie przez zooplankton zbiornika goczałkowickiego mają znaczne (2 – 3 m) obniżenia lustra wody. Powodują one spadki zasiedlenia wód zbiornika przez zwierzęta planktonowe spowodowane odsłonięciem się dna najbardziej produktywnych płycizn zbiornika. Znaczne straty ponosi zooplankton tego zbiornika także poprzez odpływy.

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