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**Research Note**

**First Record of *Alcataenia larina larina* (Cestoda: Dilepididae) in Atlantic Puffins (Aves, Alcidae, *Fratercula arctica*) from Newfoundland, Canada**

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**ABSTRACT:** The tapeworm *Alcataenia larina* (Cestoda: Cyclophyllidae: Dilepididae) is a parasite of gulls (Laridae) with a Holarctic distribution in oceanic and littoral habitats. Two subspecies *Alcataenia larina pacifica* and *Alcataenia larina larina* are recognized with the former occurring in the North Pacific basin and the latter in the North Atlantic. Alcids serve as incidental hosts for both species and infections are generally rare, usually involving few specimens. We report *A. l. larina* in Atlantic puffins (*Fratercula arctica*) collected from the Bay of Exploits, Newfoundland. The 14 strobilate and early gravid specimens were clearly distinguishable from the closely related *Alcataenia cerorhincae* and *Alcataenia fraterculae* by the smaller dimensions of the rostellar hooks and cirrus sac. Increasing numbers of gulls around seabird colonies in Newfoundland may result in more frequent contact between gulls and alcids, such as puffins (during foraging), promoting cross infections of *A. l. larina*.

**KEY WORDS:** *Alcataenia larina larina*, *Alcataenia larina pacifica*, herring gull, *Larus argentatus*, Atlantic puffin, *Fratercula arctica*, host record.

Cestodes of the genus *Alcataenia* (Cestoda: Cyclophyllidae: Dilepididae) are parasites of seabirds belonging to the avian family Alcidae (8 species) and Laridae (2 species) (Hoberg, 1986). *Alcataenia larina* (Krabbe 1869) is a parasite of gulls and has a Holarctic distribution extending across high-latitude seas (Hoberg, 1984, 1986). Baer (1956) suggested that *A. larina* represented 2 subspecies and that specimens from the North Atlantic could be clearly differentiated from those of North Pacific origin. This led to the erection of the subspecies *Alcataenia larina pacifica* Hoberg, 1984 from the North Pacific and *Alcataenia larina larina* from the North Atlantic based on differences in the dimensions of cirrus sac, number of testes, as well as variations in the other morphological characters (Hoberg 1984). These putative subspecies represent independent sister-lineages that are disjunct and geographically isolated, and as

such, justification may exist to elevate these to the status of separate species (Hoberg, 1984, 2006; Hoberg, unpublished data); that decision is beyond the scope of the current study.

*Alcataenia larina pacifica* has been reported parasitizing black-legged kittiwakes (*Rissa tridactyla pollicaris*), red-legged kittiwakes (*Rissa brevirostris*), glaucous-winged gulls (*Larus glaucescens*), and northern fulmars (*Fulmarus glacialis*) and as incidental parasites in crested auklets (*Aethia cristatella*), whiskered auklets (*Aethia pygmaea*) and ancient murrelets (*Synthliboramphus antiquus*). Its North Atlantic counterpart, *A. l. larina*, parasitizes black-legged kittiwakes (*R. tridactyla*), herring gulls (*Larus argentatus*), and great black-backed gulls (*Larus marinus*) (Threlfall, 1968) and has been reported as an incidental parasite in black guillemots (*Cephus grylle*) among the alcids. Adult tapeworms are located in the duodenum and are capable of causing lesions (Hoberg, 1984).

We collected tapeworms as part of an ongoing study of the parasites of auks and gulls. Seven of 14 juvenile Atlantic puffins (*Fratercula arctica*) confiscated from hunters and collected at Bay of Exploits, Newfoundland (23 October 2004; 49°25'N; 55°05'W) revealed 14 strobilate and early gravid specimens of *A. l. larina* (prevalence, 50%; intensity, 1; range 1–5); this constitutes the first host record from an Atlantic alcid. Identification was based on comparisons and data from representative specimens in puffins (U.S. National Parasite Collection Accession number 097603), the type specimens of *A. l. pacifica* (USNPC 77655-77657), *Alcataenia cerorhincae* Hoberg, 1984 (USNPC 77652-77654), and *Alcataenia fraterculae* Hoberg, 1984 (USNPC 77648-77651), and vouchers collected by J. Baer of *A. l. larina* held in the Muséum d'Histoire Naturelle, Geneva.

*Alcataenia larina* is part of complex of species that are characterized by large rostellar hooks (Hoberg, 1984, 1986). Within this assemblage, specimens of *A. larina* can be distinguished by mean length of

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rostellar hooks ( $\bar{x}$  = 101–107  $\mu\text{m}$  for respective subspecies) relative to *A. cerorhincae* in *Cerorhinca monocerata* ( $\bar{x}$  = 108) and *A. fraterculae* in *Fratercula corniculata* ( $\bar{x}$  = 125) from the North Pacific (Hoberg, 1984). Current data indicate that *A. fraterculae* does not occur in Atlantic puffins, and specimens of *A. l. larina* from Newfoundland are clearly differentiated by dimensions of the rostellar hooks and a significantly smaller cirrus sac, which does not exceed 200  $\mu\text{m}$  in length. The subspecies of *A. larina* are separated by differences in the dimensions of the rostellar hooks, cirrus sac, and vitelline gland (Hoberg, 1984).

Studies within this assemblage of *Alcataenia* have indicated that some species may occur in a wider array of marine birds, including larids, alcids, and procellariiformes in sympatry or geographic proximity. In contrast with the current study, infections with species of the *A. larina* group, in what might be termed incidental avian hosts, have involved immature tapeworms represented by astrobilate worms or apparently recently evaginated cysticercoids (Hoberg, 1984). Mature or gravid specimens of *A. larina* have not been found among alcid hosts in either the North Atlantic or North Pacific basins. Additionally, prior reports among alcids in the North Atlantic are rare, and only black guillemots in the Barents Sea have been recognized as a host, although extensive surveys have been conducted in some regions (e.g., Belopol'skaia, 1952; Thelfall, 1971). The occurrence of *A. l. larina* in Atlantic puffins, however, is not surprising and could be linked with host foraging strategies. Large numbers of Atlantic puffins have traditionally bred on the 3 major islands in Witless Bay and breeding gull populations on these islands have been increasing (Robertson et al., 2004). The putative intermediate hosts for species of *Alcataenia* are euphausiids belonging to the genus *Thysanoessa* (Shimazu, 1975; Hoberg, 1986).

Euphausiids form a substantial portion of the diet of puffins (Baillie and Jones, 2003, 2004) and sometimes form a component of the diet of herring gulls and black-legged kittiwakes (Massaro et al., 2001). These species come in frequent contact with one another in mixed-feeding flocks and may otherwise feed in similar areas. Herring gulls and kittiwakes often kleptoparasitize puffins returning to their nesting burrows with prey for their chicks, thereby actively seeking out foraging puffins. The likelihood for potential cross-infections by tapeworms among foraging guilds of marine birds is consequently high (Hoberg, 1986, 1996).

The presence of *A. l. larina* in puffins may also be a reflection of increasingly overlapping foraging

strategies of the gulls and puffins. Delayed arrival of capelin (*Mallotus villosus*), an important forage fish species in the Witless Bay, Newfoundland, over the past 15 yr has been attributed to unusual temperature patterns affecting the distribution and migration patterns for this forage fish (Carscadden et al., 2001). The peak chick-rearing periods of many seabird species had historically coincided with the arrival of capelin in Newfoundland waters (Massaro et al., 2001). Delay in the arrival of capelin has been associated with anomalous feeding patterns in breeding herring gulls (Massaro et al., 2001), and this may drive them toward foraging on a more diverse array of prey items. Increased abundance of euphausiids in the diet of gulls could facilitate transmission of *A. l. larina*, perhaps causing a spillover effect for infections in species that are not the usual hosts (e.g., puffins). Incidental infections in seabirds should, therefore, be carefully examined in light of changes in the regional oceanic environment.

Species of the genus *Alcataenia* can serve as precise markers of host feeding patterns because of their complex life cycles (Hoberg, 1996, 2005). Recent shifts in the distribution of *Alcataenia longicervica* from the North Pacific to the North Atlantic basin coinciding with altered oceanographic patterns linked to global warming have been reported (Muzaffar et al., 2005). Further, changes in the diets of various seabirds in the Northwest Atlantic have occurred in recent years because of such variation in marine regimes (Bryant et al., 2001; Baillie and Jones, 2003, 2004). Shifts in prey distribution and responses in the feeding ecology of seabirds may be reflected in increased or decreased abundance of tapeworms and other parasites (Hoberg, 1996, 2005). Consequently, development of comparative baselines from survey and inventory and understanding the ecology of parasites in these marine food webs is crucial to our knowledge of more profound changes in the marine environment (e.g., Hoberg et al., 2003).

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