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Helminths of an Antarctic fish, *Notothenia coriiceps*, from the Vernadsky Station (Western Antarctica) in comparison with Admiralty Bay (South Shetland Islands)

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Summary

The Antarctic fish, *Notothenia coriiceps*, was found to be infected with 21 species of adult and larval helminths in the Vernadsky Station area, namely one species of Monogenea, six Digenetic Trematoda, three Cestoda, eight Acanthocephala and three Nematoda. Infections were compared with new and previously published data from the Admiralty Bay, where 27 species of helminths were found, including all occurring at the Vernadsky Station. Levels of infections of most of helminths were lower at the Vernadsky Station. The opposite situation was found only for two trematodes, *Neolebouria antarctica* and *Elytrophalloides oatesi*, and four acanthocephalans, *Metacanthocephalus dalmori*, *M. johnstoni*, *Corynosoma arctocephali* and *C. pseudohamanni*. The latter acanthocephalan predominated at the Vernadsky Station, whereas a trematode *Macvicaria georgiana* was the dominant species in Admiralty Bay. Two acanthocephalans, *Aspersentis megarhynchus* and *Corynosoma hamanni*, which were co-dominant (together with *C. pseudohamanni*) acanthocephalan species in Admiralty Bay, were very rare at the Vernadsky Station. The southern borders of their distribution areas are probably near to this station.

Key words: Admiralty Bay; Antarctica; fish; helminths; *Notothenia coriiceps*; southern border of distribution; Vernadsky Station.

Introduction

According to DeWitt *et al*. (1990) yellowbelly rock cod, *Notothenia coriiceps* Richardson, 1844, was originally described in sub-Antarctica at Kerguelen Islands. Its distribution is circum-Antarctic on the continental shelf. Similar fishes occurring in Western Antarctica were described as a separate species, *Notothenia neglecta* Nybelin, 1951, based on specimens caught at South Georgia. Various authors accepted this form as valid species or sub-species (Fischer and Hureau, 1985), but DeWitt *et al*. (1990) regarded both forms to be identical. The present authors accept this point of view. Therefore all previous literature data on the helminth fauna of *N. neglecta* are referred here to *N. coriiceps*, one of the most frequent bottom fish species occurring circumpolarly in low Antarctica and off islands in the Kerguelen sub-region of sub-Antarctica.

The first data on parasitic worms (acanthocephalans) occurring in *N. coriiceps* were given by Linstow (1892) and on nematodes by Railliet and Henry (1907). Further data on the occurrence of nematodes, cestodes and acanthocephalans of this host in Eastern Antarctica and the Kerguelen sub-region including also Macquarie Island area were published thirty or more years later (Johnston 1937a,b; Johnston and Best, 1937; Johnston and Mawson, 1945; Mawson, 1953). First data on digenetic trematodes of this host were published by Szidat (1965) and Prudhoe and Bray (1973). All these reports were based on limited samples of fish examined and concerned a few species and larval forms of helminths. Broader check-lists of parasites of *N. coriiceps* caught at the Adelie Land were published by Zdzitowiecki *et al*. (1998) and Zdzitowiecki (2001). The last list concerned 19 species and larval forms of Trematoda, Cestoda, Acanthocephala and Nematoda. One additional acanthocephalan species was reported from environs of the Casey Station (Rohde *et al.,* 1998).

The report on various parasitic worms occurring in *N. coriiceps* (under the name *N. neglecta*) in Western Antarctica was published by Szidat (1965). Fish were caught at the

Melchior Islands (near the Antarctic Peninsula) and the South Orkney Islands. Later, large fish samples were examined from various areas of Western Antarctica by Hoogesteger and White (1981), Lutnicka and Zdzitowiecki (1984), Zdzitowiecki (1986a,b, 1988), Zdzitowiecki and Rokosz (1986), Wojciechowska (1993a,b, 1993c), Zdzitowiecki and White (1996), Zdzitowiecki *et al.* (1997), Palm *et al*. (1998) and Rocka (1999). Some contributions were published by Hoberg (1986), Zdzitowiecki and White (1992a,b) and others. All these data were based on material collected at South Georgia, South Orkney Islands, South Shetland Islands and Anvers Island.

The present paper concerns data on the occurrence of parasitic worms, Monogenea, Digenetic Trematoda, Cestoda, Acanthocephala and Nematoda, in *N. coriiceps* in the more southern area near to the south polar circle and compares them with previous data from the Admiralty Bay (South Shetland Islands).

Material and Methods

Field investigations were carried out in February – March 2002 during the Seventh Ukrainian Antarctic Expedition organized by the Ukrainian Antarctic Center in Kiev, according to the Polish-Ukrainian international scientific exchange. All specimens of *N. coriiceps* were caught, mainly using a fishing rod and additionally using traps, at the Vernadsky Station (previously Faraday Station) (65°15'S 64°16'W) at the shore of Galindez Island, at depths from 10 to 30 m. Standard length of fish (n = 93) ranged from 10.2 to 42.5 cm, mean 23.0 cm. Most of fishes were immature and shorter than 30 cm. Fish were examined in 1 % saline solution using a stereomicroscope just after catching or were kept alive for several hours to three days in a large tank (over 1000 liters) with marine water and killed just before examination. Parasitic worms were collected from the skin, lumen of alimentary tract, stomach's wall, liver and mesentery. All parasites were collected alive and counted. Platyhelminths were killed by heat in warm water. Cystacanths of acanthocephalans *Corynosoma* spp. were liberated from cysts using digestive solution (water solution of 1 % pepsin and 0.4 % HCl) and, together with mature acanthocephalans from the intestine, relaxed in a fresh water. Diphyllobothriid plerocercoids and larval nematodes were counted and the latter discriminated into *Pseudoterranova decipiens* and *Contracaecum* spp. All other parasites were fixed and stored in 75 % ethanol. Monogenea were determined according to Lutnicka and Zdzitowiecki (1984), Trematoda according to Zdzitowiecki (1997), Cestoda from the intestine according to Wojciechowska (1993a), Acanthocephala according to Zdzitowiecki (1991), anisakid larvae according to the presence of one or two caeca and Nematoda from the stomach according to Rocka (1999). All species and larval forms were compared with specimens collected by the first author in the Admiralty Bay in 1978/79 during 12 months. Numerical data for tetraphyllidean metacestodes, Trematoda, adult Nematoda and Acanthocephala from this area were previously published (Zdzitowiecki, 1986a,b, 1988; Zdzitowiecki and Rokosz, 1986; Wojciechowska, 1993c; Rocka, 1999). Data for Monogenea, diphyllobothriid plerocercoids and anisakid larvae are published for the first time. Junior synonyms of some trematodes and acanthocephalans were used in some publications cited in the present paper and their lists were published by Zdzitowiecki (1991, 1997).

For comparison of the infection of fish of various length, fish were discriminated into six 5 cm size classes; the only specimen longer than 40 cm was added to the class containing specimens longer than 34.9 cm. Three indices of infection are given, namely prevalence (percent of infected fish), mean abundance (number of parasites per number of fish examined) and maximum intensity (maximum number of parasites in fish examined).

Results

In total, 21 species and larval forms were recognized, including one monogenean ectoparasite and 20 species and larval forms of endoparasitic worms. Table 1 shows indices of infection of fish caught at the Vernadsky Station, as well as indices of infection of *N. coriiceps* caught in the Admiralty Bay (South Shetland Islands), which were partly unpublished and partly based on papers cited in the Material and Methods. All parasite species and larval forms found at the Vernadsky Station occur also in the Admiralty Bay, where 248 host specimens were examined by the first author in 1978/1979. In total, 27 species and larval forms were recognized there.

Small fishes, shorter than 20 cm, were at the Vernadsky Station usually infected with various helminths with lower prevalence and/or mean abundance than larger specimens (Table 2). More detailed data are given below.

Monogenea

Only one species, *Pseudobenedenia notothenia*e Johnston, 1931, was found on the skin of fishes in both areas mentioned. It should be noted that indices of infection are rather doubtful (underestimated), because of unknown number of parasites could be lost during catching of fishes and keeping them in a tank.

Trematoda

Six species occurred in both areas in the lumen of the stomach and intestine. The dominant species was *Macvicaria georgiana* (Kovaljova et Gaevskaya, 1974) followed by sub-dominant *Genolinea bowersi* (Leiper et Atkinson, 1914) and much less numerous *Lepidapedon garrardi* (Leiper et Atkinson, 1914) and *Lecithaster macrocotyle* Szidat et Graefe, 1967. All four species were more numerous in the Admiralty Bay than at the Vernadsky Station. Surprisingly, *Elytrophalloides oatesi* (Leiper et Atkinson, 1914) and *Neolebouria antarctica* (Szidat et Graefe, 1967) were much more numerous at the Vernadsky Station, especially the latter one, which was very rare in *N. coriiceps* in the Admiralty Bay. All specimens of other digeneans co-

Table 1. Helminths of *Notothenia coriiceps* at the Vernadsky Station (n = 93) and in Admiralty Bay (n = 248) (in parentheses)

Parasites	Prevalence (%)	Mean abundance	Maximum intensity
Monogenea			
*Pseudobenedenia nototheniae**	20 (36)	0.82 (1.12)	21 (24)
Trematoda			
Macvicaria georgiana	94 (99)	29.45 (141)	318 (1017)
Neolebouria antarctica	30 (2)	9.00 (0.02)	267 (1)
Lepidapedon garrardi	18 (29)	0.35 (1.00)	6 (40)
Neolepidapedon trematomi	0 (1)	0 (0.03)	0 (3)
Genolinea bowersi	74 (88)	5.96 (9.0)	100 (101)
Gonocerca phycidis	0 (5)	0 (0.12)	0 (11)
Elytrophalloides oatesi	47 (13)	2.49 (0.3)	41 (12)
Lecithaster macrocotyle	1 (6.5)	0.01 (0.3)	1 (32)
Cestoda			
Metacestode monolocular	0 (5)	0 (0.17)	0 (8)
Metacestode bilocular	74 (90)	14.23 (27.5)	401 (544)
Metacestode trilocular	8 (65)	0.11 (5.98)	2 (64)
*Diphyllobothriid plerocercoid**	22 (57)	0.87 (2.85)	27 (50)
Acanthocephala			
Aspersentis megarhynchus	2 (99)	0.16 (33.5)	14 (180)
Heterosentis heteracanthus	0 (0.8)	0 (0.01)	0 (2)
Metacanthocephalus dalmori	47 (27)	1.38 (1.57)	15 (47)
Metacanthocephalus johnstoni	74 (58)	3.61 (1.91)	25 (16)
Echinorhynchus petrotschenkoi	0 (0.4)	0 (0.004)	0 (1)
Corynosoma hamanni	19 (96)	0.43 (24)	8 (149)
Corynosoma pseudohamanni	99 (99.6)	78.70 (36)	421 (856)
Corynosoma bullosum	3 (41)	0.03 (0.8)	1 (13)
Corynosoma arctocephali	44 (14)	0.98 (0.3)	6 (38)
Corynosoma shackletoni	4 (9)	0.05 (0.1)	2 (2)
Nematoda			
Ascarophis nototheniae	2 (6.5)	0.02 (0.1)	1 (6)
*Pseudoterranova decipiens**	67 (94)	4.55 (10.6)	61 (206)
Anisakis sp.*	0 (4)	0 (0.04)	0 (2)
Contracaecum spp.*	30 (52)	1.16 (1.96)	20 (39)

* – Data from Admiralty Bay marked by asterisk are published for the first time; other data according to Zdzitowiecki (1986a,b, 1988), Zdzitowiecki and Rokosz (1986), Wojciechowska (1993c) and Rocka (1999)

occurred in hosts with *M. georgiana*. The smallest fish shorter than 15 cm were infected with digeneans with the prevalence 65 %, whereas larger fish specimens were 100 % infected. Two digenean species, *Neolepidapedon trematomi* Prudhoe et Bray, 1973 and *Gonocerca phycidis* Manter, 1925, reported as rare in *N. coriiceps* in the Admiralty Bay and Potter Cove (King George Island) (Zdzitowiecki, 1988; Palm *et al.*, 1998), were not found in this host at the Vernadsky Station.

Cestoda

Only three larval forms were found at the Vernadsky Station. Diphyllobothriid plerocercoids probably mainly maturing in seals occurred in cysts in the body cavity and in the stomach's wall. Tetraphyllidean metacestodes probably maturing in skates (Wojciechowska, 1993a) occurred in the lumen of intestine. All were much less numerous than in the Admiralty Bay. Diphyllobothriid plerocercoids and bilocular metacestodes (Cercoid IV of Wojciechowska, 1993a-c) represent probably mixed groups of various species. Bilocular metacestode was the dominant form, the only occurring in the smallest fishes. According to Wojciechowska (1990, 1993b) trilocular metacestode (Cercoid VI) could be identical with *Onchobothrium antarcticum* Wojciechowska, 1990. This form was rare at the Vernadsky Station and occurred there only in fish larger than 20 cm in length. One larval form, monolocular metacestode (Cercoid I), rare in the Admiralty Bay (Wojciechowska, 1993a-c) was absent in the sample from environs of the Vernadsky Station.

Acanthocephala

Acanthocephalans occurring in the Antarctic fish belong to two orders. Representatives of Echinorhynchida mature in fish and occur in the lumen of intestine, whereas Polymorphida mature in mammals and birds and occur in fishes

Table 2. Prevalence (%) and mean abundance of *Notothenia coriiceps* at the Vernadsky Station in fish belonging to six size classes

Parasites	Fish size classes (cm)					
	10.2 – 14.9 n=17	15 – 19.9 n=18	20 – 24.9 n=18	25 – 29.9 n=24	30 – 34.9 n=10	35 – 42.5 n=6
Monogenea	%	%	%	%	%	%
Pseudobenedenia nototheniae	0	6 %; 0.11	17 %; 0.33	46 %; 1.46	30 %; 1.20	17%; 3.50
Trematoda						
Macvicaria georgiana	65%; 4.41	100%; 19.44	100%; 25.50	100%; 29.50	100%; 95.10	100%; 32.67
Neolebouria antarctica	0	22%; 0.50	11%; 0.50	58%; 20.04	70%; 33.70	17%; 0.17
Lepidapedon garrardi	0	6%; 0.06	6%; 0.06	29%; 0.50	70%; 1.80	17%; 0.17
Genolinea bowersi	24%; 0.29	67%; 1.72	89%; 3.44	96%; 6.25	90%; 15.50	83%; 25.17
Elytrophalloides oatesi	18%; 0.71	33%; 0.83	61%; 2.61	58%; 3.46	70%; 5.90	50%; 2.67
Lecithaster macrocotyle	0	0	6%; 0.06	0	0	0
Cestoda						
Metacestode bilocular	71%; 3.24	39%; 1.11	83%; 8.44	92%; 10.50	70%; 14.00	100%; 117.33
Metacestode trilocular	0	0	17%; 0.28	4%; 0.08	10%; 0.10`	33%; 0.33
Diphyllobothriid plerocercoid	6%; 0.06	11%; 0.17	17%; 0.39	17%; 0.63	60%; 1.60	67%; 6.50
Acanthocephala						
Aspersentis megarhynchus	0	0	0	4%; 0.04	10%; 1.40	0
Metacanthocephalus dalmori	12%; 0.18	22%; 0.50	56%; 1.89	75%; 1.83	60%; 1..40	67%; 4.00
Metacanthocephalus johnstoni	47%; 1.71	78%; 4.22	83%; 4.61	83%; 3.58	70%; 4.90	83%; 2.16
Corynosoma hamanni	0	22%; 0.22	22%; 0.33	13%; 0.29	40%; 0.50	50%; 3.00
Corynosoma pseudohamanni	100%; 13.47	94%; 45.67	100%; 64.22	100%; 105.21	100%; 106.9(	100%; 253.00
Corynosoma bullosum	0	0	6%; 0.06	0	10%; 0.10	17%; 0.17
Corynosoma arctocephali	6%; 0.06	39%; 0.56	50%; 1.11	50%; 1.13	60%; 1.90	100%; 2.33
Corynosoma shackletoni	0	0	6%; 0.06	4%; 0.04	10%; 0.10	17%; 0.33
Nematoda						
Ascarophis nototheniae	6%; 0.06	0	0	0	10%; 0.10	0
Pseudoterranova decipiens	24%; 0.29	61%; 3.39	72%; 1.56	83%; 6.63	90%; 12.60	83%; 7.33
Contracaecum spp.	0	0	39%; 0.72	42%; 1.21	60%; 2.10	83%; 7.50

as paratenic hosts in cysts within the mesentery. Three echinorhynchid species were recognized at the Vernadsky Station. Two species of the genus *Metacanthocephalus*, *M. dalmori* Zdzitowiecki, 1983 and *M. johnstoni* Zdzitowiecki, 1983, were even a little more abundant here than in the Admiralty Bay and occurred even in small fishes. The third species, *Aspersentis megarhynchus* (Linstow, 1892), the dominant echinorhynchid species in the Admiralty Bay (according to Zdzitowiecki and Rokosz, 1986 its prevalence was 99 % and mean abundance 33.5), was extremely rare at the Vernadsky Station (prevalence 2 %). Only two host specimens of 93 examined were infected by one and 14 parasites. Two species rare in *N. coriiceps* at the South Shetland Islands including the Admiralty Bay, *Echinorhynchus petrotschenkoi* (Rodjuk, 1984) and *Heterosentis heteracanthus* (Linstow, 1896; Zdzitowiecki, 1986b; Palm *et al.*, 1998), were not found at the Vernadsky Station.

Lists of Polymorphida occurring as cystacanths in fish in both areas are identical and concern five species (Zdzitowiecki, 1986a), four maturing in seals and fur seals (Zdzitowiecki, 1984a,b), and one, *Corynosoma shackletoni* Zdzitowiecki, 1978, maturing in penguins (Zdzitowiecki, 1985; Hoberg, 1986). In all cases levels of infections were as a rule positively correlated with the host size. *C. pseudohamanni* Zdzitowiecki, 1984 was the dominant species in both areas (prevalence 99 %). This predominance was especially strong at the Vernadsky Station, where *C. pseudohamanni* was the most abundant parasite. *C. arctocephali* Zdzitowiecki, 1984 was the second species more abundant at the Vernadsky Station than in the Admiralty Bay. Remaining three acanthocephalans were more abundant in the Admiralty Bay. *C. hamanni* (Linstow, 1892) was relatively rare and *C. bullosum* (Linstow, 1892) was extremely rare at the Vernadsky Station. *C. shackletoni* was rare in the both areas.

Nematoda

Only one species maturing in fish, *Ascarophis nototheniae* Johnston et Mawson, 1945, rarely occurred in the stomach of *N. coriiceps* (Rocka, 1999) in both areas, however it was more abundant in the Admiralty Bay. Apart of it, two larval forms of Nematoda were found in fish at the Vernadsky Station in the body cavity, liver and stomach's wall. As in the case of cystacanths, levels of infections were positively correlated with the fish size and larger infections were found in the Admiralty Bay. *Pseudoterranova decipiens* (Krabbe, 1878) larvae were the most frequent. According to Palm *et al.* (1998) *Contracaecum* spp. occurring

at the South Shetland Islands belonged to two species, *C. radiatum* (Linstow, 1907) and *C. osculatum* (Rudolphi, 1802) and probably it is the same in environs of the Vernadsky Station. If these two species have been taking into account separately, the number of species of parasites occurring at the Vernadsky Station would increase to 22, and that for the Admiralty Bay to 28. *P. decipiens* and both species of the genus *Contracaecum* mature in seals. The larval form of *Anisakis* sp. was absent at the Vernadsky Station, while it was rare in *N. coriiceps* in the Admiralty Bay. This is probably mainly a parasite of whales.

Discussion

According to Palm *et al*. (1998) helminths of *N. coriiceps* were relatively widely studied compared with other fish in Antarctica. These authors reviewed most of previous data and included new material based on the examination of 50 fish caught in the Potter Cove at the King George Island. However, they neither determined all acanthocephalan cystacanths into species nor discriminated different forms of larval cestodes and adult nematodes from the alimentary tract (the latter were determined as possibly *A. nototheniae*). These data were published in studies from the Admiralty Bay (Zdzitowiecki, 1986a; Wojciechowska, 1993a-c; Rocka, 1999). On the other hand, larval nematodes (anisakids) of the genus *Contracaecum* from the Admiralty Bay and environs of the Vernadsky Station were not specifically determined, whereas it was done for the Nematoda from the Potter Cove (Palm *et al.*, 1998). Taking into account differences in the determination of parasites collected in two localities at the King George Island (Potter Cove and Admiralty Bay), it is more easily to compare parasitic fauna of *N. coriiceps* at the Vernadsky Station with that in the Admiralty Bay (Table 1). It should be noted that levels of infections with almost all parasites were smaller in the Potter Cove than in the Admiralty Bay.

The comparison between helminth fauna at the Vernadsky Station and in the Admiralty Bay is not easy because of two reasons. First, fish from the Admiralty Bay (248 specimens) had been caught during the whole year (as a rule 20 fish monthly), whereas those from the Vernadsky Station (93) were collected only in February and March. Moreover, fish differed in size. Standard length of the former was 17.8 – 44.0 (mean 31.4) cm, whereas this of the latter was 10.2 – 42.5 (mean 23.0) cm. As it is shown in the Table 2, larger fishes are as a rule more strongly infected. Especially cystacanths and larval Nematoda accumulate in fish during their whole life. This is a result of changes in feeding. Larger rock cods consume small fish together with their parasites. Actually, present authors found fish of two species, *Trematomus newnesi* and *Harpagifer antarcticus*, in the stomach of *N. coriiceps*. Some parasites in the larval stage of development could establish in predators. Therefore, the size difference could be one reason of lower infection level of relatively small rock cods at the Vernadsky Station. The lack of six rare parasites in this area could be explained either as a result of scanty fish sample or by the actual absence of some of them.

Differences between occurrence of some helminths in both areas are extremely strong. The dominant species in the Admiralty Bay is the digenean, *M. georgiana*, which uses fish as definitive hosts. Contrary to it, the dominant species at the Vernadsky Station is the acanthocephalan, *C. pseudohamanni*, using fishes as paratenic hosts. Its definitive hosts are Weddell seals, leopard seals and crabeaters (Zdzitowiecki, 1984b), all occurring in both areas studied. According to Zdzitowiecki and Presler (2001) its intermediate host is the amphipod, *Cheirimedon femoratus,* and this crustacean is extremely abundant at shores nearby the Vernadsky Station. According to present observations over 90 % of amphipods caught using traps with pieces of a meat belonged to this species. Another acanthocephalan, *C. hamanni*, is rare at the Vernadsky Station and abundant (together with *C. pseudohamanni* and *A. megarhynchus*) in the Admiralty Bay. It is probably associated with different abundance of its intermediate hosts. The definitive hosts of *C. hamanni* are Weddell seals and leopard seals occurring in both investigated areas. Probably, the southern border of distribution of *C. hamanni* is anywhere near the Vernadsky Station. Similarly, acanthocephalan *A. megarhynchus* is also dominant species in fish in a lot of localities in low Antarctica and sub-Antarctica, including Admiralty Bay, whereas absent in high Antarctica (Zdzitowiecki, 1991). The most rare acanthocephalan species at the Vernadsky Station is *C. bullosum*, which matures in elephant seals. Its biology is associated with deeper shelf environment (Zdzitowiecki, 1990; Zdzitowiecki and Presler, 2001) and its cystacanths were found in fish even in high Antarctica, in the Weddell Sea (Zdzitowiecki, 1996). Therefore, it is only rarely found in fish in shallow sub-coastal waters at the Vernadsky Station.

Two digenean species *N. antarctica* and *E. oatesi* are more abundant at the Vernadsky Station than in the Admiralty Bay and Potter Cove at the King George Island (see Zdzitowiecki, 1988 and Palm *et al.*, 1998). It seems to be associated with unknown environmental reasons, because *E. oatesi* and *Neolebouria* spp. are frequent parasites of broad spectrum of fish including *N. coriiceps*, in many areas of both low and deep Antarctica, e.g. at South Georgia (Zdzitowiecki and White, 1992a) and Adelie Land (Zdzitowiecki, 2001).

Low level of the infection with tetraphyllidean metacestodes at the Vernadsky Station is probably associated with fishing restricted to shallow waters, whereas definitive hosts of Antarctic Tetraphyllidea, skates, occur much deeper (personal observations of the first author).

High level of the infection with anisakid larvae in the Admiralty Bay is clearly associated with the presence of numerous seals and whales at the South Shetland Islands (personal observations of the first author).

Finally, differences between helminth fauna of *N. coriiceps* at the Vernadsky Station and in the Admiralty Bay could be explained as mainly a result of more southern position of the former and associated with it probable differences of fauna of invertebrate intermediate as well as vertebrate de-

finitive hosts of helminths. Additionally, they could be associated with a short period of field investigations (two months) and limitation of place of fishing to small area of shallow waters (depth 10 – 30 m) at the Vernadsky Station. Fishing on *N. coriiceps* in the Admiralty Bay was done during the whole year and at the depth up to more than 100 m.

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