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Acanthocephalan infection of inshore fishes at the South Orkney Islands

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Abstract: An examination of notothenioid fish of three species, including 23 immature *Notothenia coriiceps* Richardson, revealed seven acanthocephalan species, including two Echinorhynchida occurring in the intestine and five Polymorphida in the body cavity. Four species - *Metacanthocephalus johnstoni* Zdzitowiecki, *Corynosoma arctocephali* Zdzitowiecki, *C. pseudohamanni* Zdzitowiecki, *C. shackletoni* Zdzitowiecki - are reported for the first time from the area. Polymorphida were twice as numerous as Echinorhynchida. The dominant parasites were *Aspersentis megarhynchus* (Linstow) and *C. hamanni* (Linstow) in *Notothenia coriiceps*, and *C. bullosum* (Linstow) in *Chaenocephalus aceratus* (Lönnberg). The infection of *Notothenia coriiceps* and *Chaenocephalus aceratus* in this area was compared with these species and *Notothenia rossii* Richardson in neighbouring areas. The infection of *Notothenia coriiceps* at the South Orkney Islands is more similar to that at the South Shetland Islands than that found at South Georgia.

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Introduction

The acanthocephalan fauna of fish occurring in areas neighbouring the South Orkney Islands is well known. For example, both coastal and inshore fish at the South Shetland Islands and South Georgia have been extensively investigated by the present authors (Zdzitowiecki 1986a, 1986b, 1987, 1990b, Zdzitowiecki & Rokosz 1986, Zdzitowiecki & White 1992). Some acanthocephalan species were reported from these areas by Linstow (1892), Baylis (1929), VanCleave (1929), Hoberg (1986) and various other authors (see Zdzitowiecki 1991).

The only data previously recorded on acanthocephalans, parasites of inshore fish at the South Orkney Islands, were given by Hoogesteger & White (1981) and Szidat (1965). These authors reported the occurrence of *Rhadinorhynchus wheeleri* (= *Aspersentis megarhynchus*) in fish intestine and two species occurring in cysts in the body cavity, defined as probably *Corynosoma hamanni* and *C. bullosum*. Szidat (1965) found *Hypechinorhynchus magellanicus* in the intestine and an unidentified *Corynosoma* sp. in cysts. Earlier, Markowski (1971) reported *C. hamanni*, but data on the kind of environment (inshore or neritic) were not given. Zdzitowiecki (1987) found *Metacanthocephalus campbelli* in one open-sea fish and prepared a list of acanthocephalans occurring in fish in this area. The list includes four species mentioned above, with the exception of *H. magellanicus*. According to Zdzitowiecki (1987, 1990a, 1991), this last species occurs exclusively in the subantarctic, and reports from the Antarctic (Szidat 1965, Szidat & Graefe 1967) were based on imperfect identifications.

Materials and methods

The present authors collected parasites from 38 fish specimens caught in the coastal zone at Signy Island (South Orkney Islands). The sample is not large, but it is sufficient to prepare a list of common parasites for this area, and for the preliminary comparison with data from adjacent areas of the Scotia Arc. The infection of *Notothenia coriiceps* and *Chaenocephalus aceratus* occurring at the South Orkney Islands is compared with infections of three coastal species, *Notothenia coriiceps*, *Notothenia rossii* (immature fjord fish), and *Chaenocephalus aceratus* occurring at the South Shetland Islands and South Georgia.

All three notothenioid species were collected in Borge Bay at Signy Island (60°42'S, 45°36'W) from 20–40 m depth. All *Notothenia coriiceps* specimens (n = 23, standard length mean = 20.8 cm, range = 18–24 cm) were immature and they were typical inhabitants of the coastal zone. Three of four *Gobionotothen gibberifrons* (n = 4, standard length mean = 28.4 cm, range = 21.5–32 cm) and ten of eleven *Chaenocephalus aceratus* (n = 11, standard length mean = 50.0 cm, range = 38.5–56 cm) were mature. Specimens of both these species occur commonly in both coastal and neritic zones of the Western Antarctic. The site of the present investigations is a coastal bay rather than a fjord.

Fish were collected in January 1993. Most of them were fixed and stored in 4% formaldehyde solution and examined

Table I. Infection of coastal fish by acanthocephalans at the South Orkney Islands.

	Notothenia coriiceps			*Gobionotothen gibberifrons*			*Chaenocephalus aceratus*		
Parasites	P	I	RD	P	I	RD	P	I	RD
A. megarhynchus	100.0	6–81	27.48	-	-	-	-	-	-
*M. johnstoni**	82.6	1–11	3.35	-	-	-	-	-	-
Echinorhynchida	100.0	6–86	30.83	-	-	-	-	-	-
*C. arctocephali**	100.0	15–36	22.77	25.0	1	0.25	27.2	1–2	0.36
C. bullosum	53.8	1–4	1.23	25.0	1	0.25	90.0	2–43	10.72
C. hamanni	100.0	10–48	27.31	25.0	5	1.25	72.7	1–18	5.36
*C. pseudohamanni**	100.0	1–23	6.77	-	-	-	54.5	1–7	1.25
*C. shackletoni**	7.7	1	0.08	-	-	-	-	-	-
Polymorphida	100.0	29–101	58.15	75.0	1–5	1.75	90.9	6–68	17.72

Prevalence (P%), intensity range (I) and relative density (RD) * Species recorded for the first time at the South Orkney Islands.

nine months after collection. Fresh viscera of ten *Notothenia coriiceps* specimens were isolated, guts put into fresh water, opened and were then fixed in 4% formaldehyde solution after one hour. As a result of this procedure, parasites were relaxed and easy to examine for identification. Most cysts with juvenile acanthocephalans were lost during isolation of viscera and so numerical data for these was only possible from 13 *Notothenia coriiceps* specimens.

Fish and isolated guts were examined in fresh water using a dissecting microscope. Juvenile acanthocephalans were removed from cysts with dissecting needles. Acanthocephalans were transferred into 75% ethyl alcohol, dehydrated and cleared in oil of cloves.

Some juvenile specimens were dissected and identified mainly on the basis of proboscis armature visible inside or partly outside the proboscis receptacle isolated from a worm. Body morphology was also used for identification. Almost all acanthocephalans from the intestine had the proboscis more or less expanded and they were easily identified. A few contracted specimens were dissected. Features of all specimens fitted well with diagnoses previously published (Zdzitowiecki 1991).

Prevalence (% of hosts infected), intensity range (number of parasites in infected hosts) and relative density (mean number of acanthocephalans per host examined) were used as indices of infection.

Statistical methods are not used for comparison of infections in various areas, because the fish were not all from the same size range or maturity stage.

Results

Seven acanthocephalan species were positively identified; two are species that mature in the fish intestine (order Echinorhynchida) and five others (order Polymorphida) that mature either in seals (four species), or in birds (*C. shackletoni*), occurring in fish as paratenic hosts. Four species are reported to occur in the South Orkney Islands area for the first time (Table I). A total of 2369 acanthocephalans was collected. Indices of the infection are shown in Table I.

Polymorphida were only found in *Gobionotothen gibberifrons* and *Chaenocephalus aceratus*. The level of infection of *Gobionotothen gibberifrons* seemed to be low, but this is based on the examination of few fish. The infection of *Chaenocephalus aceratus* was low (maximum intensity 68, relative density 17.72), and *C. bullosum* (a parasite of elephant seals) was the dominant acanthocephalan species in this host (60.5% total specimens), whereas *C. hamanni* was the subdominant species.

The dominance of Polymorphida over Echinorhynchida was observed in *Notothenia coriiceps*; the relative density of Polymorphida (58.15) is almost double that of Echinorhynchida (30.83). However, representatives of both orders have been found in all specimens of this host examined. *A. megarhynchus* is the dominant acanthocephalan species (89% total echinorhynchid specimens) in *Notothenia coriiceps*. Its relative density (27.48) is practically the same as that of the most common polymorphid species, *C. hamanni* (27.31). Two parasites, *C. hamanni* and *C. pseudohamanni* are associated with leopard seals and Weddell seals (and occasionally also found in crabeater seals); of these, *C. hamanni* was approximately four times more numerous than *C. pseudohamanni*. *C. arctocephali* (a parasite of fur seals and occasionally leopard seals) is considered to be the subdominant species in *Notothenia coriiceps*. *C. bullosum* was much less numerous in *Notothenia coriiceps* than in *Chaenocephalus aceratus*. Only one specimen of *C. shackletoni* (a parasite of penguins) was found in *Notothenia coriiceps* (absent in other hosts).

Discussion

Chaenocephalus aceratus occurs commonly in both coastal and open shelf zones. Some of its parasites could be acquired in the open sea and this is the main reason for the dominance of *C. bullosum* in this host (Table II). *C. bullosum* is associated with the open-sea shelf environment and is not

Table II. Prevalence (P%) and relative density (RD) of acanthocephalans in inshore fish from three areas of the Western Antarctic.

	South Shetland Islands				South Orkney Islands		South Georgia			
	N. coriiceps adult and juv. *n* = 248		*N. rossii* juv. *n* = 50		*N. coriiceps* juv. *n* = 23		*N. coriiceps* adult *n* = 3		*N. rossii* juv. *n* = 92	
Parasites	P	RD	P	RD	P	RD	P	RD	P	RD
A. megarhynchus	99.2	33.49	100.0	34.42	100.0	27.48	100.0	18.33	92.4	13.07
H. heteracanthus	0.8	0.01	2.0	0.02	-	-	33.3	1.00	12.0	0.32
M. dalmori	27.0	1.57	34.0	0.74	-	-	-	-	-	-
M. johnstoni	57.7	1.91	90.0	12.22	82.6	3.35	100.0	33.33	95.7	30.37
E. petrotschenkoi	0.4	0.004	-	-	-	-	66.7	1.33	1.1	0.01
C. arctocephali	13.7	0.33	30.0	0.32	100.0	22.77	100.0	35.00	30.4	2.08
C. bullosum	40.7	0.81	50.0	1.00	53.8	1.23	66.7	3.00	6.5	0.10
C. hamanni	96.3	24.31	100.0	40.10	100.0	27.31	33.3	6.67	46.7	0.95
C. pseudohamanni	99.6	36.21	100.0	29.82	100.0	6.77	-	-	-	-
C. shackletoni	8.9	0.11	8.0	0.10	7.7	0.08	100.0	9.27	22.8	0.62
A. baylisi	-	-	-	-	-	-	100.0	2.67	12.0	0.23

numerous in fish found in inshore habitats (Zdzitowiecki 1990b, Zdzitowiecki & White 1992). All other acanthocephalans presently found are associated with the coastal zone. Comparison of *Chaenocephalus aceratus* infection by acathocephalans indicates that fjord fish from the South Shetland Islands have the greatest diversity of parasite species (Table III).

The occurrence of acanthocephalans in coastal (fjord) fish from the South Shetland Islands and South Georgia was previously investigated by the present authors (Zdzitowiecki & White 1992). The infection of *Notothenia coriiceps* and *Notothenia rossii* (immature fjord fish) at Admiralty Bay, South Shetland Islands was most similar to *Notothenia coriiceps* at Signy Island. Data for *Notothenia coriiceps* occurring at South Georgia were few (only three host specimens are shown in comparison with the present data from the South Orkney Islands area (Table II)).

Eleven acanthocephalan species, five echinorhynchids and six polymorphids, occur in *Notothenia coriiceps* and *Notothenia rossii*. Two echinorhynchids, *Heterosentis heteracanthus* and *Echinorhynchus petrotschenkoi* (the latter is an abundant parasite of some fish living in the neritic zone), occur only rarely in inshore fish at the South Shetland Islands and more commonly at South Georgia. They were not collected during the present investigation, probably because of the small number of fish examined. *Metacanthocephalus dalmori* is abundant (but in fish other than *Notothenia coriiceps* and *Notothenia rossii*) at the South Shetland Islands and rare at South Georgia. Out of two echinorhynchids presently found, *A. megarhynchus* is the dominant species at the South Shetland Islands and South Orkney Islands, while much less numerous at South Georgia. The converse situation is observed for *M. johnstoni*, the dominant species at South Georgia but much less numerous in both other areas. Thus, the echinorhynchid fauna of fish of the coastal zone at the South Orkney Islands is much more similar to that at the South Shetland Islands than to that at South Georgia.

The same is true for polymorphids. The polymorphid fauna of the South Shetland Islands and South Orkney Islands and the region extending from the Gerlache Strait to

Table III. Prevalence (P%) and relative density (RD) of acanthocephalans in *Chaenocephalus aceratus* at three areas of the Western Antarctic.

	South Shetland Islands				South Orkney Islands		South Georgia	
	Open sea *n* = 13		Admiralty Bay *n* = 20		Borge Bay *n* = 11		Open sea *n* = 23	
Parasites	P	RD	P	RD	P	RD	P	RD
A. megarhynchus	-	-	45.0	5.15	-	-	-	-
M. dalmori	-	-	55.0	3.65	-	-	-	-
C. arctocephali	23.1	0.92	45.0	0.85	27.2	0.36	13.0	0.17
C. bullosum	84.6	66.69	100.0	34.85	90.9	10.72	60.9	6.09
C. hamanni	23.1	9.15	85.0	20.80	72.7	5.36	-	-
C. pseudohamanni	53.8	9.46	100.0	59.05	54.5	1.27	-	-
C. shackletoni	-	-	40.0	1.00	-	-	4.3	0.04
A. baylisi	-	-	-	-	-	-	4.3	0.04

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Anvers Island consists of the same five species. In general, most indices of infection are similar although distributional trends can be seen among species. An important difference is in the occurrence of *C. arctocephali*, which is a relatively rare species at the South Shetland Islands and common at the South Orkney Islands and South Georgia. The gradual increase in the incidence of *C. pseudohamanni* in fish at more southerly locations is observed. This species is absent at South Georgia, less numerous than *C. hamanni* at the South Orkney Islands, and of similar abundance to *C. hamanni* at the South Shetland Islands (more numerous in some host species there). According to Hoberg (1986), *C. pseudohamanni* is much more abundant than *C. hamanni* in a region extending south along the Antarctic Peninsula from the southern Bransfield Strait to Anvers Island. The senior author examined some fish caught in the Ross Sea and Davis Sea; *C. pseudohamanni* was the only polymorphid species found there (unpublished data). Among polymorphids maturing in birds, only *C. shackletoni* occurred, albeit rarely, at the South Shetland Islands and South Orkney Islands. This species is more abundant in fish at South Georgia, with a second species, *Andracantha baylisi* (a parasite of cormorants).

Finally, the dominance of polymorphids over echinorhynchids is observed in fish at the South Shetland Islands and South Orkney islands, whereas the reverse level of dominance is found at South Georgia.

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