

FRESHWATER SNAILS (MOLLUSCA: GASTROPODA) OF FISH PONDS IN SILESIA (SOUTHERN POLAND)

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ABSTRACT: The paper presents results of studies on the snail fauna of 22 fish ponds of Silesia and its vicinities. 20 species were found. The results suggest that neither the size and depth of a reservoir nor the bottom type effect directly particular snail species. It seems that the impact of these factors is overlapped or modified by cultivation which limits the number and species diversity of snails. As regards ponds in the Upper-Silesian Industrial Region, another limiting factor is industrial water pollution.

KEY WORDS: environment pollution, species diversity, malacofauna, small reservoir, fish pond

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INTRODUCTION

The malacofauna of fish ponds in the Upper Silesian Industrial Region and its vicinities is poorly known, since there is only one paper dealing with it (Kownacka 1963). Some fragmentary data on the subject were given by other authors who dealt with the bottom fauna of particular ponds (Kysela 1958, Zaćwilichowska 1965, Zięba 1967, Krzyżanek 1973). The malacofauna of other types of artificial reservoirs was studied by Strzelec and Serafiński (1984) and Strzelec (manuscript).

The aim of this paper is to describe the snail fauna of fish ponds in Silesia. Since practically there are no natural water bodies in the region the four types of artificial reservoirs distinguished (sinkhole ponds, sand pits, storage reservoirs, and fish ponds) have been regarded as the only habitat of the stagnant water fauna.

Characteristics of the studied fish ponds

| Situation of pond | Area (ha.) | Maximum depth (m) | Bottom type | pH | Water hardness (°G) | Water from: | Means of cultivation | Plant species (numbers according to table 2) |
|--|------------|-------------------|----------------|-----|---------------------|------------------------|-----------------------------------|---|
| Ciasna near Lubliniec complex I (4 ponds) | 40.7 | 2.0 | slimy-sandy | 7.2 | - | Legiewnicki stream | liming | 3, 4, 6, 8, 11, 12, 13, 26, 30, 32, 35, 40, 43, 44, 45, 48, 51. |
| Ciasna near Lubliniec complex II (6 ponds) | 6.5 | 1.8 | slimy-sandy | 7.4 | - | Lublinica river | fertilization | 4, 11, 12, 13, 30, 32, 35, 40, 44, 48, 51. |
| Laski near Bukowno | 0.04 | 0.7 | slimy-sandy | 6.9 | 14.0 | ground water | periodical drying | 4, 5, 35, 36, 40, 44, 51. |
| Pond of the "Śląsk" mine Ruda Śl. Kochłowice | 1.5 | 2.5 | slimy-sandy | 7.6 | 11.5 | two springs | mowing, liming | 9, 29, 30, 32, 34, 35, 37, 44, 45. |
| Kuźnia Nieborowska near Knurów complex (2 ponds) | 7.0 | 1.5 | slimy-sandy | 7.4 | 8.7 | ground water | liming, regulation of water level | 5, 6, 8, 13, 15, 17, 23, 25, 26, 27, 30, 31, 32, 34, 35, 42, 43, 47, 48, 49, 50, 51. |
| "Brzeziniak" near Racibórz | 25.0 | 1.8 | slimy-sandy | - | - | Bodek stream | - | 2, 3, 5, 6, 10, 11, 12, 13, 14, 16, 18, 21, 22, 26, 29, 30, 32, 34, 38, 39, 41, 42, 43, 44, 46, 47, 48, 49, 50, 51. |
| "Syrński II" Wielikąt near Wodzisław | 33.0 | 3.5 | slimy-clayey | - | - | Syrnka stream | liming, mowing | 7, 13, 19, 20, 24, 34, 44, 48. |
| Zebrzydowice | 0.4 | 1.5 | slimy-clayey | 6.9 | - | stream | liming, period. drying | 3, 13, 17, 26, 30, 32, 44, 47, 49, 50. |
| Urbanowice near Tychy | 2.0 | 1.5 | slimy-clayey | 7.3 | 18.8 | ground water | liming, mowing | 29, 32, 44, 48, 49. |
| "Stenclok" Wisła Wielka near Pęczyna | 4.0 | 1.0 | slimy detritus | 7.0 | - | canal | fertilization, periodical drying | 3, 19, 26, 27, 28, 43, 44, 49, 50, 51. |
| "Maciek Wielki" Goczałkowice | 51.0 | 2.0 | slimy-clayey | - | - | Goczałkowice reservoir | - | 1, 3, 34, 44, 45, 48, 51. |
| "Sokół D" Ligota near Bielsko-Biała | 3.5 | 0.4 | slimy-clayey | 7.2 | 7.4 | ground water | - | 3, 27, 44, 47, 49, 50. |
| "Łaziński I" Grodziec Śl. near Bielsko-Biała | 0.8 | 1.5 | slimy-clayey | 7.3 | 11.0 | stream | liming, mowing | 26, 30, 32, 33, 48, 51. |

MATERIAL AND METHODS

Samples of the snail fauna of 22 ponds were taken every two weeks from May to October, by means of common hydrobiological qualitative methods. In each pond snails were collected close to the bank, along 100 m of the water margin. In some ponds the snails were collected on several stations, because of the mosaic distribution of plant patches. 142,931 specimens were collected altogether. The nomenclature of the species is acknowledged after Piechocki (1979).

CHARACTERISTICS OF THE STUDIED PONDS

The studied ponds were situated in three voivodships in South Poland: Katowice (eight single ponds and a complex of two ponds in Kuźnia Nieborowska), Częstochowa (two complexes of ponds in Ciasna), and Bielsko-Biała (two single ponds). The data on each pond or pond complex are given in Table 1. The plant species found there are listed in Table 2.

Table 2

Vegetation of the studied fish ponds

1. Riccia fluitans L., 2. Sphagnum sp., 3. Salvinia natans (L.) All.,
4. Equisetum limosum L., 5. Equisetum palustre L., 6. Polygonum amphibium L., 7. Polygonum hydropiper L., 8. Batrachium aquatile (L.) Dum., 9. Caltha palustris L., 10. Ranunculus lingua L., 11. Nymphaea alba L., 12. Nuphar luteum (L.) Sm., 13. Ceratophyllum demersum L., 14. Comarum palustre L., 15. Epilobium sp., 16. Lythrum salicaria L., 17. Myriophyllum verticillatum L., 18. Myriophyllum spicatum L., 19. Oenanthe aquatica (L.) Poir., 20. Veronica scutellata L., 21. Scutellaria galericulata L., 22. Lycopus europaeus L., 23. Mentha aquatica L., 24. Stachys palustris L., 25. Bidens tripartita L., 26. Sagittaria sagittifolia L., 27. Alisma plantago-aquatica L., 28. Butomus umbellatus L., 29. Hydrocharis morsus-ranae L., 30. Elodea canadensis Rich., 31. Potamogeton compressus L., 32. Potamogeton natans L., 33. Potamogeton lucens L., 34. Iris pseudoacorus L., 35. Juncus effusus L., 36. Juncus conglomeratus L., 37. Scirpus silvaticus L., 38. Eriophorum angustifolium Honck., 39. Heleocharis palustris (L.) R. et Sch., 40. Carex gracilis Curt., 41. Carex vesicaria L., 42. Carex elongata L., 43. Carex hudsonii Bennet, 44. Phragmites communis Trin., 45. Glyceria aquatica (L.) Wahlb., 46. Spirodela polyrrhiza (L.) Schleiden, 47. Lemna trisulca L., 48. Lemna minor L., 49. Acorus calamus L., 50. Sparganium ramosum Huds., 51. Typha latifolia L.

Table 3

Freshwater snails of the studied fish ponds (%)

| pond species | complex I Clasna near Lubliniec | complex II Clasna near Lubliniec | Laski near Bukowno | pond of the "Slask" mine Ruda Sl. Koch- toniec | complex Kuznia near Knurdw | "Brzeziniak" near Raciborz | "Syrniski II" Wielikiet near Modziszew | Zebrzydowice | Urbanowice near Tychy | "Stenclok" Wielka near Pszczyna | "Maclek Wielki" Goczikowice | "Sokół D" Ligota near Bielsko-Biala | Laszki I Grodziec Sl. near Bielsko-Biala | M | constancy index |
|-----------------------|---------------------------------------|--|-----------------------|---|-------------------------------|-------------------------------|--|--------------|--------------------------|---------------------------------------|--------------------------------|---|--|--------|--------------------|
| <i>V. confectus</i> | 1.20 | 0.18 | - | - | 0.01 | 0.40 | 0.15 | - | 0.10 | 1.60 | 0.16 | 0.01 | 0.199 | 200 | 76.92 |
| <i>V. cristata</i> | - | - | - | - | - | - | - | - | - | 13.03 | - | 19.30 | - | 15864 | 15.38 |
| <i>V. piscinalis</i> | - | - | - | - | - | - | - | - | - | - | - | 0.01 | - | 9 | 7.69 |
| <i>B. tentaculata</i> | - | - | - | - | - | - | 3.13 | - | - | - | - | - | - | 166 | 7.69 |
| <i>A. hypnorum</i> | 0.50 | 1.46 | - | 0.36 | 1.31 | - | - | - | - | - | - | 0.01 | - | 332 | 38.46 |
| <i>Ph. fontinalis</i> | - | 0.01 | 1.17 | - | - | 3.18 | 2.32 | - | - | - | 0.32 | 0.02 | - | 360 | 46.15 |
| <i>L. stagnalis</i> | 12.74 | 26.44 | 9.92 | 1.36 | 3.12 | 3.29 | 6.05 | 3.70 | 3.75 | 3.20 | 0.37 | 0.03 | 32.56 | 7071 | 100.00 |
| <i>L. auricularia</i> | 0.60 | - | - | 0.98 | 0.01 | 1.84 | 0.21 | 1.48 | - | - | - | 0.01 | - | 249 | 53.85 |
| <i>L. corvus</i> | 6.89 | 17.47 | - | 4.49 | 0.60 | 0.45 | - | - | - | - | 0.16 | - | 0.04 | 2881 | 53.85 |
| <i>L. peregra</i> | 21.16 | 0.10 | 8.75 | 64.45 | 15.40 | - | - | - | 0.04 | - | - | - | 0.02 | 5131 | 53.85 |
| <i>L. truncatula</i> | - | - | 0.41 | 2.94 | - | - | - | 0.05 | - | - | - | - | - | 160 | 23.08 |
| <i>P. planorbis</i> | 13.20 | 43.00 | 1.37 | - | - | 40.64 | 79.07 | - | 1.02 | 0.30 | 40.67 | 0.70 | 4.80 | 14591 | 76.92 |
| <i>A. spitorbis</i> | 2.73 | 0.61 | - | - | 0.01 | - | - | 31.25 | - | 7.86 | - | - | 0.16 | 1084 | 41.15 |
| <i>A. vortex</i> | - | - | - | - | - | 43.80 | 1.85 | 23.85 | 1.90 | 4.04 | 6.02 | 0.98 | 0.02 | 4369 | 61.54 |
| <i>A. contortus</i> | 1.14 | 0.02 | 60.57 | - | 12.43 | 0.08 | - | - | - | 33.30 | 6.30 | 33.48 | 1.05 | 30191 | 69.23 |
| <i>G. albus</i> | 31.14 | 0.13 | 0.34 | 23.89 | 8.84 | 0.20 | 1.11 | 25.23 | 51.21 | 13.58 | 0.28 | 0.01 | 55.62 | 10854 | 100.00 |
| <i>A. crista</i> | - | 0.02 | - | 0.75 | 9.37 | - | - | - | 0.21 | 3.00 | - | 0.80 | - | 1436 | 46.15 |
| <i>H. complanatus</i> | - | - | - | - | - | - | - | 3.55 | - | 4.85 | 1.06 | - | - | 205 | 23.08 |
| <i>S. nitida</i> | 3.39 | 4.23 | 6.82 | - | 38.65 | 3.26 | 0.04 | 2.22 | - | 3.60 | 36.27 | 44.22 | 0.04 | 40971 | 84.62 |
| <i>P. corneus</i> | 5.31 | 6.33 | 10.65 | 0.77 | 10.25 | 2.84 | 6.07 | 8.67 | 41.77 | 11.70 | 8.38 | 0.69 | 5.49 | 6807 | 100.00 |
| Species totally | 12 | 13 | 9 | 9 | 12 | 11 | 10 | 9 | 8 | 12 | 11 | 14 | 11 | 6807 | 100.00 |
| Specimens totally | 7189 | 11886 | 1451 | 5211 | 7022 | 5979 | 5303 | 2029 | 6675 | 2202 | 2459 | 80500 | 5025 | 142931 | |

RESULTS

In the ponds 20 species of freshwater gastropods (Table 3) were found: Viviparus contectus (Millet, 1813), Valvata cristata O. F. Müller, 1774, V. piscinalis (O. F. Müller, 1774), Bithynia tentaculata (Linnaeus, 1758), Aplexa hypnorum (Linnaeus, 1758), Physa fontinalis (Linnaeus, 1758), Lymnaea stagnalis (Linnaeus, 1758), L. auricularia (Linnaeus, 1758), L. cornutus (Gmelin, 1778), L. peregra (O. F. Müller, 1774), L. truncatula (O. F. Müller, 1774), Planorbis planorbis (Linnaeus, 1758), Anisus spirorbis (Linnaeus, 1758), A. vortex (Linnaeus, 1758), A. contortus (Linnaeus, 1758), Gyraulus albus (O. F. Müller, 1774), Armiger crista (Linnaeus, 1758), Hippeutis complanatus (Linnaeus, 1758), Segmentina nitida (O. F. Müller, 1774) and Planorbarius corneus (Linnaeus, 1758).

Two species occurring in very small numbers and in no more than one pond (Valvata piscinalis and Bithynia tentaculata) were considered accidental faunistic elements. The remaining 18 species occurred permanently and their constancy index value ranged from 15.4 to 100%. Three species (Lymnaea stagnalis, Gyraulus albus and Planorbarius corneus) occurred in all the studied ponds, being constant but not always dominating elements. The occurrences of species in particular ponds were variable. It was impossible to indicate the dominant species for all the ponds. The following species were found to predominate in particular ponds:

Planorbis planorbis: in Goczałkowice 40.67% of the whole material, in Ciasna near Lubliniec complex II 43.0%, in Wielikąt near Wodzisław 79.07%;

Gyraulus albus: in Ciasna near Lubliniec complex I 31.14%, in Urbanowice near Tychy 51.21%, in Grodziec Śląski near Bielsko-Biała 55.62%;

Segmentina nitida: in Kuźnia Nieborowska near Knurów 38.65%, in Ligota near Bielsko-Biała 44.22%;

Anisus contortus: in Wisła Wielka near Pszczyna 33.30%, in Łaski near Bukowno 60.57%;

Lymnaea peregra: in Ruda Śląska-Kochłowice 64.45%;

Anisus vortex: in the pond Brzeziniak near Racibórz 43.80%;

Anisus spirorbis: in Zebrzydowice 31.25%.

It is noteworthy that from among three species of 100% constancy only Gyraulus albus was a dominant in some ponds, while the other two were more or less abundant, though none of them being the most numerous in any pond. A comparison of the gastropod faunae of two neighbouring fish pond complexes (Ciasna I and II) is worth of attention. Those ponds supplied with water from different sources and cultivated in various way differed somehow also in respect of their gastropod faunae in which the same species occurred in different proportions.

The results do not suggest any clear relation between the number of snail species and environmental conditions in the studied ponds. The malacofauna there seems connected neither with the area and depth of a pond nor with the type of bottom. However, human impact is the only factor that appears to affect the snail fauna qualitatively and quantitatively. In particular, mowing water weeds and the periodical drainage of ponds affect the snail fauna negatively, whereas liming has an opposite effect. In general, several years of such activities lead to a remarkable reduction of the number and diversity of snails.

DISCUSSION

The above results show that the snail fauna of the studied fish ponds is differentiated depending on pond. This is due to variable local conditions in particular ponds, especially the intensity of the fish production: the more intensive the pond cultivation the poorer the snail fauna. On the other hand no apparent relation between the snail fauna and the bottom type and area has been found.

The fact that the snail species number found in the Łaziski I pond near Grodziec (0.8 ha.) was the same (11) as in the much larger (51 ha.) pond Maciek Wielki is in disagreement with the opinion of Boycott (1936) that more snail species occur in larger water reservoirs, owing to a greater possibility of introduction there than in smaller ones. On the contrary, the observation of Aho (1966) that the density of snail populations is greatest in ponds of the highest plant production and does not depend on vegetation diversity has been confirmed by the present results.

The studied ponds seem in general to have their snail fauna richer than that of the fish ponds in Gołysz and Landek studied by Kownacka (1963), who found up to 5 - 9 snail species per pond and 12 altogether, among them Lymnaea stagnalis and Gyraulus albus as dominants. Planorbis planorbis was absent in the ponds studied by Kownacka. It was probably due to the very soft water of those ponds. In Upper Silesia, however, P. planorbis occurred abundantly in 75 - 100% of water bodies of various kinds.

It seems that an intensive cultivation of fish ponds disturbs if not eliminates the influence of natural environmental factors on the snail fauna. In this region fish ponds are additionally affected by industrial air and water pollution. The latter factor was analysed in respect of its impact on snails of other man-made water bodies (Strzelec and Serafiński 1984, Strzelec manuscript), and similar studies should be completed concerning fish ponds of the region.

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SŁODKOWodne ŚLIMAKI (MOLLUSCA: GASTROPODA) STAWÓW RYBNYCH ŚLĄSKA
(POŁUDNIOWA POLSKA)

Streszczenie: Przedstawiono wyniki badań nad fauną ślimaków 22 stawów rybnych Śląska i okolic. Stwierdzono obecność 20 gatunków. Wyniki badań wskazują że wielkość zbiornika, jego głębokość, a także typ dna nie mają bezpośredniego wpływu na występowanie określonych gatunków ślimaków. Wydaje się, że działanie tych czynników jest tłumione bądź modyfikowane przez zabiegi uprawne, które nie wpływają korzystnie na różnorodność gatunkową i liczebność ślimaków, a w przypadku stawów Górnośląskiego Okręgu Przemysłowego także przez zanieczyszczenia przemysłowe.