

Composition, density and biomass of the ichthyofauna of the Goczałkowice Reservoir (Southern Poland)*

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Abstract — In the period 1981—1984 qualitative and quantitative investigations of the ichthyofauna of the Goczałkowice dam reservoir were carried out. 16 species of fish were found to occur in the reservoir, the main components of the ichthyofauna being cyprinids (*Abramis brama* (L.), *Rutilus rutilus* (L.), *Alburnus alburnus* (L.)) and percids (*Perca fluviatilis* L., *Stizostedion lucioperca* (L.)). The density of the ichthyofauna was estimated at 4959.57 indiv. ha⁻¹, the biomass amounting to 181.41 10³ g ha⁻¹.

Key words: man-made reservoirs, ichthyofauna, fish density.

1. Introduction

The ichthyofauna of the Goczałkowice Reservoir, situated on the River Vistula, has been studied ever since the reservoir was built. The process of transformation of the fish community inhabiting the river into a fish community of a dam reservoir was thoroughly investigated by Wajdowicz (1958a, 1958b, 1961), and a complete presentation of the succession of the ichthyofauna of the reservoir from its inundation until 1983 has been given by Starmach (1984). In the Goczałkowice Reservoir the occurrence of 35 fish taxa (species, subspecies, forms, and hybrids) has been determined so far, out of which only 10 have been investigated, mainly with regard to biometrics, growth rate, and food (Suskiewicz 1961, Skóra 1964a, 1964b, 1965, 1969, Wajdowicz 1965, Gąsowska 1968, Kołder 1969, Klimczyk-Jankowska 1974, 1975). The aim of the present study was to determine the species composition, density, and biomass of the ichthyofauna of the reservoir.

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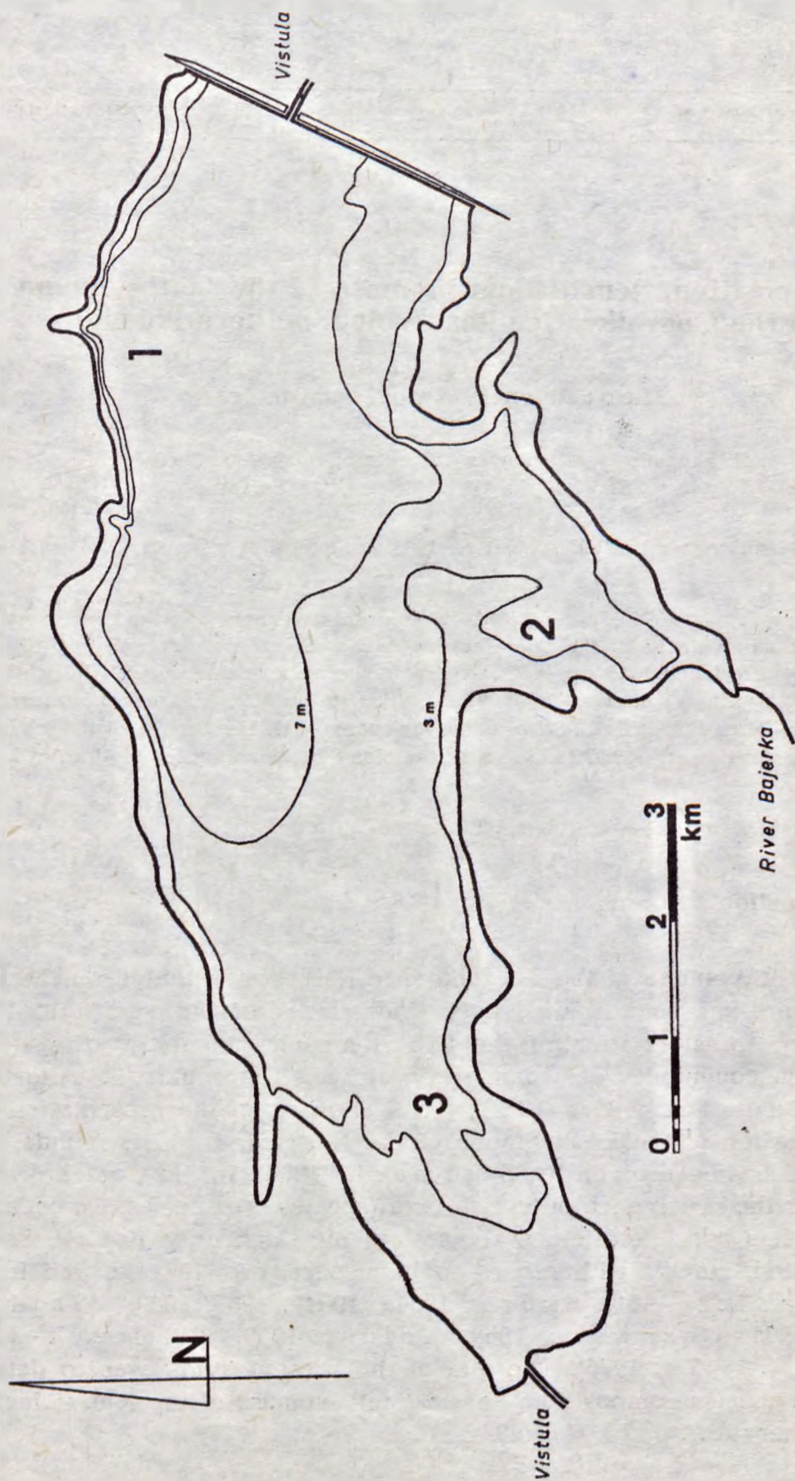


Fig. 1. Goczałkowice Reservoir. Stations: 1 — Łąka; 2 — Bajerka Bay; 3 — backwaters of the reservoir

2. Study area, material, and method

The Goczałkowice Reservoir is localized in the valley of the Vistula, in the area of the Oświęcim through. Its maximum area is 32 km² and the average depth 4–5 m. The reservoir, in existence since 1955, is used as a water supply for the Katowice city agglomeration.

Catches were carried out in three regions of the reservoir (fig. 1): near the fishing harbour at Łąka (Station 1), in the Bajerka Bay (Station 2), and in the backwaters of the reservoir (Station 3). The location of the stations permitted the collection of material from all characteristic habitats of the reservoir. The catches did not include the mouth zones of the reservoir tributaries where river fish would be caught.

The material was collected from 1981 to 1984 in the spring and summer. The catches were carried out at 8 fixed dates, using gill nets, trammel nets, a beach seine, fry trawl, and an electric current assembly.

The species composition of the ichthyofauna was determined on the basis of catches carried out using gill nets. A set of gill nets of different mesh size (24–70 mm), similar to that described by Takagi (1975, after Hamley 1980) was used. The density and biomass of the particular species were estimated on the basis of catches by means of a beach seine (length of wing 75 m, mesh size 25 mm) and a fry trawl (length of wing 5 m, mesh size 8 mm); the areas of the haul were 6500 and 500 m², respectively. These areas were separated with trammel nets and if necessary additional catches were made using the electric current assembly (4 A, 220 V). In habitats where catches were made using trawling gear a set of gill nets was also used. In this way empirical conversion factors were established which allowed the density and the biomass of fish to be estimated on the basis of material collected by means of gill nets in habitats where trawling gear could not be used. The recalculation method is discussed in detail in the paper by Jelonek and Amirówicz (1987).

3. Results

16 species of fish from 5 families were found to occur in the Goczałkowice Reservoir (Table I). Out of this number 10 species were found throughout the reservoir, the remainder appearing in the vicinity of the littoral shallows overgrown with aquatic plants or near the mouths of the affluents. The distribution presented refers to a period free from ice cover and does not take into account the seasonal migration of fish within the reservoir. Some data indicate the occurrence of this phenomenon within the reservoir and between the reservoir and its affluents, but the material collected was not sufficient to establish precisely the periods and directions of this migration.

Table I. Composition and distribution of the ichthyofauna of the dam reservoir at Goczałkowice in the period 1981-1984

Species	Stations		
	1	2	3
<u>Esocidae</u>			
<i>Esox lucius</i> L.	+	+	+
<u>Cyprinidae</u>			
<i>Cyprinus carpio</i> L.		+	+
<i>Carassius carassius</i> [L.]		+	+
<i>Tinca tinca</i> [L.]	+	+	+
<i>Abramis brama</i> [L.]	+	+	+
<i>Blicca bjoerčna</i> [L.]	+	+	+
<i>Rutilus rutilus</i> [L.]	+	+	+
<i>Scardinius erythrophthalmus</i> [L.]	+	+	+
<i>Alburnus alburnus</i> [L.]	+		+
<i>Leucaspis delineatus</i> (Heckel)		+	+
<i>Gobio gobio</i> [L.]			+
<u>Percidae</u>			
<i>Perca fluviatilis</i> L.	+	+	+
<i>Stizostedion lucioperca</i> [L.]	+	+	+
<i>Gymnocephalus cernuus</i> [L.]	+	+	+
<u>Anguillidae</u>			
<i>Anguilla anguilla</i> [L.]	+	+	+
<u>Gadidae</u>			
<i>Lota lota</i> [L.]		+	

Table II. Mean number (\bar{N}) and biomass (\bar{B}) of the ichthyofauna of the dam reservoir at Goczałkowice in the period 1981-1984

Species	\bar{N}		\bar{B}	
	indiv. ha ⁻¹	%	kg ha ⁻¹	%
<i>Abramis brama</i>	1610.88	32.48	72.38	39.90
<i>Perca fluviatilis</i>	862.49	17.39	18.47	10.18
<i>Alburnus alburnus</i>	848.09	17.10	4.06	2.24
<i>Rutilus rutilus</i>	711.20	14.34	38.37	21.16
<i>Leucaspis delineatus</i>	297.08	5.99	0.89	0.49
<i>Blicca bjoerčna</i>	293.12	5.91	4.43	2.44
<i>Gymnocephalus cernuus</i>	92.75	1.87	1.10	0.61
<i>Carassius carassius</i>	75.37	1.52	1.94	1.07
<i>Stizostedion lucioperca</i>	67.95	1.37	24.71	13.62
<i>Scardinius erythrophthalmus</i>	41.16	0.83	1.69	0.93
<i>Tinca tinca</i>	18.85	0.38	3.83	2.11
<i>Gobio gobio</i>	15.86	0.32	0.16	0.09
<i>Anguilla anguilla</i>	10.46	0.21	2.84	1.56
<i>Esox lucius</i>	8.91	0.18	5.75	3.17
<i>Cyprinus carpio</i>	3.46	0.07	0.57	0.31
<i>Lota lota</i>	1.94	0.04	0.22	0.12
Total	4959.57	100.00	181.41	100.00

In the examined period the mean density of the ichthyofauna was 4959.57 indiv. ha⁻¹ (Table II). The species with the highest frequency were: bream (one third of the fish population in the reservoir), perch, bleak, roach, sunbleak, white bream, and ruffe, which altogether accounted for 95.08% of the number of fish in the reservoir. Species of lowest density were: burbot, carp, pike, eel, gudgeon, and tench, accounting for 1.20% of the fish population of the reservoir.

The mean biomass of the ichthyofauna amounted to 181.41 10³ g ha⁻¹. Species occurring in the highest proportions in the biomass were: bream, roach, pikeperch, perch, pike, white bream, bleak, and tench, the total biomass of which accounted for 94.82% of the biomass of the

total ichthyofauna. The lowest proportion in the biomass was characteristic for gudgeon, burbot, carp, and sunbleak; the total biomass of these species was 1.01% of the biomass of the ichthyofauna of the reservoir.

4. Discussion

During the 30 years of existence of the Goczałkowice Reservoir different researchers discovered in it the occurrence of 32 species, subspecies, and forms, as well as three fish hybrids. At present only 16 species can be found there. The remaining taxa most probably receded during the natural process of ichthyofauna formation (rheophilic fishes: *Salmo trutta* m. *fario* L., *Barbus barbus* (L.), *Leuciscus leuciscus* (L.), *L. cephalus* (L.), *L. idus* (L.), *Phoxinus phoxinus* (L.), *Chondrostoma nasus* (L.), *Noemacheilus barbatulus* (L.)) or disappeared some time after their introduction (introduced fishes: *Salmo trutta* m. *lacustris* L., *S. gairdneri* R i c h., *Coregonus albula* (L.), *C. lavaretus* (L.), *C. lavaretus* × *C. albula*, *Cyprinus carpio* L. × *Carassius carassius* (L.), *Micropterus salmoides* (L a c é p è d e)). It is difficult to explain the absence of the other species (*Carassius auratus gibelio* (B l o c h), *Aspius aspius* (L.), *Misgurnus fossilis* (L.), *Rutilus rutilus* (L.) × *Abramis brama* (L.)). The presence in the ichthyofauna of two species introduced artificially into the reservoir and not mentioned in the studies to date (*Hypophthalmichthys molitrix* (Val.), *Ctenopharyngodon idella* (V a l.) — personal information) has not been confirmed either.

The density of species dominating in commercial catches carried out in the reservoir (bream, pikeperch, perch, eel, roach, and pike, which made up 99.8% of the fish mass caught in the reservoir in 1983) (S t a r m a c h 1984) was 3271.89 indiv. ha⁻¹ (65.97% of the density of the ichthyofauna). The density of fish without commercial value (bleak, sunbleak, white bream, ruffe, gudgeon) was 1546.90 indiv. ha⁻¹ (31.19% of the density of the ichthyofauna). White bream has been also included in the category of fish species of little commercial value (though older age groups are being exploited) on account of the very slow growth rate of this species. The biomass of the species dominating in commercial catches was 162.52 10³ g ha⁻¹ (89.59% of the biomass of the ichthyofauna); the biomass of species of little commercial value was 15 times smaller amounting to 10.64 10³ g ha⁻¹ (5.86% of the biomass of the ichthyofauna of the reservoir).

The estimated biomass of the ichthyofauna of the Goczałkowice Reservoir is considerably smaller than that of the Malta (438.1 10³ g ha⁻¹) and Gołuchów (507.6 10³ g ha⁻¹) reservoirs, reported by M a s t y ń s k i (1984) during their complete draining. Probably this is because the Goczałkowice Reservoir is much larger and deeper than the other two. Investigations of the ichthyofauna of the Rożnów Reservoir (J e l o n e k,

Amirowicz 1987) have revealed there a mean density 4475 indiv. ha⁻¹ and a mean biomass amounting to 162.75 10³ g ha⁻¹. These results approach those presented in this paper.

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5. Polish summary

Struktura, liczebność i biomasa ichtiofauny zbiornika Goczałkowickiego (Polska Południowa)

W latach 1981—1984 prowadzono jakościowe i ilościowe badania ichtiofauny zbiornika Goczałkowickiego, położonego w dolinie Wisły, na obszarze Kotliny Oświęcimskiej. Zebrane materiały pozwoliły uzupełnić dotychczasowe opracowania, dotyczące ichtiofauny zbiornika, o obecną strukturę gatunkową, liczebność i biomasa.

Odłowy prowadzono w trzech rejonach zbiornika (ryc. 1) za pomocą wontonów (komplet o wielkości oka 24—70 mm), drygawic, przywłoki (wielkość oka matni 25 mm), włoczka narybkowego (wielkość oka matni 8 mm) oraz agregatu prądotwórczego (4 A, 220 V). Wyniki odłowów prowadzonych narzędziami stawnymi pozwoliły określić strukturę gatunkową ichtiofauny, a materiały zebrane narzędziami ciągnionymi, przy zachowaniu zasad poboru prób ilościowych, umożliwiły oszacowanie liczebności i biomasy.

W zbiorniku Goczałkowickim obecnie występuje 16 gatunków ryb z 5 rodzin (tabela I); głównymi składnikami ichtiofauny są ryby karpowate (leszcz, płoć, ukleja) i okoniowate (okoń, sandacz). Łączna liczebność tych gatunków stanowi 82,68% całkowitej liczebności, a łączna biomasa 87,10% ogólnej biomasy ryb zbiornika. Średnia liczebność ichtiofauny wynosi 4959,57 osobn. ha⁻¹, a średnia biomasa 181,41 kg ha⁻¹ (tabela II).

6. References

- Gąsowska M., 1968. Natural hybrids between some genera of cyprinid fishes (*Cyprinidase*) of Polish bodies of water. *Ann. Zool.*, 26, 297—321.
- Hamley J. M., 1980. Sampling with gillnets. In: T. Backiel, R. L. Welcomme (Eds): *Guidelines for sampling fish in inland waters*. EIFAC Tech. Pap., 33, 37—53.
- Jelonok M., A. Amirowicz, 1987. Density and biomass of fish in the Rożnów reservoir (Southern Poland). *Acta Hydrobiol.*, 29, 243—251.
- Klimczyk-Janikowska M., 1974. Food and biometric characteristic of the silver bream (*Blicca björkna* L.) from the reservoir at Goczałkowice. *Acta Hydrobiol.*, 16, 241—254.
- Klimczyk-Janikowska M., 1975. Biometric characteristic and food of the

- rudd (*Scardinius erythrophthalmus* L.) from the reservoir at Goczałkowice. *Acta Hydrobiol.*, 17, 71—80.
- K o l d e r W., 1969. Sandacz zbiorników zaporowych w Rożnowie i w Goczałkowicach [Pikeperch of the dam reservoirs at Rożnów and Goczałkowice]. *Gosp. Ryb.*, 21, 11, 6—8.
- M a s t y Ń s k i J., 1984. Fish biomass of drained small reservoirs. *Pol. Arch. Hydrobiol.*, 31, 69—76.
- S k ó r a S., 1964a. Characteristics of the tench (*Tinca tinca* L.) in the reservoir of Goczałkowice. *Acta Hydrobiol.*, 6, 97—118.
- S k ó r a S., 1964b. The characteristics of the roach (*Rutilus rutilus* L.) living in the Goczałkowice Reservoir. *Acta Hydrobiol.*, 6, 351—374.
- S k ó r a S., 1965. Die Aalraupe (*Lota lota* L.) aus dem Staubecken von Goczałkowice. *Acta Hydrobiol.*, 7, 383—392.
- S k ó r a S., 1969. Der Brassen (*Abramis brama* L.) aus dem Staubecken von Goczałkowice. *Acta Hydrobiol.*, 11, 377—406.
- S t a r m a c h J., 1984. Development and structure of the Goczałkowice ecosystem. 15. Ichthyofauna. *Ekol. Pol.*, 34, 515—521.
- S u s k i e w i c z T., 1961. Perch (*Perca fluviatilis* L.) in the reservoir of Goczałkowice. *Acta Hydrobiol.*, 3, 241—259.
- W a j d o w i c z Z., 1958a. Das Staubecken von Goczałkowice als Fischerei-Objekt. 1. Charakteristik des Staubeckens und seine fischereiliche Würdung. *Biul. Zakł. Biol. Stawów PAN*, 6, 109—120.
- W a j d o w i c z Z., 1958b. Das Staubecken von Goczałkowice als Fischerei-Objekt. 2. Die Gestaltung des Fischbestandes im Anfangsstadium des Staubeckens. *Biul. Zakł. Biol. Stawów PAN*, 7, 67—86.
- W a j d o w i c z Z., 1961. Das Staubecken von Goczałkowice als Fischerei-Objekt. 3. Weitere Formierung des Fischbestandes. *Acta Hydrobiol.*, 3, 225—239.
- W a j d o w i c z Z., 1965. Der Hecht im Goczałkowice-Staubecken. *Acta Hydrobiol.*, 7, 179—195.