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# The occurrence of *Corynosoma strumosum* in the grey seal, *Halichoerus grypus*, caught off the Atlantic coast of Ireland

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## Abstract

The occurrence, location and sex ratio of *Corynosoma strumosum* (Acanthocephala: Polymorphidae) from 26 juvenile grey seals, *Halichoerus grypus*, by-caught from around the Inishkea Islands, Co. Mayo, from March to June 1997 were recorded. The location of *C. strumosum* within the seal did not vary, with all worms being found in the small intestine. The prevalence of infection was 100%, with no other acanthocephalan species being recorded. The mean abundance was 416 (range 80–846) *C. strumosum* per seal. There was no significant change in abundance by month. The sex ratio of mature female to mature male parasites was 1.2:1. The lengths of female and male worms did not differ significantly.

## Introduction

*Corynosoma strumosum* is an intestinal parasite of Pinnipedia, Cetacea and, to a lesser extent, birds of the marine environment (Margolis, 1958). *Corynosoma strumosum* (Rudolphi, 1802) is one of the commonest species of Acanthocephala, infecting fish of the Atlantic (Grabda, 1991). In Atlantic waters, cod (*Gadus morhua*) and herring (*Clupea harengus*) act as paratenic hosts enabling the parasites to pass from the first intermediate host, usually crustaceans, to seals, the final host (Grabda, 1991).

*Corynosoma* larvae are not usually abundant in fish paratenic hosts, however, the crustacean intermediate host can be killed by exposure to large numbers of larval stages and there is no evidence of natural or acquired immunity (Crompton, 1964). Adult *Corynosoma* can exist in high numbers in the seal intestine (Delyamure *et al.*, 1976).

The aim of the present study is to record the prevalence, abundance and sex ratio of *Corynosoma strumosum* in the grey seal in Irish Atlantic waters.

## Materials and methods

During the spring cod fishery of 1997, 26 juvenile seals (13 male and 13 female) were by-caught and recovered from fishing grounds off the north-west coast of Ireland. The Inishkea Islands (54° 04′–13′N, 10° 07′–15′W), situated less than 30 km from these fishing grounds, are known to have an associate all age population of 850–1035 grey seals throughout the year (P. Coulahan, unpublished observation).

The length (standard and curvilinear), axiliary girth and sternal blubber depth of each seal was recorded (Bonner & Laws, 1993). Animals were weighed using a Salter spring balance. The life stage of each seal was determined by body weight, where a seal under 70 kg in weight was considered juvenile and generally less than two years old (Fedak & Anderson, 1982; Anderson & Fedak, 1985). The condition was calculated using girth/length multiplied by 100 (Smith, 1987; Onderka, 1989). The sex of the seal was recorded.

The intestines were ligated at the pyloric sphincter and on the rectum before the anal opening. The intestines were removed, and frozen at −18°C for later dissection and then thawed prior to removal of parasites. The mean length (± sd) of the entire intestine (from duodenum to rectum) was 19.9 m (± 1.8 m) therefore, it was necessary to cut the intestine into several strips each approximately 2 m in length. Each strip was cut along its length while water was passed over its inner surface. Parasites were flushed onto a nest of three sieves of varying mesh size (2 mm, 1 mm and 0.5 mm respectively; Endecotts Laboratory test sieves) (Claussen *et al.*, 1991). Each portion of intestine was visually inspected for parasites embedded in the intestine wall. Parasites were fixed in 70% ethanol for later identification (Brown *et al.*, 1986).

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Each parasite in each sample was counted manually. Parasites were examined using a compound microscope (Olympus CH-2, 10–40×) and identified to species (Delyamure, 1955; Yamaguti, 1963). Random sub-samples of 10% of parasites from each intestine were sexed, staged and had their lengths measured. Parasites were placed in Petri dishes containing lactophenol (B.D.H. Laboratories) and allowed to clear. Parasites were examined as wet mounts in the clearing agent (Gibson, 1984) using a compound microscope. Mature females were recorded based on the presence of immature and shelled acanthors. The identification of males was based on the presence of sperm balls. Parasite body length was measured to an accuracy of 0.1 mm (Helle & Valtonen, 1980).

The terminology of infection follows that of Bush *et al.* (1997). Data on parasitic abundance were $\log_{10}$ transformed. Analysis of covariance (ANCOVA) was used to determine any relationship between sex and condition of the host seal and intensity of infection. One way analysis of variance (ANOVA) ($\alpha = 0.05$) was used to assess differences in *C. strumosum* abundance per month. Scheffe's tests were conducted on the means. Students t-tests were used to assess differences in condition and parasite intensity between male and female seals and to determine differences in the length of male and female, and between immature and mature *C. strumosum*.

## Results

*Corynosoma strumosum* was the only acanthocephalan species found in the intestine of the grey seal. The nematode species, *Pseudoterranova decipiens* and *Anisakis simplex* both had a prevalence of 69% in the intestine (range 0–35 and 0–12 respectively) of the grey seals (n = 26) while *Contracaecum osculatum* had a prevalence of 7.7% (range 0–2). Cestodes and digeneans were not found.

*Corynosoma strumosum* was confined to the small intestine; first seen approximately 1.5 m into the duodenum. A total of 10,806 worms were removed from the seals. The prevalence of *C. strumosum* was 100%, and it was the only acanthocephalan found in the intestine of the grey seal. The mean abundance was 416 (range 80–846) parasites per seal. Male seals had a higher mean abundance of *C. strumosum* (470 ± 238.1) than female seals (361 ± 154.6), however the difference was not significant (Students t-test, $t = 1.38$, $P > 0.05$). There was no significant relationship between the condition and sex of the host seal and parasitic intensity (ANCOVA, $F = 1.13$, $P > 0.05$).

Seals were caught from March to June 1997 (table 1). The mean abundance of *C. strumosum* did not change significantly by month (ANOVA, $F = 1.78$, $P > 0.05$).

The mean weight of seals caught during this study was 36.6 (± 13.03) kg; therefore it was assumed that they were in their first year (Fedak & Anderson, 1982; Anderson & Fedak, 1985). In the present study there was no significant difference in the mean condition of male and female seals (Students t-test, $t = 1.33$, $P > 0.05$).

The sex ratio of mature male to mature female *C. strumosum* was found to be 1:1.2. Immature worms accounted for approximately 12% of the sample. The length of 1137 *C. strumosum* was recorded, but there was no significant difference in the mean length (± sd) of female (6.0 ± 0.55 mm) and male (5.9 ± 0.49 mm) (Students t-test, $t = 1.36$, $P > 0.05$). Mature worms were significantly longer than immature worms (4.9 ± 0.43 mm) (Students t-test, $t = 29.3$, $P < 0.01$).

Table 1. Number of grey seals by-caught per month off the north-west Atlantic coast of Ireland during the cod (*Gadus morhua*) fishery of 1997, and the mean abundance (± sd) of *Corynosoma strumosum* recorded in the intestine.

| Month | No. of seals | Mean abundance (± sd) of *C. strumosum* | Range |
|---|---|---|---|
| March | 6 | 379 (± 90.9) | 257–501 |
| April | 9 | 397 (± 158.7) | 145–604 |
| May | 9 | 497 (± 288.0) | 80–846 |
| June | 2 | 244 (± 75.0) | 191–297 |

## Discussion

*Corynosoma strumosum* was the most frequently occurring helminth in the intestine of the grey seal; *C. semerme* was not found. Helle & Valtonen (1981, 1988) suggested that differences in the relative abundance of these acanthocephalan species in ringed seals (*Phoca hispida*) were due to feeding habits; either as a result of a different species ratio in the intermediate fish host (Helle & Valtonen, 1981), or the increased endurance of *C. strumosum* during the seals' fasting period (Helle & Valtonen, 1988).

Grey seals are known to undergo a period of total or partial fasting during the moulting season (December to March) (Boness & James, 1979) which may have affected the abundance of the acanthocephalan species. Helle & Valtonen (1980) suggested that variation in the number of *Corynosoma* may have been attributable to differences in prevalence and intensity of infection in different food items. Cod (*G. morhua*) and herring (*C. harengus*) are cited as paratenic hosts of *C. strumosum* in Atlantic waters (Grabda, 1991). Continuing dietary analysis of grey seal from the west coast of Ireland has revealed that cod and herring account for approximately 7% of the seal diet (R. Arnett, personal communication), although studies on the parasite fauna of fish from the sampling area did not record the presence of any acanthocephalan, cestode or digenean species (G. O'Neill, unpublished observation).

A mean of 416.0 *C. strumosum* per host seems to be relatively high for Irish grey seals; Neville (1984) recorded a mean intensity of 43.0 *C. strumosum* in grey seals (n = 3) from the east coast of Ireland. Helle & Valtonen (1981) recorded a mean intensity of 76.0 (range 9–313) and 66.0 (range 1–342) *C. strumosum* in Baltic ringed seals (*Phoca hispida*) sampled during the spring and autumn, respectively. The same study recorded a mean intensity of 504.0 (range 90–1698) *C. semerme* sampled in the spring (Helle & Valtonen, 1981).

Studies on nematodes in seals have shown that male seals, being larger, eat more than female seals and therefore are exposed to greater numbers of parasites and as a consequence carry heavier burdens (Stobo & Beck,

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1985). Assuming that a similar trend is seen in acanthocephalans, we would expect male seals to have a higher mean intensity than female seals. This was not observed in the present study, neither was any significant difference in the condition of male and female seals recorded.

Acanthocephalans are likely to induce pathological changes to the definitive host as the proboscis penetrates deeply into the gut wall (Williams & Jones, 1994). *Corynosoma strumosum* has been implicated in serious outbreaks of disease among farmed mink (*Mustela vison*) in Finland (Nuorteva, 1966), with symptoms including bloody diarrhoea and anaemia. Laws (1953) reported a southern elephant seal (*Mironga leonina*) with its intestine almost blocked by a tumour induced by *C. strumosum*. Baker (1980) also reported ulceration associated with heavy infections, but no such gross pathology was noted in the present study.

Bergman & Olsson (1984) hypothesized that only sick animals are caught and drowned in fishing gear. In the present study, only parasitized seals were by-caught suggesting that seals had to scavenge fish as they could not forage efficiently (Holmes & Zohar, 1990). However, Helle & Valtonen (1988) recorded a prevalence of 100% *C. strumosum* infection in ringed seals, which had been shot or caught in seal nets.

Mature parasites accounted for 78% of the total sample in this study. Valtonen (1980) suggested that a high proportion of male and immature female worms indicated a new infection with *Corynosoma*. The number of males is known to decrease during the course of infection (Helle & Valtonen, 1980).

Crompton (1985) reported that hosts of acanthocephalans not only frequently have female biased sex ratios but also a pronounced sexual dimorphism. Helle & Valtonen (1980) found that females of *C. strumosum* were longer than male worms, but the present study found no significant difference in the length of female and male *C. strumosum*.

Results of the present study leave a sizeable gap in the knowledge and understanding of the dynamics of acanthocephalan populations of grey seals from Irish waters, therefore obtaining a larger sample of grey seals of various ages examined at various times of the year would perhaps give a better understanding of the dynamics of acanthocephalan parasite populations.

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