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Research Article

VARIABILITY OF PERCH, *PERCA FLUVIATILIS* L. HELMINTH FAUNA IN THE GULF OF GDAŃSK, BALTIC SEA

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Abstract

A total of 233 perch, *Perca fluviatilis* L. specimens caught within April 1995–June 1997 at two sites in the Gulf of Gdańsk were examined. The fish were found to host flukes (metacercariae of *Tylodelphys clavata*, *Diplostomum* spp. and adult *Bunodera luciopercae*), cestodes (plerocerkoids of *Eubothrium crassum* and *Triaenophorus nodulosus*, and adult *Proteocephalus percae*), nematodes (*Camallanus lacustris*, *C. truncatus*, *Hysterothylacium aduncum* L_3 and adult), and acanthocephalans (*Acanthocephalus lucii*, *A. clavula*). Most prevalent were *A. lucii* (33.9%) and *T. clavata* (28.8%). Most of the parasites were found in the perch caught off the Vistula mouth and the level of infection was higher there than elsewhere in the Gulf, which indicates that ecological and hydrological conditions in the area enhance parasitism.

INTRODUCTION

The Gulf of Gdańsk is a part of the Baltic Sea with a relatively low salinity (7-8‰); it is affected by saline waters of the North Sea and by riverine runoff, mainly from the Vistula. For this reason, the Gulf supports freshwater species which co-occur with species typically found in marine and brackish water. Perch, *Perca fluviatilis* a representative of freshwater fish, occurs in the Gulf of Gdańsk at a relatively low abundance, but is an important fishing target (Strzyżewska 1990). It is a predator that, apart from in the brackish water of the Gulf of Gdańsk, the Pomeranian Bay, and off mouths of small Pomeranian rivers, is found in

Poland mostly in inland water bodies.

Knowledge of the parasitic fauna of the Gulf of Gdańsk perch is based only on studies by Markowski (1933) and Rokicki (1975) who examined 10 and 90 specimens, respectively. It seems justified to believe that the composition of the perch parasitic fauna in the area has changed since. The present work is a continuation of a study commenced in the early 1990s (Rolbiecki *et al.* 1999). That study, however, was limited to metacercariae. Therefore an attempt to update the list of the helminth fauna in the Gulf of Gdańsk perch was made. In addition, the composition of the parasitic fauna and the level of infection were compared between the perch caught in two distant areas in the Gulf of Gdańsk, *i.e.*, open Gulf waters off Hel and the area between the mouths of the Vistula and the Śmiała Vistula (Fig. 1).

MATERIALS AND METHODS

A total of 233 perch, *Perca fluviatilis* L. specimens (103 females and 130 males measuring 180-280 mm and weighing 150-230 g) were examined from 26 April 1995 to 6 June 1997. The area off Hel yielded 47 specimens, while 186 were caught between the mouths of the Vistula and the Śmiała Vistula (Fig. 1). The perch were caught with fish traps.

To find parasites, the fish were dissected and their skin with fins, gills, eyes, and viscera (gut, liver with gall bladder, spleen, heart, kidney, gonads and swim bladder) were examined under a stereomicroscope. The helminths collected were

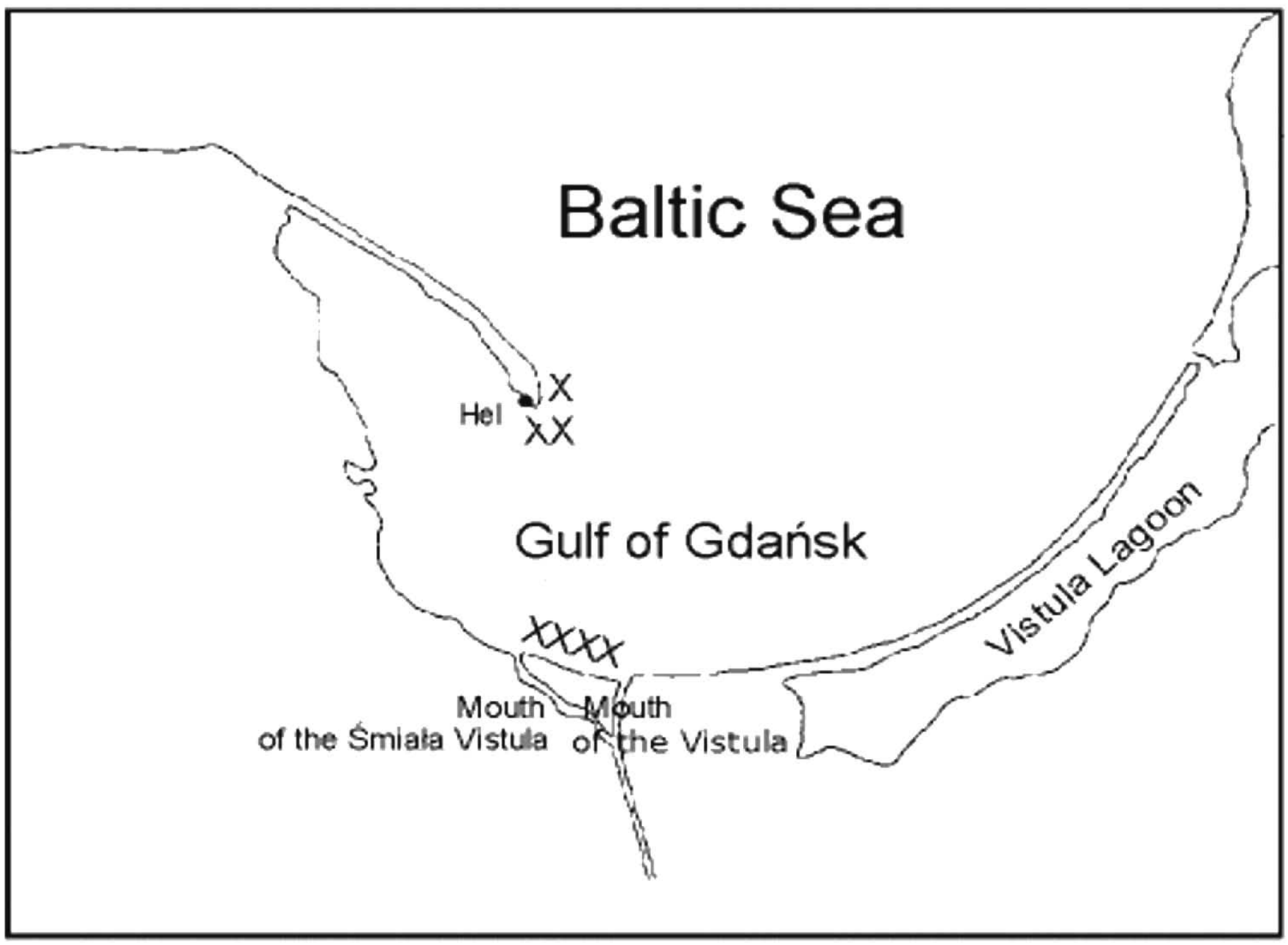

Fig. 1. Fish capture sites (x)

fixed in a glacial acetic acid-formalin mixture and preserved in 70% ethanol. Appropriate techniques aiding the identification of parasites were applied. Nematodes were cleared in lactophenol and embedded in glycerine-gelatine; flukes, cestodes, and acanthocephalans were stained with alum carmine, dehydrated in an alcohol series or in glacial acetic acid, cleared in benzyl alcohol, and embedded in Canada balsam.

RESULTS

The perch examined were found to be hosts to a total of 10 helminth species and *Diplostomum* metacercariae which could be identified to genus only. The fish caught off Hel harboured 7 species, while those caught off the mouth of the Vistula contained 9 species and the *Diplostomum* metacercariae (Table 1).

DISCUSSION

In the Gulf of Gdańsk the perch parasitic fauna is controlled by the ecological and hydrological conditions of the area. Direct effects of the Vistula are clearly visible in the reduced salinity of the Gulf, which determines the species composition of the parasites.

As shown by the present study, most helminths find appropriate conditions for their development off the Vistula mouth (Table 1). Apart from a single marine nematode, *Hysterothylacium aduncum*, the parasites recorded belong to freshwater species which are tolerant of brackish water. Their intermediate hosts (mostly molluscs and crustaceans) are also freshwater animals which are more commonly found off the Vistula mouth than in the open Gulf waters off Hel. There is a clear-cut correlation between the occurrence of the major hosts and their parasites.

Freshwater cyclopoids and diaptomids are the first intermediate hosts of *Eubothrium crassum*, *Triaenophorus nodulosus*, *Proteocephalus percae*, *Camallanus lacustris*, and *C. truncatus* (Michajłow 1962, Moravec 1969, 1971, Wootten 1974, Kennedy 1978). In the Gulf of Gdańsk, they are limited in their occurrence to the inshore zone off the Vistula mouth (Siudziński 1977, Wiktor *et al.* 1982, Wiktor and Żmijewska 1985) and to the Puck Bay (Wiktor 1993) where the salinity ranges from 1‰ to 8‰. The developmental cycle of the fluke *Bunodera luciopercae* also involves freshwater cyclopoids, in addition to freshwater ostracods and cladocerans, as the second intermediate hosts (Wiśniewski 1958). As with freshwater cyclopoids, freshwater ostracods and cladocerans are found in the Gulf only off the Vistula mouth and in the Puck Bay (Sywula 1966, Wiktor *et al.* 1982, Wiktor and Żmijewska 1985, Wiktor 1993). The intermediate

Table 1

The level of parasitic infection of perch in the Gulf of Gdańsk off Hel and off the Vistula mouth (Vis)

Parasites	No. of parasites		Prevalence [%]		Mean int. [ind.]		Range of int. [ind.]		Abundance [ind.]	
	Hel	Vis	Hel	Vis	Hel	Vis	Hel	Vis	Hel	Vis
DIGENEA										
Diplostomum spp., met.	-	272	-	6.5	-	22.7	-	13-26	-	1.5
Tylodelphys clavata, met.	14	3845	6.4	34.4	4.7	60.1	1-8	2-278	0.3	20.7
Bunodera luciopercae	11	280	2.1	9.7	11	15.6	11	1-134	0.2	1.5
CESTODA										
Eubothrium crassum	-	1	-	0.5	-	1	-	1	-	0.005
Triaenophorus nodulosus, pl.	7	91	6.4	19.4	2.3	2.5	1-4	1-6	0.1	0.5
Proteocephalus percae	-	14	-	3.2	-	2.3	-	1-4	-	0.08
NEMATODA										
Camallanus lacustris (246 ♀♀ and 147 ♂♂)	-	393	-	25.8	-	8.2	-	1-48	-	2.1
Camallanus truncatus (5 ♀♀ and 9 ♂♂)	1	13	2.1	3.2	1	2.2	1	1-4	0.02	0.07
Hysterothylacium aduncum, L_3 i ad (7 ♀♀ and 8 ♂♂)	14	1	23.4	0.5	1.3	1	1-2	1	0.3	0.005
ACANTHOCEPHALA										
Acanthocephalus lucii (217 ♀♀ and 172 ♂♂)	29	360	19.1	37.6	3.2	5.1	1-15	1-135	0.6	1.9
Acanthocephalus clavula (♂)	1	-	2.1	-	1	-	1	-	0.02	-

-: no parasites present

host of the acanthocephalan *Acanthocephalus lucii* is the freshwater *Asellus aquaticus* (Andryuk 1979), encountered in the inshore waters of, *i.a.*, the Puck Bay (Żmudziński 1967) and off the Vistula mouth (Herra and Wiktor 1985). Another parasite of the species, *A. clavula,* parasitises the isopod *Proasellus meridianus* (=*Asellus meridianus*) (Chubb 1964), has not yet been recorded in Poland. It is possible that *A. aquaticus* plays the role of intermediate host for that acanthocephalan as well. The single specimen of *A. clavula* recorded in this study was found off Hel.

In contrast, H*ysterothylacium aduncum* uses a very wide array of intermediate hosts. Crustaceans are obligatory intermediate hosts, whereas polychaetes, chaetognaths and fishes may act as transport hosts (Køie 1993). Although, in addition to marine hosts, the nematode occurs occasionally in fishes dwelling in brackish waters and, more seldom, in freshwater bodies, it was more common in the open sea, off Hel, than off the Vistula mouth where it is adversely affected by the fresh water run off.

Of the three fluke taxa known at present from the area, the developmental

cycles of two (*Diplostomum* spp. and *Tylodelphys clavata*) involve lymnaeid snails (Niewiadomska 1960, Shigin 1986). The Gulf of Gdańsk supports only one native taxon of the gastropod family in question, viz. *Lymnaea peregra* f. *balthica*, its distribution being limited mainly to the Puck Bay and, to a lesser extent, to the Vistula mouth area (Żmudziński 1967, Herra and Wiktor 1985). Cichowlas (1961) regards the species as the only host of parthenogenetic generations of the *Diplostomum* flukes in the Gulf of Gdańsk; perhaps it also supports another fluke, *Tylodelphys clavata*. As those flukes were mainly recorded in the Gulf of Gdańsk off the Vistula mouth, where the snails are not abundant (Żmudziński 1967), one may presume that some of the infected fish must have migrated into the area from the Vistula or other, smaller, rivers. The case with the fish infected with the flukes *Bunodera luciopercae* is similar. The first intermediate host is the bivalve *Sphaerium* spp. (Wiśniewski 1958), which is not recorded in the Gulf of Gdańsk.

Comparison of the perch parasitic fauna found in this and in an earlier study (Rolbiecki *et al.* 1999) combined with the data reported in the 1970s (Rokicki 1975) reveals a change in the species composition, accompanying a slight reduction in the number of species and a concurrent increase in the frequency of some helminths (Table 2). It should be remembered, however, that the study reported on by Rokicki (1975) did not involve an inspection of the fish eyes and, consequently, no *Diplostomum*, *Tylodelphys*, and *Apatemon* metacercariae were found. On the other hand, the present study failed to detect the presence of the *Apatemon annuligerum* and *Ichthyocotylurus platycephalus* flukes, which were found in the earlier survey (Rolbiecki *et al.* 1999). Continuing the comparison to the 1970s study, no representatives of the following species were recorded: *Bucephalus polymorphus*, *Rhipidocotyle campanula*, *Azygia lucii* and *Nicolla skrjabini*, plerocercoids of the *Bothriocephalus scorpii* and *Triaenophorus crassus* tapeworms, and the acanthocephalan *Neoechinorhynchus rutili*. However, studies carried out in the Gulf of Gdańsk on other fish species (*i.a.*, Sulgostowska 1993, Rokicki 1995, Rolbiecki and Rokicki 1996, Køie 1999, Morozińska-Gogol 1999) do show the presence of some of the helminths recorded earlier in the perch.

It is the first time that larvae of the cestode *Eubothrium crassum*, of the nematode *Camallanus truncatus* and of the acanthocephalan *Acanthocephalus clavula* were recorded in perch from the Gulf of Gdańsk. The acanthocephalan *Acanthocephalus clavula* is not known from the Gulf of Gdańsk before. On the other hand, the nematode *Camallanus truncatus* is a common parasite of zander, *Stizostedion lucioperca* in the Gulf (Rolbiecki and Rokicki 1996). It was surprising to find only a single plerocercoid of the cestode *Eubothrium crassum* in perch, because the adult cestode is common in trout and salmon in the Gulf and in the Baltic (Rolbiecki 1998 unpubl.).

Table 2

Perch parasites in the Gulf of Gdańsk, as shown by the results of the present study and data reported by other authors: the level of infection is expressed as prevalence (percentage of infected hosts in a sample) and mean intensity (mean number of parasites in an infected host) or intensity range (the lowest and the highest number of parasites in a host)

Parasite	Markowski (1933) n = 10	Rokicki (1975) n = 90	Rolbiecki *et al.*(1999) n = 281	Present study n = 233
Bucephalus polymorphus, ad.	-	1%, 4 ind.	-	-
Rhipidocotyle campanula, ad.	-	8%, 1-18 ind.	-	-
Diplostomum spp., met.	-	-	7.1%, 14.9 ind.	5.2%, 22,7 ind., 13-26 ind.
Tylodelphys clavata, met.	-	-	32.4 %, 45,2 ind.	28.8%, 57.6 ind., 1-278 ind.
Ichthyocotylurus platycephalus, met.	-	-	1 %, 3 ind.	-
Apatemon annuligerum, met.	-	-	1.7 %, 1.6 ind.	-
Bunodera luciopercae	-	17%, 1-17 ind.	-	8.2%, 15.3 ind., 1-134 ind.
Azygia lucii	-	1%, 1 ind.	-	-
Nicolla skrjabini	-	1%, 1 ind.	-	-
Eubothrium crassum, pl.	-	-	-	0.4%, 1 ind.
Bothriocephalus scorpii, pl.	-	8%, 1-16 ind.	-	-
Triaenophorus crassus, pl.	-	1%, 3 ind.	-	-
Triaenophorus nodulosus, pl. and ad.*	-	3%, 1-3 ind.	-	16.7%, 2,5 ind., 1-6 ind.
Proteocephalus percae	50%, 3 ind.	14%, 1-19 ind.	-	2.6%, 2.3 ind., 1-4 ind.
Contracaecum aduncum **	10%, 2 ind.	2%, 1-2 ind.	-	-
Hysterothylacium aduncum, L_3 and ad.	-	-	-	5.2%, 1.3 ind., 1-2 ind.
Camallanus lacustris	-	3%, 1-3 ind.	-	20.6%, 8.2 ind., 1-48 ind.
Camallanus truncatus	-	-	-	3%, 2 ind., 1-4 ind.
Neoechinorhynchus rutili	-	3%, 2-14 ind.	-	-
Acanthocephalus lucii	-	13%, 1-6 ind.	-	33.9%, 4,9 ind., 1-135 ind.
Acanthocephalus clavula	-	-	-	0.4%, 1 ind.

*: including one adult

**: at present regarded as synonymous with *Hysterothylacium aduncum*

Variations in the helminth fauna composition may be a reflection of more general changes taking place in the Gulf of Gdańsk ecosystem (an increased level of eutrophication, industrial and municipal pollution), manifested as, among other things, a modification of the composition of free-living invertebrates acting as intermediate parasite hosts. This, in turn, results in transformations of the qualitative and quantitative composition of fish parasitic fauna. A similar trend had already been observed by Sulgostowska (1988) during a study on parasites of flounder in the South-East Baltic. It can be thus concluded that parasites may provide a useful tool in monitoring the quality of the water.

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