

## PARASITE FAUNA OF SELECTED FISH SPECIES OF LAKE MIEDWIE

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**ABSTRACT.** A total of 136 fishes, representing 9 species (perch, *Perca fluviatilis* L.; pike, *Esox lucius* L.; European eel, *Anguilla anguilla* (L.); common bream, *Abramis brama* (L.); roach, *Rutilus rutilus* (L.); tench *Tinca tinca* (L.); European whitefish, *Coregonus lavaretus* (L.); vendace, *Coregonus albula* (L.); and zander, *Sander lucioperca* (L.)), from Lake Miedwie were studied within 1997–1999. The necropsies yielded 41 parasite species (taxa). The most diversified were parasite faunas of pike (19 parasite species) and perch (16 species). The parasites found represented 13 higher taxa: Monera, Fungi, Protista, Myxozoa, Monogenea, Cestoda, Digenea, Nematoda, Acanthocephala, Branchiura, Copepoda, Mollusca, and Acarina. The parasites affecting fishes of Lake Miedwie exhibited diversified host-specificity. The most fish species were infected by metacercariae of *Diplostomum* spp. (8 fish species) and *Tylodelphys clavata* (7). Three fish species harboured: *Ichthyocotylurus platycephalus*, *Ergasilus sieboldi*, and glochidia Unionidae gen. sp. while *Dermocystidium* sp., *Trichodinella epizootica*, *Henneguya psorospermica*, *Triaenophorus nodulosus*, *Posthodiplostomum cuticula*, and *Camallanus lacustris* parasitised two host species. The remaining parasites were found in single fish species.

**Key words:** fish, Lake Miedwie, parasite fauna.

### INTRODUCTION

Lake Miedwie is the sixth largest lake in Poland. Its surface area covers 3527 hectares while its maximal depth is 43.8 m. It holds a great volume of water (681–672.4 thousand m<sup>3</sup>) and it tends not to silt up and overgrow. Considering the lack of pollution it constitutes a prime source of drinking water for the city of Szczecin. It has also been used for agricultural, tourist, recreational, and fisheries purposes. The fish production is low (9.1–9.5 kg/ha) and has been maintained on this level for many years. The quantities, however, of high oxygen demand fishes – typical for cold and clean waters – have been declining from year to year.

A complex research project has been initiated in Lake Miedwie in response to the changing specific structure of the fishes caught, especially a substantial decline in catches of zander, reported by the fishermen. One of the crucial elements of this study was the present parasitological survey of fishes inhabiting this body of water. Such survey seemed to be desirable in view of the complete lack of publications on parasites of fishes of this lake.

## MATERIAL AND METHODS

The present survey was carried out within 1997–1999. It was based on a total of 136 fishes representing 9 species. The fishes were necropsied shortly after capture. In 1997 they were caught from October until first half of December; in 1998 – from March to December; while in 1999 – from mid April to mid November. This survey covered a total of 40 perch *Perca fluviatilis* L. (weight: 44–400 g, av. 159.3 g; length: 15.5–31 cm TL, av. 23.9 cm), 32 pike, *Esox lucius* L. (200–7100 g, av. 679.4 g; 31–115 cm, av. 49.2 cm), 20 eels, *Anguilla anguilla* (L.) (85–475 g, av. 398 g; 41–64.5 cm, av. 53.1 cm), 14 common bream, *Abramis brama* (L.) (180–850 g, av. 552.6 g; 20–37 cm, av. 35.4 cm), 11 roach, *Rutilus rutilus* (L.) (250–392 g, av. 345 g; 26.5–31 cm, av. 26 cm), 9 tench, *Tinca tinca* (L.) (230–360 g, av. 247 g; 23.4–28 cm, av. 25.8 cm), 6 vendace, *Coregonus albula* (L.) (av. 160 g; 26 cm), 3 European whitefish, *Coregonus lavaretus* (L.) (850–1050 g, av. 916 g; 42.5–47.5 cm, av. 46 cm), and one zander, *Sander lucioperca* (L.) (3075 g, 58 cm). Detailed parasitological necropsies covering the skin, eyes, buccal cavity, fins, heart, swim bladder, alimentary tract, liver, spleen, and the gall bladder were carried out on the day of catch or on the next day. The parasites found, representing tapeworms, nematodes, and digenean flukes were preserved in ethyl alcohol. Ciliate preparations were silvered with silver nitrate or were stained with Giemsa solution. Parasitic copepods were cleared in lactic acid and examined in a hanging drop of this acid. Systematic affiliation of the remaining pathogens (Table 1) was determined on live specimens.

## RESULTS

Among the fish surveyed, the perch was represented in highest numbers. The presence of parasites was determined in 39 specimens of this fish, which translates into prevalence of 97.5%. The parasites found on the gills represented the following species: *Erastophrya chattoni* Fauré-Fremiet, 1943; *Capriniana piscium* (Bütschli, 1889) Jankovski, 1973; *Ichthyophthirius multifiliis* Fouquet, 1876; *Trichodinella epizootica* (Raabe, 1950); *Trichodina* sp., *Henneguya psorospermica* Thélohan, 1852. The gills hosted also glochidia of Unionidae gen. sp. and a single water mite (Acarina gen. sp.). Metacercariae of digenean flukes *Diplostomum* spp. and *Tylodelphys clavata* (von Nordmann, 1832) were found in the eye lens and vitreous humour, respectively. The alimentary tract contained: *Bunodera luciopercae* (Müller, 1776); *Triaenophorus nodulosus* Pallas, 1781; *Acanthocephalus lucii* (Müller, 1776); *Acanthocephalus anguillae* (Müller, 1780); *Camallanus lacustris* (Zoega, 1776); *Schulmanella petruschewski* (Shulman, 1948) Ivashkin, 1964. The most prevalent (77.5%) and abundant were metacercariae of *Tylodelphys clavata* (mean intensity 57.3; abundance 45.5), followed by adult flukes *Bunodera luciopercae* (67.5%; m. intensity 19.2;

abundance 13.1), and glochidia (Unionidae gen. sp.) (57.5%; 16; 9.1, respectively). The basic infection parameters of all fish species are listed in Table 1. In total this fish hosted 2763 specimens of countable parasites of which more than half (1531) constituted *T. clavata*.

The second most abundant fish in the present survey was the pike. The pathogens were present in as many as 93.8% necropsied specimens of this host. The only representatives of Monera were bacteria of *Flavobacterium columnare* (Bernardet et Grimont, 1989) (= *Flexibacter columnaris*), found on the skin of a single pike. The skin hosted also *Ichthyophonus hoferi* (Caulery et Mesnil, 1905) and *Trichodinella epizootica*. Plasmodia of *Henneguya oviperda* Cohn, 1895 were present in the ovary. A congener of the above parasite occurred on the gills of the pike studied, along with *Myxobolus anurus* Cohn, 1895 and *Tetraonchus monenteron* (Wagener, 1867) Diesing, 1858. Tapeworms *Triaenophorus nodulosus* and *Proteocephalus percae* Müller, 1780 were found in the intestine along with mature flukes *Azygia lucii* (Müller, 1776) and nematodes *Raphidascaris acus* Bloch, 1779. Metacercariae of *Tylodelphys podicipina* Kozicka et Niewiadomska, 1960 were found in the vitreous humour of the eye. Copepods *Ergasilus sieboldi* von Nordmann, 1832 were found on the gills, while a branchiuran, *Argulus foliaceus* L. — in the buccal cavity. *Trypanoplasma* sp. and *Trichodina* sp. occurred on the gills, while metacercariae *Diplostomum* spp. — in the eye lens and in a single case in the vitreous humour. In addition the eye of a single pike hosted a very minute nematode (Nematoda gen. sp.). Larval molluscs at the stage of glochidium (Unionidae gen. sp.) were found attached to gill filaments. The most prevalent (56.3%) and abundant were metacercariae of *Tylodelphys podicipina* (m. intensity 18.6; abundance 10.5), followed by a monogenean, *Tetraonchus monenteron* (m. intensity 16.8; abundance 4.8). A relatively high prevalence of 43.8% was attained by a nematode *Raphidascaris acus* (m. intensity 6; abundance 2.6). A total of 827 countable parasites were found in pike examined.

All of the eels examined were infected with parasites. The gills were infected by *Myxidium giardii* Cépède, 1906 and *Dactylogyrus* sp. The intestine of a single eel contained nematode *Camallanus lacustris*. Swim bladders of all eels necropsied revealed the presence of *Anguillicola crassus* Kuwahara, Niimi et Itagaki, 1974. A copepod *Ergasilus* sp. was found on the gills of a single host. Nematodes *Anguillicola crassus* were the most prevalent (100%) and the most abundant (m. intensity 8.2; abundance 6.7). The remaining parasites occurred in low numbers (Table 1). A total of 196 countable parasites were recovered from eels.

The presence of parasites was revealed in 11 out of 14 common bream examined. The parasites occurred on the gills, vitreous humour and eye lenses, liver, heart, and in the alimentary tract. Kingdom Protista was represented by *Dermocystidium* sp. found in low intensities on the gills without causing anatomopathological changes. The phylum Myxozoa was represented by

Table 1. Fish parasites of Lake Miedwie and basic infection parameters (1997-1999)

No. Parasite species	T.A.	Prevalence [%]/intensity of infection [specimens per host]										No. of parasites			
		Perch	Pike	Eel	Bream	Rough	Tench	Whitefish	Vendace	Zander					
1. <i>Flavobacterium columnare</i>	M		3.1/f. num.												
2. <i>Ichthyophonus hoferi</i>	F		15.6/few												
3. <i>Dermocystidium</i> sp.	P				64.3/few									100/few	
4. <i>Trypanoplasma</i> sp.	P		4.5/few												
5. <i>Trichodinella epizoontica</i>	P		22.5/few												
6. <i>Trichodina</i> sp.	P		7.5/few												
7. <i>Ichthyophthirius multifiliis</i>	P		2.5/1												
8. <i>Chilodonella piscicola</i>	P														
9. <i>Caprimona piscium</i>	P		5/few												
10. <i>Eratophrya chattoni</i>	P		12.5/few												
11. <i>Henneguya oviperda</i>	Mx		3.1/few												
12. <i>Henneguya psorospermica</i>	Mx		9.4/num.												
13. <i>Myxobolus anurus</i>	Mx		9.4/num.												
14. <i>Myxobolus</i> sp.	Mx				7.1/num.										
15. <i>Myxidium giardi</i>	Mx				20/few-num.										
16. <i>Tetraonchus monenteron</i>	Mo														
17. <i>Dactylogyrus</i> sp.	Mo														
18. <i>Caryophyllaeus laticeps</i>	C		12.5/1-4												
19. <i>Tricenocephalus nodulosus</i>	C														
20. <i>Protocephalus percae</i>	C		3.1/5												
21. <i>Protocephalus</i> sp.	C														
22. <i>Azygia luci</i>	D		3.1/1												
23. <i>Banodera lucioperce</i>	D		67.5/3-107												
24. <i>Bucephalus polymorphus</i>	D														
25. <i>Posidophilostomum cuticola</i>	D														
26. <i>Ichthyocyostomum platycephalus</i>	D														
27. <i>Tylodelphys clavata</i>	D		10/1												
28. <i>Tylodelphys podicipina</i>	D		77.5/3-223												
29. <i>Diplostomum</i> spp.	D		20/1-10												
30. <i>Anguillicola crassus</i>	N														
31. <i>Camallanus lacustris</i>	N		22.5/1-10												
32. <i>Raphidascaris acis</i>	N														
33. <i>Schulmanella petruschewskii</i>	N		2.5/1												
34. Nematoda gen. sp.	N														
35. <i>Acanthocephalus lucii</i>	A		10/1-10												
36. <i>Acanthocephalus anguillae</i>	A		7.5/2-11												
37. <i>Argulus foliaceus</i>	B		3.1/1												
38. <i>Ergasilus sieboldi</i>	Cop		6.3/1-80												
39. <i>Ergasilus</i> sp.	Cop														
40. <i>Uromidaea</i> gen. sp.	Moll		57.5/1-100												
41. <i>Acarina</i> gen. sp.	Ac		2.5/1												

T.A. - taxonomic affiliation, A - Acanthocephala, Ac - Acarina, B - Branchiura, C - Cestoda, Cop - Copepoda, D - Digenea, F - Fungi, M - Monera, Mo - Monogenea, Moll - Mollusca, Mx - Myxozoa, P - Protista, num. - numerous, f. num - fairly numerous

*Myxobolus* sp. found on the gills of a single host. Four species of digenetic flukes were larval forms in the stage of metacercaria. Of these, *Tylodelphys clavata* and *Diplostomum* spp. were found in the vitreous humour and eye lens, respectively, *Ichthyocotylurus platycephalus* (Creplin, 1825) was encysted on the heart, while *Posthodiplostomum cuticula* (von Nordmann, 1832) was noted on the skin of bream. *Caryophyllaeus laticeps* (Pallas, 1781), a single representative of Cestoda was found in the intestine of three bream. The highest prevalence of 64.3 was shown by *Dermocystidium* sp., while the highest individual intensity (1–18) was exhibited by *Diplostomum* spp. (m. intensity 9.7; abundance 4.1). A total of 77 countable parasites were found in bream.

Five out of 11 roach examined harboured metacercariae representing three species of digenetic trematodes, namely *Tylodelphys clavata*, *Diplostomum* spp., and *Posthodiplostomum cuticula*. *T. clavata* showed the highest mean intensity of 126 (abundance was 57.5). A total of 671 countable parasites were recovered from the infected roach.

Five out of nine tench examined were infected with parasites. They represented five species: *Chilodonella piscicola* (Zacharias, 1894) Jankovski, 1980, *Tylodelphys clavata*, *Diplostomum* spp., *Ichthyocotylurus platycephalus* and *Ergasilus sieboldi*. In total, the specific affiliation of 42 countable parasites was determined. The highest values of the mean intensity (9.79) and abundance showed a copepod *Ergasilus sieboldi*. The findings of the remaining parasites were single encounters.

Three European whitefish studied harboured parasites belonging to three higher taxa: Digenea, Mollusca, and Cestoda. The vitreous humour and the eye lens were inhabited by metacercariae of *Tylodelphys clavata* and *Diplostomum* spp., respectively. The gills were attacked by molluscan larvae at the stage of glochidium (Unionidae gen. sp.). A juvenile tapeworm *Proteocephalus* sp. was found in the alimentary tract of a single whitefish. A total of 6 countable parasites were found in this host.

Only single metacercariae of digenetic flukes *Tylodelphys clavata* and *Diplostomum* spp. were found in vendace. Fish of this species were available only in the autumn of 1997.

The only zander necropsied was infected with 6 species (taxa) of parasites, namely *Dermocystidium* sp., *Diplostomum* spp., *Tylodelphys clavata*, *Ichthyocotylurus platycephalus*, *Bucephalus polymorphus* Baer, 1927, and *Ergasilus sieboldi*. Metacercariae of *P. cuticula* and *I. platycephalus* were very numerous. This host harboured a total of 109 countable parasites.

Parasites recovered from the studied fishes of Lake Miedwie exhibited variable host specificity. The highest number of hosts was infected with metacercariae of *Diplostomum* spp. (8 fish species) and *Tylodelphys clavata* (7). Fishes representing three host species harboured *Ichthyocotylurus platycephalus*, *Ergasilus sieboldi* and glochidia of Unionidae gen. sp. Two fish species were infected with: *Dermocystidium* sp., *Trichodinella epizootica*, *Henneguya*

*psorospermica*, *Triaenophorus nodulosus*, *Posthodiplostomum cuticula*, and *Camallanus lacustris*. The remaining parasites were encountered in single host species only. A total of 4696 countable parasites were found in fishes examined of which more than half constituted metacercariae of *Tylodelphys clavata* (2418).

#### DISCUSSION

The biological surveys that have hitherto been carried out in Lake Miedwie did not cover parasites of fishes inhabiting this body of water. Other post-glacial lakes of the Polish Western Pomerania are equally poorly known in this respect. The only exception is the work of Wierzbicka et al. (1998) describing parasite fauna of tench from lakes neighbouring the town of Insko.

According to the present study, the most diversified parasite fauna was observed in pike. The parasites recovered from this fish represent 20 species (taxa). According to Wielńska (1999) the total number of parasite species, attributed to this host, approaches 60. The majority of those parasites are specific to pike (Wielńska 1999).

The findings of *Flavobacterium columnare* and *Ichthyophonus hoferi* in pike constitute new host records. The highest value of prevalence (56.3%) was associated with metacercariae of *Tylodelphys podicipina*. The intensity was 108. This digenean species has been recorded in pike of Warniak Lake in Poland (Groba 1973) and from Kallavesi Lakes in Finland (Routsalainen and Yloenen 1987). The above authors suggested that the infection rate was high in pike from eutrophic lakes and that that situation was possibly associated with high abundance of grebes, known as the final hosts of this fluke.

Nematodes *Raphidascaris acus* occurred with a lower prevalence (43.8%). Similar values have been recorded from the Gulf of Finland (Rintamaeki 1989) and from Greifswalder Bodden (Engelbrecht 1958). Surveys of pike from Polish lakes did not show such high infection parameters. Milicer (1938) recorded 16% prevalence in Wigry Lake. Kozicka (1959) found this parasite in 3% of pike in Družno Lake, while in Tajty Lake the prevalence was 23% (Kozicka 1953).

In the present study a moderately high prevalence (28.1%) was shown by a monogenean *Tetraonchus monenteron*. Grabda-Kazubska et al. (1987) recorded a similar prevalence value (26.61%) for pike of Dgał Wielki Lake.

The second fish species in respect to the number of parasites was the perch. It harboured parasites belonging to 16 species (taxa), representing 8 higher taxa. It is evident based on literature data that the majority of parasites presently found in perch were not specific to this host. The most extensively represented group were protozoans (including Myxozoa) belonging to 6 species. Among them the most prevalent and numerous was *Henneguya psorospermica* found on the gills of 13 fish, which translates into prevalence of 32.5%.

Pojmańska et al. (1980) recovered this parasite from almost 10% of pike of Gopło Lake. Post (1987) considered the genus *Henneguya* a cosmopolitan one, infecting many freshwater fishes. In Lake Miedwie parasites of this genus were found also in pike. *Erastophrya chattoni* (affecting 12.5% of perch) and *Capriniana piscium* (5%) were found in this host for the first time in Poland. *E. chattoni* is known to attach to the body surface of many fishes according to Lom and Dyková (1992). The latter authors also reported *C. piscium* on perch from the Czech Republic. The most numerous and the most prevalent were digenean flukes *Tylodelphys clavata* and *Bunodera luciopercae*, and also glochidia (Unionidae gen. sp.). The intensity of infection with *T. clavata* reached 223. The presently determined infection parameters of *T. clavata* in perch were lower than those reported in the literature (Wierzbicki 1970, Pojmańska et al. 1980).

The prevalence of *Bunodera luciopercae* was 67.5%. In the study of perch from the Szczecin Lagoon (Grabda 1973) it amounted to 45%. Similar values were found by Pojmańska et al. (1980) in Konin Lakes. In contrast – in the lakes located south east of Berlin only 5% of perch were infected with this parasite (Priemer 1979). Prevalence of this species of fluke is strictly associated with the seasons of the year (Wierzbicki 1970, Andersen 1971, Scholz 1987).

A substantial number of glochidia was found on the gills of perch studied reaching a maximum of 100 specimens in one host. The prevalence was 57.5%. The infection parameters of this parasite are very seasonal and therefore individual publications are incomparable.

Water mites (Acarina gen. sp.) have not been previously recorded on perch in Poland.

The poorest parasite fauna was observed in vendace – with metacercariae of two species of eye flukes.

The mean numbers of countable parasites per one fish infected were the highest for roach (134) despite the small sample size. Definitely fewer parasites were found in perch (75.4), pike (47.7), tench (11.5), eel (9.8), and bream (6.8). It is also worth to note that a single zander examined contained 109 parasites. Such high infection level of the latter fish might have been a reason behind the drop in the population of this fish, reported by local fishermen.

In 1999 a total of 151 *Anguillicola crassus* were found in swim bladders of eels. This translated to infection intensity of 15.1 with 100% prevalence. Infection parameters reported within 1990–94 from eels caught in lakes and in the Szczecin Lagoon were lower (68.4%) (Własow et al. 1992, Sobocka 1995).

Comparing data on parasites found in fish examined in 1998 and 1999 it is evident that in 1998 *Tylodelphys clavata* was the most abundant. The same parasite next year was six times less abundant. The mean infection intensity was 63.79 and 28.56, respectively. Quite an opposite tendency was observed in relation to glochidia (Unionidae gen. sp.). In 1998 the mean infection intensity was 6.25, while in 1999 – 23.9. The above difference was probably caused by different specific composition of the samples and the seasonal differences.

## Conclusions

- (1) Parasite fauna of fishes of Lake Miedwie is diversified in the respect of its specific composition and quantities. In 1998 a total of 25 pathogenic species was recovered from the fishes surveyed, while in 1999 — 26 pathogens.
- (2) The most infected species turned out to be the roach and the zander. The former featured *Tyloodelphys clavata* and *Diplostomum* spp. occurring with 100% prevalence and the latter (a single fish studied) harbouring 109 countable parasites belonging to 6 species. The least infected was the vendace studied in a single sample only.
- (3) The majority of presently studied parasites constituted non-specific parasites (generalists), able to infect almost all fish species inhabiting Lake Miedwie.
- (4) Such high number of parasites found in zander could indicate that parasites are behind the decline of this fish population in the studied body of water.

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