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# The helminth fauna of some notothenioid fishes collected from the shelf of Argentine Islands, West Antarctica

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**Abstract**: The infections of four fish species, *Trematomus newnesi*, *T. bernacchii*, *Lindbergichthys nudifrons* and *Harpagifer antarcticus* with parasitic worms, in the coastal zone off the Vernadsky Station (Argentine Islands, West Antarctica) are described. Data on infections are compared with previous results from Admiralty Bay at the South Shetland Islands. Indices of infection are for each host–parasite relationship. In total, 16 taxa of parasites were recorded: 6 digeneans, 3 larval cestodes, 4 (adult and cystacanth) acanthocephalans, and 3 (adult and larval) nematodes. Fifteen of them have been previously recorded in *Notothenia coriiceps* from this area. Hence, the number of parasitic taxa recorded in this region increased from 21 to 22. Either the digenean *Macvicaria georgiana* or acanthocephalan *Corynosoma pseudohamanni* were dominants in different hosts. *Trematomus bernacchii* was the most strongly infected, especially with *M. georgiana* (prevalence 100%, mean abundance 113.7). The infection parameters of the majority of parasites were lower at the Vernadsky Station than in the Admiralty Bay, especially for host–parasite relations with larval cestodes and nematodes. The presently reported study have confirmed that the southern range of distribution of two acanthocephalans, *Aspersentis megarhynchus* and *Corynosoma hamanni* extends south to the area near the Argentine Islands.

Key words: Antarctica, Argentine Islands, Vernadsky Station, parasitic worms, fishes, infection.

## Introduction

Many papers have been published on fish endoparasitic worms in the West Antarctica (see monographs by Zdzitowiecki 1991, 1997; Rocka 2003, 2004), but the relevant data from the coastal area of the Antarctic Peninsula are scarce (Szidat 1965; Hoberg 1986; Zdzitowiecki and Laskowski 2004).

Szidat (1965) surveyed "*Notothenia neglecta* Nybelin, 1951" (= *N. coriiceps* Richardson, 1844) caught at the Melchior Islands. He recorded three digeneans: "*Plagioporus pennelli* (Leiper *et* Atkinson, 1914)" = *Macvicaria georgiana* (Ko-

valjova *et* Gaevskaya, 1974), "*Lepocreadium trullaeforme* Linton, 1940" = *Lepidapedon garrardi* (Leiper *et* Atkinson, 1914), and "*Derogenes parvus* Szidat, 1950" = *Genolinea bowersi* (Leiper *et* Atkinson, 1914); larval cestode (diphyllobothriid plerocercoids); two forms of larval nematodes, *Anisakis* sp. and *Contracaecum* sp.; and two acanthocephalans, "*Hypechinorhynchus magellanicus* Szidat, 1950" (= *Metacanthocephalus* sp.) and cystacanths of *Corynosoma* sp. Relevant parasite names were revised and systematised by Prudhoe and Bray 1973, Gibson 1976, Zdzitowiecki 1986b, 1990, and Zdzitowiecki *et al.* 1992.

Hoberg (1986) listed three species of Acanthocephala: *Corynosoma arctocephali* Zdzitowiecki, 1984; *C. hamanni* (Linstow, 1892); and *C. pseudohamanni* Zdzitowiecki, 1984, as occurring in the cystacanth stage in nototheniid fishes at the Anvers Island.

Twenty taxa of endoparasitic worms and one monogenean, *Pseudobenedenia nototheniae* Johnston, 1931, occurring on skin, were found in/on *N. coriiceps* (Zdzitowiecki and Laskowski (2004).

The present paper focuses on parasites of fishes (excluding *N. coriiceps*) collected by the authors from inshore fishes caught off the Argentine Islands during the Seventh Ukrainian Antarctic Expedition organized by the Ukrainian Antarctic Center in Kiev, in the frames of the Polish-Ukrainian scientific exchange.

## Material and methods

Details on parasite collection and relaxation methods were previously described by Zdzitowiecki and Laskowski (2004) and only the most important information is given here. Fishes were caught at the Vernadsky Station (Galindez Island, Argentine Islands; 65°15'S 64°16'W) at the depths 0.1–30 m, using a fishing rod (most of them) and a trap (2 specimens of *T. newnesi* and one specimen of *H. antarcticus*). Three individuals of *T. newnesi* and one of *H. antarcticus* were obtained from a stomach of *N. coriiceps.* They were determined according to Gon and Heemstra (1990). Standard length (SL) of each fish specimen was measured. Endoparasites were collected alive from the lumen of alimentary tract, stomach's wall, liver, and mesentery. Relaxed digeneans, cestodes, and acanthocephalans as well as live nematodes were fixed and stored in 75% ethanol. Digeneans were identified according to Zdzitowiecki (1997), cestodes according to Wojciechowska (1993a) and Rocka (2003), acanthocephalans according to Zdzitowiecki (1991), and nematodes according to Rocka (2004). The helminths were identified and counted using a dissection microscope and/or compound microscope Olympus BX50. Three indices of infection were calculated: prevalence, mean abundance, and maximum intensity (Margolis *et al.* 1982). Comparative data on the occurence of parasites in the Admiralty Bay are given according to Zdzitowiecki 1986a, 1986b, 1988; Wojciechowska 1993b, Rocka 1999, and unpublished data (material collected by Zdzitowiecki).

## Results

The majority of fishes examined during this Antarctic expedition represented *Notothenia coriiceps*, and its helminth fauna was described separately (Zdzitowiecki and Laskowski 2004). Other fishes collected were also notothenioids belonging to the family Nototheniidae: *Trematomus newnesi* Boulenger, 1902, *T. bernacchii* Boulenger, 1902, *Lindbergichthys nudifrons* (Lönnberg, 1905), and to the family Harpagiferidae: *Harpagifer antarcticus* Nybelin, 1947. The four fish species listed above harboured a total of six digenean species, three larval cestodes, four acanthocephalans (two species of the genus *Metacanthocephalus* in the adult stage and two species of the genus *Corynosoma* in the cystacanth stage), two nematodes: adult *Ascarophis nototheniae* Johnston *et* Mawson, 1945 and larval *Pseudoterranova decipiens* (Krabbe, 1878), and a larval form of Nematoda assigned to the genus *Contracaecum* and probably containing two species, *Contracaecum osculatum* (Rudolphi, 1802) and/or *Contracaecum radiatum* (Linstow, 1907). The helminth fauna of each species is described below:

***Trematomus newnesi* (n = 17)**. — The majority of specimens were caught using a fishing rod, but five of the six smallest fish (shorter than 9.6 cm) were either caught using a trap (two) or were found in the stomach of a large *N. coriiceps* (three). Two of these six smallest specimens were free of helminths, while the remaining ones were infected only with a few (1–2) larval cestodes. All larger fish were infected. Taking into account the prevalence, the most frequently occurring parasites were larval cestodes, mainly diphyllobothriid plerocercoids. However, the most numerous were digeneans *Macvicaria georgiana* and larval nematodes of the genus *Contracaecum* (Table 1).

***Trematomus bernacchii* (n = 10)**. — All specimens were caught using a fishing rod. Every fish was infected and the level of infection was high, in some cases similar to that of large specimens of *N. coriiceps.* All hosts were infected with the digenean *M. georgiana* and cystacanths of *C. pseudohamanni*. The former was found as the dominant parasite species occurring with the mean abundance exceeding one hundred. Unlike in other hosts, the majority of specimens of *M. georgiana* occurred in the small intestine and not in pyloric caeca (Table 2). The findings of a digenean *Neolebouria antarctica* (Szidat *et* Graefe, 1967) and an acanthocephalan *C. arctocephali* represent new host records.

***Lindbergichthys nudifrons* (n = 58)**. — All specimens were caught using a fishing rod. Every fish was infected. The most numerous parasites were digeneans and acanthocephalans, with the domination of cystacanths of *C. pseudohamanni*. However, levels of infections with each parasite were not high as the highest mean abundance (of *C. pseudohamanni*) was 4.88. Only a single specimen of the digenean *Gonocerca phycidis* Manter, 1925 was found in this host (Table 3).

Table 1

Helminth fauna of *Trematomus newnesi* at the Vernadsky Station – V (n = 17; SL = 5.6–18.0 cm mean 11.7 cm) and in the Admiralty Bay – AB (n = 28; SL = 10.5-21.5 cm mean 16 cm).

| Parasites | Prevalence (%) | | Mean abundance | | Maximum intensity | |
|---|---|---|---|---|---|---|
| | V | AB | V | AB | V | AB |
| Digenea | | | | | | |
| *Macvicaria georgiana* | 53 | 29 | 10.00 | 1.50 | 63 | 18 |
| *Neolebouria antarctica* | 41 | 4 | 1.71 | 0.04 | 12 | 1 |
| *Genolinea bowersi* | 53 | 54 | 2.41 | 1.30 | 14 | 8 |
| *Elytrophalloides oatesi* | 41 | 0 | 0.88 | 0 | 5 | 0 |
| Cestoda | | | | | | |
| Metacestode bilocular | 59 | 93 | 3.71 | 7.96 | 18 | 39 |
| Metacestode trilocular | 18 | 64 | 0.24 | 2.64 | 2 | 11 |
| Diphyllobothriid plerocercoid* | 76 | 100 | 3.06 | 13.26 | 7 | 54 |
| Acanthocephala | | | | | | |
| *Metacanthocephalus dalmori* | 28 | 7 | 0.94 | 0.18 | 6 | 4 |
| *M. johnstoni* | 28 | 43 | 0.47 | 0.93 | 2 | 6 |
| *Corynosoma pseudohamanni* | 47 | 36 | 1.94 | 1.00 | 8 | 9 |
| Nematoda | | | | | | |
| *Ascarophis nototheniae** | 18 | 0 | 0.59 | 0 | 7 | 0 |
| *Pseudoterranova decipiens** | 18 | 19 | 0.18 | 0.23 | 1 | 2 |
| *Contracaecum* spp.* | 59 | 94 | 8.24 | 9.13 | 29 | 38 |

* n = 31

***Harpagifer antarcticus* (n = 2).** — Of two specimens available, one was taken from a trap and the second from the stomach of *N. coriiceps*. Because of small sample size, indices of infection were not calculated and only intensities of infection for each parasite are given (Table 4).

## Discussion

Taking into account data for all four host species examined, almost all taxa of parasites recorded occurred also in *N. coriiceps* (Tables 1–5) (Zdzitowiecki and Laskowski 2004). The only parasite not found in the latter fish was the digenean *G. phycidis* (presently found in *L. nudifrons*). Levels of infection in three host species, *T. newnesi*, *T. bernacchii*, and *L. nudifrons*, were diverse. The strongest infection was found for a digenean *M. georgiana* occurring in *T. bernacchii* (mean abundance exceeded 100). Levels of infection with other digeneans were low. Only *G. bowersi* was a relatively frequent species and its mean abundance in three host species oscillated around 2 (from 1.66 in *L. nudifrons* to 2.41 in *T. newnesi*).

Table 2

Helminth fauna of *Trematomus bernacchii* at the Vernadsky Station – V (n = 10; SL = 13.0–16.5 cm mean 14.4 cm) and in the Admiralty Bay – AB (n = 38; SL = 14–32 cm mean 21 cm).

| Parasites | Prevalence (%) | | Mean abundance | | Maximum intensity | |
|---|---|---|---|---|---|---|
| | V | AB | V | AB | V | AB |
| Digenea | | | | | | |
| *Macvicaria georgiana* | 100 | 18 | 113.7 | 0.3 | 296 | 6 |
| *Neolebouria antarctica* | 10 | 0 | 0.1 | 0 | 1 | 0 |
| *Lepidapedon garrardi* | 40 | 74 | 1.0 | 2.8 | 4 | 22 |
| *Genolinea bowersi* | 50 | 95 | 2.1 | 7.4 | 10 | 41 |
| *Elytrophalloides oatesi* | 10 | 53 | 0.1 | 1.2 | 1 | 10 |
| Cestoda | | | | | | |
| Metacestode bilocular | 30 | 95 | 0.30 | 35.70 | 1 | 172 |
| Diphyllobothriid plerocercoid* | 70 | 100 | 0.90 | 13.26 | 2 | 54 |
| Acanthocephala | | | | | | |
| *Metacanthocephalus dalmori* | 80 | 16 | 9.20 | 1.55 | 24 | 38 |
| *M. johnstoni* | 40 | 3 | 1.20 | 0.05 | 5 | 2 |
| *Corynosoma arctocephali* | 20 | 0 | 0.20 | 0 | 1 | 0 |
| *C. pseudohamanni* | 100 | 92 | 8.30 | 4.90 | 22 | 26 |
| Nematoda | | | | | | |
| *Ascarophis nototheniae** | 80 | 10 | 8.00 | 0.02 | 20 | 3 |
| *Pseudoterranova decipiens** | 10 | 68 | 0.10 | 4.46 | 1 | 49 |
| *Contracaecum* spp.* | 40 | 41 | 0.70 | 1.66 | 3 | 10 |

* n = 41

Infections with larval cestodes were low. Only *T. newnesi* hosted a trilocular metacestode. Of Acanthocephala, *C. pseudohamanni* was the most abundant in two host species, but less numerous than *Metacanthocephalus dalmori* Zdzitowiecki, 1983 in *T. bernacchii*. Of two adult parasites, *M. dalmori* was more numerous than *Metacanthocephalus johnstoni* Zdzitowiecki, 1983 (the opposite situation than in *N. coriiceps* studied by Zdzitowiecki and Laskowski 2004). A nematode *A. nototheniae* occurred in all host species and the relatively strong infection was observed in *T. bernacchii* (mean abundance 8.00). Of two larval nematodes, *P. decipiens* and *Contracaecum* spp., the latter were abundant (mean abundance 8.24) in *T. newnesi*, although all host species were infected with both parasites. Summarising results, the level of infection of *T. bernacchii* was higher than that of *N. coriiceps*, whereas the reverse situation was between the latter and *T. newnesi* and *L. nudifrons*. The diversity of parasites was lower in all host species presently studied than in *N. coriiceps* (Zdzitowiecki and Laskowski 2004). *C. pseudohamanni* was the dominant parasite of *L. nudifrons*, whereas *M. georgiana* of *T. newnesi* and of *T. bernacchii*.

Table 3

Helminth fauna of *Lindbergichthys nudifrons* at the Vernadsky Station – V (n = 58; SL = 5.4–19.7 cm mean 13.5 cm) and in the Admiralty Bay – AB (n = 29; SL = 11.3–20.0 cm mean 15 cm).

| | Prevalence (%) | | Mean abundance | | Maximum intensity | |
|---|---|---|---|---|---|---|
| Parasites | V | AB | V | AB | V | AB |
| Digenea | | | | | | |
| *Macvicaria georgiana* | 57 | 79 | 4.24 | 16.6 | 75 | 94 |
| *Neolebouria antarctica* | 2 | 0 | 0.02 | 0 | 1 | 0 |
| *Lepidapedon garrardi* | 9 | 90 | 0.17 | 11.3 | 3 | 131 |
| *Genolinea bowersi* | 45 | 72 | 1.66 | 5.4 | 19 | 34 |
| *Gonocerca phycidis* | 2 | 0 | 0.02 | 0 | 1 | 0 |
| *Elytrophalloides oatesi* | 40 | 17 | 1.29 | 0.2 | 14 | 2 |
| Cestoda | | | | | | |
| Metacestode bilocular | 43 | 69 | 1.05 | 5.72 | 6 | 48 |
| Diphyllobothriid plerocercoid* | 38 | 97 | 0.67 | 14.09 | 4 | 78 |
| Acanthocephala | | | | | | |
| *Metacanthocephalus dalmori* | 67 | 31 | 3.22 | 2.90 | 16 | 39 |
| *M. johnstoni* | 49 | 7 | 2.24 | 0.14 | 16 | 3 |
| *Corynosoma arctocephali* | 10 | 0 | 0.14 | 0 | 2 | 0 |
| *C. pseudohamanni* | 90 | 66 | 4.88 | 1.6 | 20 | 15 |
| Nematoda | | | | | | |
| *Ascarophis nototheniae** | 29 | 44 | 0.95 | 2.9 | 8 | 2 |
| *Pseudoterranova decipiens** | 7 | 47 | 0.07 | 0.88 | 1 | 8 |
| *Contracaecum* spp.* | 3 | 60 | 0.03 | 2.97 | 1 | 49 |

* n = 32

Table 4

Helminth fauna of *Harpagifer antarcticus* (n = 2; SL = 9.8 cm and 10.2 cm) at the Vernadsky Station.

| Parasites | | Intensities |
|---|---|---|
| Digenea | *Macvicaria georgiana* | 11; 1 |
| Cestoda | Diphyllobothriid plerocercoid | 1; 0 |
| Acanthocephala | *Corynosoma arctocephali* | 1; 0 |
| | *C. pseudohamanni* | 13; 34 |
| Nematoda | *Ascarophis nototheniae* | 0; 1 |
| | *Pseudoterranova decipiens* | 1; 0 |
| | *Contracaecum* spp. | 2; 1 |

The check-list of fish parasites recorded in the Vernadsky Station area consists of 22 taxa, of which 21 occurred in *N. coriiceps* (Zdzitowiecki and Laskowski 2004), whereas 16 in other hosts (present data) (Table 5). The digenean *M. georgiana* and the acanthocephalan *C. pseudohamanni* were found to be domi-

Table 5

Occurrence of parasitic worms in different fish species at the Vernadsky Station according to Zdzitowiecki and Laskowski (2004) and present data.

| Parasites \ Fish species | N. c. | T. n. | T. b. | L. n. | H. a. |
|---|---|---|---|---|---|
| Monogenea | | | | | |
| *Pseudobenedenia nototheniae* Johnston, 1931 | + | – | – | – | – |
| Digenea | | | | | |
| *Macvicaria georgiana* (Kovaljova *et* Gaevskaya, 1974) | + | + | + | + | + |
| *Neolebouria antarctica* (Szidat *et* Graefe, 1967) | + | + | + | + | – |
| *Lepidapedon garrardi* (Leiper *et* Atkinson, 1914) | + | – | + | + | – |
| *Genolinea bowersi* (Leiper *et* Atkinson, 1914) | + | + | + | + | – |
| *Gonocerca phycidis* Manter, 1925 | – | – | – | + | – |
| *Elytrophalloides oatesi* (Leiper *et* Atkinson, 1914) | + | + | + | + | – |
| *Lecithaster macrocotyle* Szidat *et* Graefe, 1967 | + | – | – | – | – |
| Cestoda | | | | | |
| Metacestode bilocular | + | + | + | + | – |
| Metacestode trilocular | + | + | – | – | – |
| Diphyllobothriid plerocercoid | + | + | + | + | + |
| Acanthocephala | | | | | |
| *Aspersentis megarhynchus* (Linstow, 1892) | + | – | – | – | – |
| *Metacanthocephalus dalmori* Zdzitowiecki, 1983 | + | + | + | + | – |
| *M. johnstoni* Zdzitowiecki, 1983 | + | + | + | + | – |
| *Corynosoma arctocephali* Zdzitowiecki, 1984 | + | – | + | + | + |
| *C. bullosum* (Linstow, 1892) | + | – | – | – | – |
| *C. hamanni* (Linstow, 1892) | + | – | – | – | – |
| *C. pseudohamanni* Zdzitowiecki, 1984 | + | + | + | + | + |
| *C. shackletoni* Zdzitowiecki, 1978 | + | – | – | – | – |
| Nematoda | | | | | |
| *Ascarophis nototheniae* Johnston *et* Mawson, 1945 | + | + | + | + | + |
| *Pseudoterranova decipiens* (Krabbe, 1878) | + | + | + | + | + |
| *Contracaecum* spp. | + | + | + | + | + |

N. c. – *Notothenia coriiceps*; T. n. – *Trematomus newnesi*; T. b. – *T. bernacchii*; L. n. – *Lindbergichthys nudifrons*; H. a. – *Harpagifer antarcticus.*

nants. Of other parasites three digeneans: *N. antarctica*, *G. bowersi*, *Elytrophalloides oatesi* (Leiper *et* Atkinson, 1914) two larval cestodes: metacestode bilocular and diphyllobothriid plerocercoid, three acanthocephalans: *M. dalmori*, *M. johnstoni* and *C. arctocephali*, as well as all three nematods: *A. nototheniae*, *P. decipiens*, and *Contracaecum* spp., were found in four or five host species (Tab. V). One monogenean species, *P. nototheniae*, seems to be a specific parasite of *N. coriiceps* in the investigated area (Zdzitowiecki and Laskowski 2004). Other parasites were rare and less important than those listed above.

The presently reported results from the Vernadsky Station can be compared with data from the same hosts caught in the Admiralty Bay (King George I., South Shetland Is). The comparison of infection parameters from the Vernadsky Station and the Admiralty Bay are shown in Tables 1–3. Digeneans, *Neolepidapedon trematomi* Prudhoe *et* Bray, 1973 and *Lecithaster macrocotyle* Szidat *et* Graefe, 1967, metacestode monolocular, and acanthocephalans: *Aspersentis megarhynchus* (Linstow, 1892), *Metacanthocephalus campbelli* (Leiper *et* Atkinson, 1914), *Corynosoma bullosum* (Linstow, 1892) and *C. hamanni*, were absent in any of the presently investigated hosts but they were present in these fish species in the Admiralty Bay (Zdzitowiecki 1986a, b, 1988; Zdzitowiecki and Rokosz 1986; Wojciechowska 1993b; Rocka 1999). On the other hand *L. macrocotyle, A. megarhynchus*, *C. bullosum* and *C. hamanni* were present in *N. coriiceps* in the region of Galindez Island (Vernadsky Station). Data for diphyllobothriid plerocercoids and larval Nematoda are published here for the first time. The comparison between infections of *Harpagifer antarcticus* in two studied areas is impossible, because only two specimens were examined at the Vernadsky Station. However, it can be noted that infections of both specimens mentioned with *C. pseudohamanni* were higher than maximal infection at the South Shetland Islands (Zdzitowiecki and Zadróżny 1999).

The main conclusion from the comparison of infections of *N. coriiceps* (Zdzitowiecki and Laskowski 2004) is presently confirmed. Two species, *A. megarhynchus* and *C. hamanni*, being two of three dominant acanthocephalan species in the Admiralty Bay and rare at the Vernadsky Station, were absent in other hosts in the latter area. It is consistent with the conclusion that the southern limits of distribution of these species are near the Argentine Islands.

Other acanthocephalans were consistently more frequent at the Vernadsky Station. Various digeneans and the nematode *A. nototheniae* were more frequent in some host species at the Vernadsky Station and in other hosts in the Admiralty Bay. It should be emphasized that *M. georgiana* was rare in *T. bernacchii* in the Admiralty Bay, and extremely frequent in this host at the Vernadsky Station. It is true, to lower extent, also for *A. nototheniae*. Larval cestodes and nematodes were invariably more frequent in the Admiralty Bay. This can be explained by the frequent presence of the definitive hosts, skates for metacestodes and seals for plerocercoids and larval nematodes, in the Admiralty Bay (personal observations of Zdzitowiecki).

*T. bernacchii* has been investigated for the presence of all endoparasitic worms also in the Eastern Antarctica, namely at the Ross Sea coasts (Holloway and Spence 1980, Moser and Cowen 1991). Unfortunately these data are not comparable with those from the West Antarctica because of the different points of view on the taxonomy of parasites. Zdzitowiecki *et al.* (1999a) recognized in *T. bernacchii* from the Ross Sea two species of the genus *Metacanthocephalus*: *M. campbelli* and probably *M. rennicki* (Leiper *et* Atkinson, 1914), and *C. pseudohamanni*, while Holloway and

Spence (1980) only *M. campbelli* and *C. hamanni*, and Moser and Cowen (1991) – *Echinorhynchus* sp. and *C. hamanni*. Zdzitowiecki *et al.* (1999b) recognized seven species of Digenea (two recently described), while Holloway and Spence (1980) four, and Moser and Cowen (1991) only two. Wojciechowska *et al.* (1994) divided metacestodes into three separate forms, while Holloway and Spence (1980) as well as Moser and Cowen (1991) reported the presence of one form. Because of these differences, the precise comparison is impossible.

Numerical data for infections of *T. newnesi* in the East Antarctica are not available, with the exception of a note on the occurrence of 98 specimens of the digenean *Neolebouria terranovaensis* Zdzitowiecki, Pisano *et* Vacchi,1993 found in one of two fishes caught in the coastal zone of Davis Sea (Zdzitowiecki 1997).

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