

# Coal Mine Waters and Their Influence on the Purity Ecological State of River and the Fish Production

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Studies concerning ecological quality of coal mine waters were carried out in Lublin Coal Basin (Eastern Poland). The waters were collected in a mining reservoir and entered to small rivers Świnka and Wieprz. These waters were medium salinity, mainly chlorides, which average content ranged between 834 mg/l - 922 mg/l. Fairly rich water fauna was found in this reservoir. It was represented by 31 taxons of invertebrates and 10 species of fish. Fish reached high annual weight and length gains, usually higher than in other waters in Poland. The high content of chlorides in coal mine waters exerted a negative changes on the chemical composition and the zoocoenosis structure of the Świnka and Wieprz rivers. Among others, the number of river species decreased and the eurytopic and euryhalinic ones increased.

Investigations were carried out in Lublin Coal Basin (Eastern Poland). Waters originating from the carboniferous and jurassic layers are collected in a small reservoir (area 6,0 ha, mx. depth of 3,5 m). After precipitating the suspension they entered to small rivers the Świnka and the Wieprz. The main goal of the studies concerned was to determine the ecological status of coal mine waters and their influence on the river zoocoenosis (mainly invertebrates) and the possibility of using these waters for fish production.

## Methods.

Samples were collected in 1984 and 1988-1989, during the vegetation seasons at one station in the reservoir (st.1) and at three stations located on the Świnka river, above and below the inflow of the coal mine waters (stations 2 and 3 respectively) and at the confluence of the Świnka and the Wieprz rivers (st.4). The standard methods were used for collecting and analysing the chemical and biological samples (Golterman 1971, Edmondson and Vinberg 1971).

## Results.

Some physical and chemical properties of water in the reservoir and in the river reached fairly high and variable values. The reservoir water temperature ranged between 20°C-23,3°C whereas in the river 17,3°C-19,5°C. The total suspension in the reservoir ranged from 13,6 mg/l to 26,8 mg/l and in the Świnka river from 6,5 mg/l-8,5 mg/l above and below the inlet of the mine waters, to 13,6 mg/l near the confluence of this river to the Wieprz river. Coal mine waters were of medium salinity, caused mostly by chlorides. The average concentration of chlorides in the reservoir ranged between 834 mg/l-922 mg/l. In the Świnka river the level of chlorides amounted to 84,0 mg/l-105 mg/l above the inflow of the mine waters, 275 mg/l-276 mg/l below the inflow and 200 mg/l-235 mg/l at the confluence of both rivers. There was also relatively

high content of sodium (416-507 mg/l) and potassium (11-35 mg/l). The concentration of remaining major elements influencing the water quality was low. Heavy metals (Mn, Zn, Pb, Cd, Co, Fe) also showed low values, too.

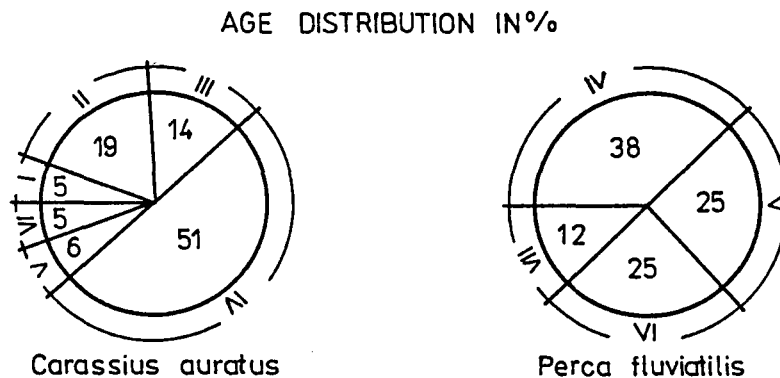
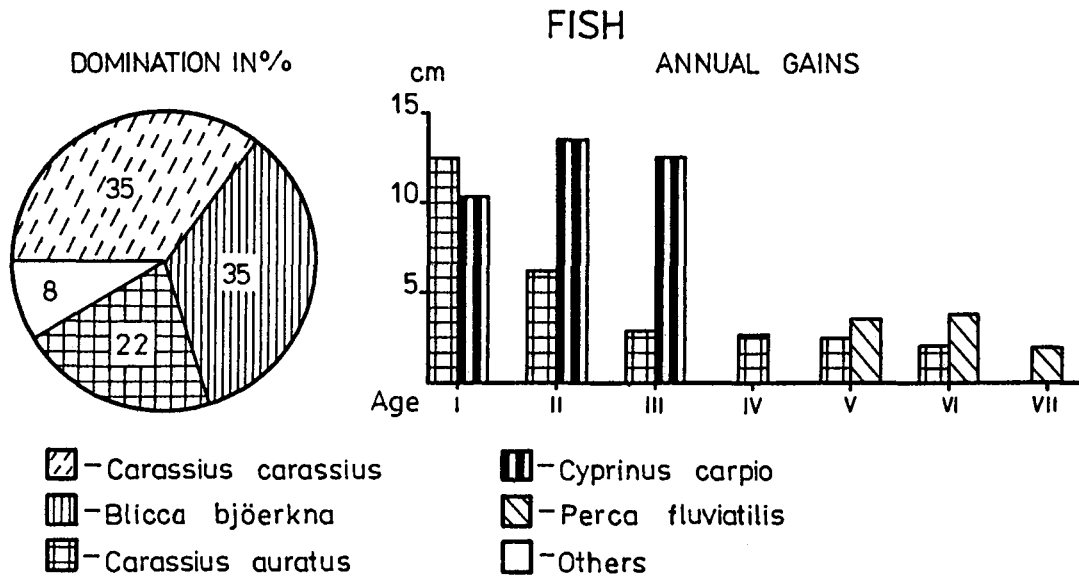
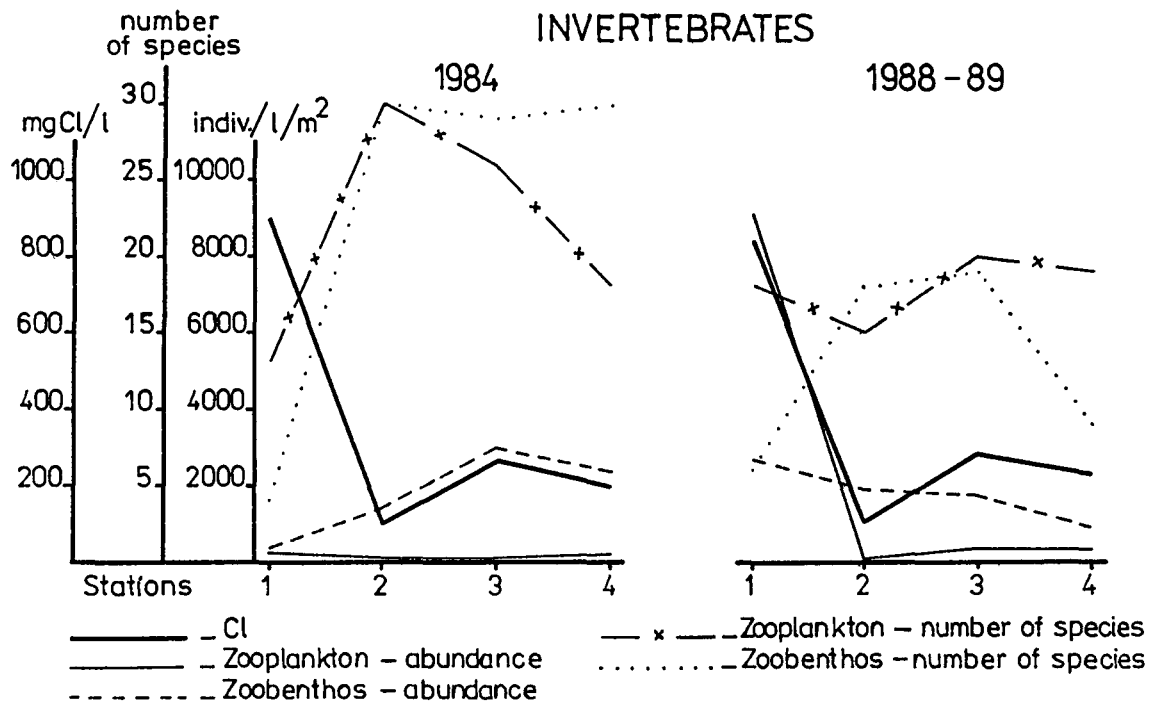


Fig 1. Some ecological factors of the waters of mining reservoir and Świnka river.

Fairly rich invertebrate fauna, represented by 54 taxons of zooplankton (33 *Rotatoria*, 12 *Cladocera*, 9 *Copepoda*) and 58 taxons of zoobenthos (32 *Insecta*, mainly *Chironomidae*, 11 *Hydracarina*, 4 *Annelida*, 4 *Mollusca*, 1 *Crustacea*), was encountered in survey area. In the mining reservoir 20 species of zooplankton and 11 taxons of zoobenthos were found. In the Świnka river zooplankton and zoobenthos were represented by 48 and 53 taxons, respectively. The qualitative differentiation of the fauna was much greater in the river than in the reservoir. Zooplankton comprised from 12 to 17 species in the reservoir and from 15 to 28 species in the Świnka river. Zoobenthos was represented by 1-10 taxons in the reservoir and 7-23 taxons in the river. Since 1988 the number of species tolerating saline waters has increased both in the river and the reservoir. Some of them are regarded as mesohaline forms - *Brachionus angularis* and *B. calyciflorus* or oligohaline form - *Asplanchna priodonta* (Ruttner-Kolisko 1979, Radwan and Paleolog 1983). However, the number of river species, in the Świnka river decreased. The abundance of zooplankton was higher in the reservoir than in the river, especially in 1988-89. The dominant were: *Brachionus angularis*, *B. calyciflorus*, *Polyarthra vulgaris*, *Acanthocyclops vernalis* and *Cyclops strenuus*. In the course of time the abundance of zoobenthos gradually decreased in the river and increased in the reservoir /Fig.1/.

The total number of 10 species of fish was found in the reservoir. Three species, namely *Carassius carassius*, *C. auratus* and *Blicca björkna* were dominant. They reached 92% of the total fish caught. As to the age distribution - four-year-old individuals dominated. All the species reached fairly high annual length and weight gains, too /Fig.1/, as a rule higher than in other waters in Poland (Wajdowicz 1964). All those data may indicate the existence of good spawning and alimentary conditions in the reservoir.

### Conclusions.

1. Since 1984 small changes of water salinity in the mining reservoir and the river have been observed.
2. A negative effect of coal mine waters on the zooplankton and zoobenthos in the Świnka river has been noted. The number and abundance of river species in the course of the river length decreased, but simultaneously the increase in number of eurytopic and euryhaline species was observed.
3. Slightly saline coal mine waters were found to be generally suitable for fish production, considering both species composition and fish growth. Four year old individuals predominated in the age distribution in the most of species.

### References.

- Edmondson, W. T. and G. G. Vinberg. 1971. A manual on methods for the assessment of secondary productivity in fresh waters. IBP Handb. 17: 1-358.
- Golterman, H. L. 1971. Methods for chemical analysis of fresh waters. IBP Handb. 3: 1-166.
- Radwan, S. and A. Paleolog. 1983. Notes on the rotifers of coal mine water in Eastern Poland. *Hydrobiologia*. 104: 307-309.
- Ruttner-Kolisko, A. 1971. Rotatorien als Indikatoren für den Chemismus von Binnensalzwässern. *Abhandl. des Natrongew. Symp.* 12: 283-298.

Wajdowicz, Z. 1964. The development of ichthyofauna in dam reservoirs with small variations in water levels. Acta Hydrobiol. 6: 61-79.