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Occurrence of acanthocephalans in notothenioid fishes in the Beagle Channel (Magellanic sub-region, sub-Antarctic)

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Abstract: 104 specimens of notothenioid fishes of five species (*Patagonotothen longipes*, *P. tessellata*, *Champsocephalus esox*, *Cottoperca trigloides* and *Patagonotothen brevicauda*) caught at two sites in the Beagle Channel (Magellanic sub-region, sub-Antarctica) were examined for the presence of thorny-headed worms (Acanthocephala). Representatives of three fish species, *Patagonotothen longipes*, *P. tessellata*, and *Champsocephalus esox*, were infected. Fishes caught at the eastern mouth of the channel were infected with 180 echinorhynchids representing three species, *Aspersentis johni* (the most numerous species), *Heterosentis heteracanthus*, and *Hypoechinorhynchus magellanicus*, and only 12 cystacanths of four polymorphids, *Andracantha baylisi*, *Corynosoma* sp., *Corynosoma beaglense*, and *Corynosoma evae*. *Patagonotothen longipes* was the most highly infected in the eastern mouth of the channel (prevalence 85%, maximum intensity 26). *Aspersentis johni* was the dominant parasite species in this host (prevalence 85%, mean abundance 4.00, maximum intensity 18) and *H. heteracanthus* was the sub-dominant one (prevalence 50%, mean abundance 2.60, maximum intensity 25). The infections of *C. esox* were the most diverse (six parasite species – three echinorhynchids and three polymorphids). Fish caught near the city of Ushuaia were infected only with six cystacanths of *C. evae* (intensity one). Taking into account the whole sample, *C. evae* was the most abundant polymorphid, represented by 10 of 18 specimens found. Three species, *H. heteracanthus*, *A. baylisi* and *C. evae*, have been previously reported from the low western Antarctic (*H. heteracanthus* also from the Kerguelen sub-region of sub-Antarctic), remaining four species seem to be endemics of the Magellanic sub-region of sub-Antarctic.

Key words: Sub-Antarctic, Beagle Channel, Acanthocephala, notothenioid fishes.

Introduction

Representatives of two orders of Palaeacanthocephala occur in notothenioid fishes (Zdzitowiecki 1991). Echinorhynchida use fish as definitive hosts and occur in the lumen of the alimentary tract (normally intestine). The same fish play a role as

paratenic hosts of Polymorphida localized in cysts in the body cavity. Fish become infected by feeding on intermediate hosts, crustaceans or, in cases of Polymorphida, also small infected fishes. Crustaceans of the order Amphipoda have been recorded as intermediate hosts of one echinorhynchid species, *Aspersentis megarhynchus* (Linstow, 1892) and three polymorphids, *Corynosoma bullosum* (Linstow, 1892), *C. hamanni* (Linstow, 1892) and *C. pseudohamanni* Zdzitowiecki, 1984, in the Antarctic (Hoberg 1986, Zdzitowiecki 2001, Zdzitowiecki and Presler 2001). Ultimate hosts of Antarctic polymorphids are marine mammals and birds.

Fish of the super-family Notothenioidei are endemics of the Antarctic and sub-Antarctic (Gon and Heemstra 1990). Many Antarctic species have been examined for the presence of Acanthocephala, but only one species, *Eleginops maclovinus* (Cuvier *et* Valenciennes, 1830), was examined in the Beagle Channel (Szidat 1950). One echinorhynchid species, *Hypoechinorhynchus magellanicus* Szidat, 1950, and undetermined cystacanths (*Corynosoma* sp.) were recorded. The present authors examined over 100 notothenioid fish of five species (*Patagonotothen longipes*, *P. tessellata*, *Champsocephalus esox, Cottoperca trigloides* and *Patagonotothen brevicauda*) caught in the Beagle Channel (Magellanic sub-region, sub-Antarctic) during the Seventh Ukrainian Antarctic Expedition in January and March 2002 and have collected parasitic worms including acanthocephalans. Descriptions of two echinorhynchids, *Aspersentis johni* (Baylis, 1929) and *Hypoechinorhynchus magellanicus*, and four cystacanths of polymorphids, *Andracantha baylisi* (Zdzitowiecki, 1986), *Corynosoma* sp., *Corynosoma beaglense* Laskowski, Jeżewski et Zdzitowiecki, 2008 and *C. evae* Zdzitowiecki, 1984, have been published (Laskowski and Zdzitowiecki 2004, 2008, Laskowski *et al*. 2008).

The present paper contains faunistic data on these species as well as on one additional echinorhynchid species, *Heterosentis heteracanthus* (Linstow 1896). This species occurs in the Antarctic and sub-Antarctic (Linstow 1896; Meyer 1931; Van Cleave 1931; Zdzitowiecki 1984a, 1990b; Zdzitowiecki and White 1992; Zdzitowiecki and Pisano 1996).

Material and methods

In total, 104 fish of five notothenioid species were examined (Table 1). They were caught with fishing rods in two sites, at the eastern mouth of the Beagle Channel (54˚59'S, 66°45'W; depth 30 m) and in the city of Ushuaia (54°49'S, 68°18'W; depth 7–9 m). Examinations of fresh fish were carried out using a dissecting microscope. Cystacanths were liberated from cysts using a digestive water solution (1% of pepsin, 0.4% of HCl). Almost all acanthocephalans were relaxed in fresh water and fixed and stored in 75% ethanol. All cystacanths and a part of adult specimens collected from the intestines were dehydrated in graded ethanol and cleared either in creosote or in benzyl alcohol without staining. Determina-

Table 1

A list, including standard length (SL) in cm, of notothenioid fishes examined for the presence of acanthocephalans in the eastern mouth of the Beagle Channel (EM) and in Ushuaia (U)

Host	Place	*n*	SL range (mean)
Bovichtidae			
Cottoperca trigloides (Forster, 1801)	EM	4	10.2–19.8 (14.4)
Nototheniidae			
Patagonotothen brevicauda (Lönnberg, 1905)	EM	1	13.2
	U	6	9.0–10.7 (9.6)
Patagonotothen longipes (Steindachner, 1876)	EM	20	13.2–20.0 (16.2)
	U	20	12.0–22.8 (17.0)
Patagonotothen tessellata (Richardson, 1845)	EM	20	13.3–20.8 (16.7)
	U	13	8.4–17.2 (13.0)
Channichthyidae			
Champsocephalus esox (Günther, 1861)	EM	20	23.5–35.0 (27.1)

tions of cleared specimens were done on temporary total mounts in clearing solution using a compound microscope Olympus BX50. Uncleared specimens, examined under a dissecting microscope and a compound microscope, were found to belong to the same species. Voucher specimens have been deposited in the Natural History Museum in London (BMNH) (Table 2). Three indices of infection, namely prevalence (percentage of infection), mean abundance (number of parasites per number of hosts examined), and intensity range, are given separately for each host/parasite relation and the collection site (Table 2).

Results

Data on the infection of fish in both places are shown in the Table 2. In total, 198 individuals of acanthocephalans, including 180 echinorhynchids occurring mainly in the large intestine and sometimes in the posterior part of the small intestine, and only 18 cystacanths of polymorphids normally occurring in cysts in the body cavity (one specimen of *C. evae* in the stomach), were found. Out of five fish species examined, two, *C. trigloides* and *P. brevicauda*, were not infected.

Echinorhynchids were absent from Ushuaia and present in three host species, *P. longipes*, *P. tessellata*, and *C. esox*, at the eastern mouth of the Beagle Channel. *Patagonotothen longipes* was the most highly infected (prevalence 85%, maximum intensity 26) with two parasite species, of which *A. johni* was the dominant species (prevalence 85%) and *H. heteracanthus* the sub-dominant one (prevalence 50%). The infection of *C. esox* was lower (prevalence 30%, maximum intensity 9), but more diverse (three species of parasites). It was the only host of *H. magella-*

Table 2

Infection with Acanthocephala of three notothenioid fish species in the Beagle Channel (eastern mouth) (EM) and in Ushuaia (U). P – prevalence, MA – mean abundance, IR – intensity range.

Parasite	Voucher specimen numbers	Place	Host	P %	MA	IR
Echinorhynchida						
Aspersentis johni	BMNH 2004.1.29.1–11	EM	*P. longipes*	85	4.00	1–18
		EM	*C. esox*	25	0.60	1–4
Heterosentis heteracanthus	BMNH 2007.2.21.13–16	EM	*P. longipes*	50	2.60	1–25
		EM	*P. tessellata*	15	1.35	1–17
		EM	*C. esox*	10	0.10	1
Hypoechinorhynchus magellanicus		EM	*C. esox*	5	0.35	7
Polymorphida						
Andracantha baylisi	BMNH 2007.10.15.6–7	EM	*P. longipes*	5	0.05	1
		EM	*C. esox*	10	0.15	1–2
Corynosoma sp.	BMNH 2007.10.15.1	EM	*P. tessellata*	5	0.05	1
Corynosoma beaglense	BMNH 2007.10.15.4–5	EM	*C. esox*	15	0.15	1
Corynosoma evae	BMNH 2007.10.15.2–3	EM	*P. longipes*	10	0.10	1
		U	*P. longipes*	30	0.30	1
		EM	*C. esox*	10	0.10	1

nicus. Only one echinorhynchid species, *H. heteracanthus*, was found in *P. tessellata* (prevalence 15%). However, the maximum intensity (17) was only a little lower than in the case of *P. longipes*.

Cystacanths of Polymorphida were relatively rare (maximum intensity 4 in the case of one *C. esox*). *C. esox* was the host of three of four polymorphid species, with total prevalence of 25% and the only host of *C. beaglense*. Only one specimen of *A. baylisi* and two *C. evae* in *P. longipes* and one *Corynosoma* sp. in *P. tessellata* (the only host) were found in the eastern mouth of the Beagle Channel.

Patagonotothen tessellata caught in Ushuaia (13 specimens) were free of Acanthocephala. Only *P. longipes* were infected in this place with one acanthocephalan species, *C. evae.* The prevalence was relatively high (30%), but intensity low (invariably one). Taking into account the combined infection parameters from both sites, *C. evae* was the most abundant, as 10 of 18 specimens (55.56%) belonged to this species.

Discussion

Of five fish species examined, three were infected and two uninfected. However, samples of three infected fishes, *P. longipes*, *P. tessellata*, and *C. esox*, were

larger (40, 33 and 20 specimens respectively) than samples of the uninfected fishes, *C. trigloides* and *P. brevicauda* (4 and 7, respectively). Thus, the lack of infection of two species could be a result of small numbers of fish examined.

Of three echinorhynchids, the most abundant was *A. johni* which, in the Beagle Channel, replaced *A. megarhynchus* recorded in many notothenioid species in the low Antarctic and in the Kerguelen sub-region of the sub-Antarctic (*e.g.*, Zdzitowiecki 1991). However, the infection with *A. johni* in the Beagle Channel was lower than the infection with *A. austrinus* Van Cleave, 1929 (= *A. megarhynchus*) of *Notothenia coriiceps* and *N. rossii* in the Admiralty Bay (South Shetland Islands, Antarctica) (Zdzitowiecki and Rokosz 1986).

H. heteracanthus is rather rare in the low Antarctic (Zdzitowiecki 1991). According to the present data it is mainly a sub-Antarctic species occurring also in the Kerguelen sub-region (Zdzitowiecki and Pisano 1996). Notothenioids seem to be its main definitive hosts.

According to Szidat (1950), *H. magellanicus* was an abundant parasite of the notothenioid fish *Eleginops maclovinus* at the same locality as the present investigation. This host was not available to the present authors and this parasite was found only in one host specimen (*C. esox*). Probably, *E. maclovinus* is the main host and infection of *C. esox* was occasional. Previous reports on the presence of this species in Antarctic fishes (Szidat 1965; Szidat and Graefe 1967) were based on incorrect determinations (Zdzitowiecki 1990a). The report from the Kerguelen sub-region (Parukhin 1989) needs confirmation, because morphological data are lacking and *H. heteracanthus* was found in this area (see above).

Infection of fish in the Beagle Channel with cystacanths of Polymorphida was very low, many times lower than that of fish in Admiralty Bay (Zdzitowiecki 1986a), in fjords of South Georgia (Zdzitowiecki and White 1992) and at Galindez Island (Argentine Islands) (Zdzitowiecki and Laskowski 2004, Laskowski and Zdzitowiecki 2005). The most numerous *C. evae* was originally described based on specimens from the ultimate host, one male leopard seal, *Hydrurga leptonyx* (cf. Zdzitowiecki 1984b). It was also recorded in the fur seal, *Otaria flavescens*, at the Falkland Islands (Zdzitowiecki 1986b) and in Uruguay (Aznar *et al.* 2006). One cystacanth was recognized in a fish at South Georgia (Zdzitowiecki 1984b). Representatives of another species, *C. australe* Johnston, 1937, were found in the same leopard seal specimen (Zdzitowiecki 1984b). Occurrence of cystacanths of this species was reported from various teleost fishes in Atlantic and Pacific sub-coastal waters around South America off Peru, Chile, Argentina, Uruguay, and Brazil (Vergara and George-Nascimento 1982; Zdzitowiecki 1989; Tanzola *et al.* 1997; Oliva 1999; Alves and Luque 2001; González *et al.* 2001; and others). Surprisingly, *C. australe* was also found in elasmobranch fishes (Knoff *et al.* 2001). Further records on the occurrence of this species in definitive hosts at South America (Morini and Boero 1960; Aznar *et al.* 2004; and others) and near Australia (Johnston 1937, Johnston and Edmonds 1953 and others) have been published.

These data indicate that *C. australe* occurs mainly in the temperate zone of the southern hemisphere, whereas *C. evae* occurs mainly in the sub-Antarctic zone. A male specimen of the leopard seal examined on the South Shetland Islands acquired both parasites during the voyage from the Antarctic to sub-Antarctic regions and possibly temperate zones.

All remaining cystacanths probably belong to species specific for birds as definitive hosts. Adult *A. baylisi* were recorded in the sheathbill, *Chionis alba*, at the South Shetland Islands (Zdzitowiecki 1985) and in the cormorant, *Phalacrocorax albiventer*, in Patagonia (Zdzitowiecki 1986c). Some cystacanths were found in fish at South Georgia (Zdzitowiecki 1989, 1990b, Zdzitowiecki and White 1992). Two other species presently found, *Corynosoma* sp. and *C. beaglense*, were described during the present investigations for the first time (Laskowski *et al*. 2008). Adult specimens and, as a consequence, the definitive hosts are not known. However, the body shape (trunk not divided into two parts), proboscis shape (maximum width at the half length) and arrangement of proboscis armature (number of basal hooks only a little lower than that of rooted large hooks) of both species mentioned are similar to such parasites of birds like *A. baylisi*, *Corynosoma tunitae* (Weiss, 1914) (cf. Zdzitowiecki 1986c) and *C. clavatum* Goss, 1940 (Johnston and Edmonds 1953).

None of the acanthocephalan species abundant in Antarctic fishes (Zdzitowiecki 1991), were found in the Beagle Channel. However, three of seven species presently recognized, *H. heteracanthus*, *C. evae*, and *A. baylisi*, have been recorded in northern part of the Southern Ocean, mainly at South Georgia. This area seems to occupy the intermediate position between the western Antarctic and Magellanic sub-region of sub-Antarctic.

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