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POSSIBLE RECENT RANGE EXPANSION OF *ALCATAENIA LONGICERVICA* (EUCESTODA: DILEPIDIDAE) PARASITIC IN MURRES *URIA* SPP. (ALCIDAE) INTO THE NORTH ATLANTIC

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A wide range of helminths has been recorded from murres *Uria* spp. (Threlfall 1971, reviewed by Hoberg 1984a, Muzaffar & Jones 2004). Of the cyclophyllidean cestodes that parasitize murres, the genus *Alcataenia* Spasskaya 1971 (Dilepididae) is represented by ten species, eight of which are restricted and specific to the auks; the other two species occur in gulls (Laridae). The intermediate hosts of *Alcataenia* are euphausiid crustaceans such as species of *Thysanoessa* (Shimazu 1975), which also form an important dietary component of breeding and wintering murres, particularly Thick-billed Murres *Uria lomvia* (Gaston & Noble 1985, Birkhead & Nettleship 1987, Elliot *et al.* 1990, Rowe *et al.* 2000, Ainley *et al.* 2002). *Alcataenia armillaris* Rudolphi 1810 and *A. meinertzhageni* Baer 1956 are restricted to the murres and have been recorded from different locations in the Holarctic (Threlfall 1971; Hoberg 1984a, 1986). *Alcataenia longicervica* Hoberg 1984 was described from murres in the North Pacific basin and has been regarded as endemic to the region (Hoberg 1986) because relatively extensive surveys of murres from the North Atlantic and Arctic basin have previously failed to find the species (e.g. Markov 1937, 1942, Belopolskaya 1952, Threlfall 1971, Galkin *et al.* 1994).

We report a new geographic record of *A. longicervica* in wintering Thick-billed Murres and Common Murres *Uria aalge*. Thick-billed Murres and Common Murres were collected by hunters in February 2005 from Harbor Breton (47.467°N, 55.800°W) and St. Mary's Bay (46.933°N, 53.583°W), Newfoundland. Each bird was dissected, and the gastrointestinal tracts were frozen. These samples were later analyzed under a dissecting microscope to collect helminths. Helminth specimens were preserved in 70% ethanol and subsequently stained in Semichon acid carmine stain and mounted entire for identification. The armed rostellum was dissected from some specimens and mounted separately to facilitate accurate determination of form, number, distribution and dimensions of hooks. Identifications were based on descriptions or re-descriptions (Hoberg 1984b) and direct comparison to holotype, paratype or known voucher specimens representing species of *Alcataenia* held in the US National Parasite Collection (USNPC), Beltsville, Maryland, USA.

Seven Thick-billed Murres yielded 39 specimens of *A. longicervica* and 40 specimens of *A. armillaris*. In addition, five Common Murres yielded eight *A. longicervica* and 24 *A. armillaris*. No specimens of *A. meinertzhageni* were found. Infections with *Alcataenia* are generally associated with lesions, because the tapeworm is deeply imbedded in the host's intestinal mucosa, making it susceptible to secondary infections (Threlfall 1971, Hoberg 1984b). Specimens

of *A. longicervica* have been deposited in the collections of the USNPC under accession numbers 97386–97388.

The appearance of *A. longicervica* in the Northwest Atlantic can be explained in two ways, involving either inadequate earlier sampling or a recent range expansion and establishment in the North Atlantic among populations of *Uria* spp.

Under the first scenario, *A. longicervica* has been continuously present across the Holarctic as a component of the helminth fauna of murres established in the Pleistocene (e.g. Hoberg 1986), but was not previously detected in the Atlantic basin. Studies by Belopolskaya (1952) in the Barents Sea and Threlfall (1971) in the Northwestern Atlantic examined large numbers of murres and other alcids and reported the common occurrence of *A. armillaris* and, to a much lesser extent, *A. meinertzhageni*. Other surveys from the North Atlantic and Arctic basin, although involving smaller sample sizes for either species of murre, also apparently did not document dilepidid cestodes other than *A. armillaris* or *A. meinertzhageni* (e.g. Krabbe 1869; Markov 1937, 1941; Baer 1956, 1962; Galkin *et al.* 1994; Galaktionov 1996).

Alcataenia longicervica was described based on an extensive collection of specimens in *U. lomvia* and *U. aalge* from the eastern Bering Sea (Hoberg 1984b, 1986) and, because of its similarity to *A. armillaris*, may have escaped recognition in the North Atlantic in the course of earlier surveys. We believe that scenario to be unlikely, because unequivocal diagnostic characters serve to distinguish *A. longicervica* from its congeners in murres. An elongated neck region, the structure and dimensions of the rostellar sac, and attributes of the genital organs in mature cestodes clearly distinguish this cestode. The specimens of Belopolskaya (1952) or Threlfall (1971) are no longer available because they are unrepresented in museum collections. However, all cestodes remaining from collections by Krabbe (1869) and Baer (1956, 1962) were examined during a re-description and found to be consistent with *A. armillaris* (see Hoberg 1984b). Although such circumstantial evidence does not fully resolve the issue of the historical distribution of *A. longicervica*, it also does not refute an alternative hypothesis.

Alternatively, assuming that *A. longicervica* was formerly absent in the northwest Atlantic, the current finding could be considered in light of the distributional patterns of recognized intermediate hosts for species of *Alcataenia*. Shimazu (1975) found cysticercoids of *A. armillaris* in the euphausiid *Thysanoessa inermis*, and it

is suggested that in general, species of *Thysanoessa* or perhaps *Euphausia* are intermediate hosts for other *Alcataenia*. Changing patterns of distribution for species and populations of euphausiids may be implicated in the putative range expansion and geographic colonization for *A. longicervica* across the Arctic basin into the North Atlantic.

In the scenario that we propose, increasingly pronounced eastward currents such as the Transpolar Drift (Dyke *et al.* 1997) may have facilitated the advective movement of infected euphausiids (specifically species of *Thysanoessa*) leading to geographic colonization of high-latitude seas adjacent to the Canadian Arctic and western Greenland. Because globally significant colonies of Thick-billed Murres occur in these regions (Gaston & Hipfner 2000, CAFF 2004) this exposure via infected *Thysanoessa* most likely facilitated the establishment of populations of *A. longicervica* in Thick-billed Murres. Infected Thick-billed Murres could then have further disseminated the parasite through populations of *Thysanoessa* in the Labrador Sea and to the Grand Banks in Newfoundland waters, subsequently exposing Common Murres, distributed further south and co-occurring with Thick-billed Murres in those regions (Gaston & Jones 1998, Gaston & Hipfner 2000, Ainley *et al.* 2002, CAFF 2004). Long-term changes are also evident in the distributions of many marine invertebrates, including euphausiids and calanoid copepods (Beaugrand *et al.* 2002, Barnard *et al.* 2004), and such shifts in distribution could contribute to the apparent spread of parasitic organisms among marine vertebrates (Hoberg 1996, 2005).

A test of our hypothesis could be achieved through phylogeographic comparisons based on mitochondrial DNA derived from populations of *Alcataenia* in the North Atlantic and North Pacific basins (e.g. Avise 2000). In this case, a contemporary range expansion would be consistent with the absence of geographic partitioning between populations of *A. longicervica* across the Holarctic and would argue against a longer history for this species in the western North Atlantic.

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