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Short note

Anisakid nematodes in dolphins (Cetacea: Delphinidae) from the Baltic Sea area

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ABSTRACT. Dolphins are rarely observed in the Baltic Sea, making only sporadic appearances as a result of their migrations. The study included six specimens: four white-beaked dolphins *Lagenorhynchus albirostris* and two striped dolphins *Stenella coeruleoalba.* Their gastrointestinal tracts were found to contain the nematodes *Anisakis simplex* (in both species) and *Contracaecum* sp. (only in the white-beaked dolphins). This is the first record of Anisakidae nematodes in dolphins found in the Baltic Sea.

Keywords: *Anisakis simplex*, *Contracaecum* sp., *Lagenorhynchus albirostri*s, marine mammals, parasites, *Stenella coeruleoalba*

Introduction

The Delphinidae (Cetacea: Odontoceti) is a family of marine mammals comprising 37 species [1], some of which are widely distributed [2]. Although the members of this group are not native to the Baltic Sea area, representatives of 10 species have been observed there at least once [3]. One of such taxon is the white-beaked dolphin *Lagenorhynchus albirostris* (Gray, 1846), associated with the cold waters of the Northern Atlantic [2]. It is the second most common cetacean species in the Baltic Sea, following the native harbour porpoise *Phocoena phocoena* (Linnaeus, 1758), and it is frequently observed in its waters. The first documented case of its presence originates from Sweden in 1844, while the first report in Polish waters was published in 1862, near Kołobrzeg [3]. In contrast, the striped dolphin *Stenella coeruleoalba* (Meyen, 1833), a widely-distributed species, inhabiting temperate to tropical seas; is rarely observed in the Baltic Sea and is considered to be more thermophilic. The first verified stranding of this mammal originates from 1987 from the Swedish coast, with later stranding reported from Poland, in the area of the Vistula Spit (included in the present study) from 1998 and 1999, and in Danish waters in 2001 [3].

Stranded individuals give the possibility of conducting highly valuable parasitological tests. The Delphinidae are predatory mammals with a rather wide trophic spectrum, and they feed mainly on fish, cephalopods and crustaceans, swallowing their prey whole [2,4,5]. Moreover, like other migratory aquatic animals [6–8] they are also highly-mobile, and often exhibit very wide distribution areas [2,4,5]. Thus, they can be hosts to many different parasites, contributing to their dispersal and circulation in the environment.

As dolphins are facing increasing threats from both direct human activity and ongoing climate change [9], there is a need for regular studies aimed at monitoring their health status, as well as identifying the causes and outcomes of the extensive migrations into their parasite distribution boundaries.

Table 1. Sampling details for the dolphins examined for gastrointestinal parasites, with numbers and developmental stages of nematodes recovered

Catalog no.	Collection date	Sampling locality (landing)	Sex	Age	Length (cm)	Weight (kg)	Parasite	Habitat	No. of parasites
Lagenorhynchus albirostris									
1D	13.06.1989	Baltic Sea (Kołobrzeg)	F	0+	214.0	146.0	*Contracaecum* sp.	intestine	1 L*
2D	13.06.1989	Baltic Sea (Kołobrzeg)	M	1	196.0	114.0	*Anisakis simplex*	intestine	18 L4
4D	21.08.1995	Gulf of Gdańsk (Hel)	F	2	229.0	165.5	*Anisakis simplex*	stomach	1 ♂, 1 ♂
5D	19.09.1998	Baltic Sea (fishing area P11/12)	F	ND	231.0	130.4	–	–	–
Stenella coeruleoalba									
6D	05.12.1998	Gulf of Gdańsk (Przebrno)	M	ND	187.0	75.0	*Anisakis simplex*	stomach	26 ♀♀, 68 ♂♂, 24 L4
7D	04.04.1999	Gulf of Gdańsk (Skowronki)	M	ND	187.0	56.5	–	–	–

*: stage not determined, F: female, L: larvae, M: male, ND: no data

Materials and Methods

Retrospective parasitological analyses of dolphins were conducted based on the material collected in the Laboratory of Parasitology and General Zoology, University of Gdańsk, and from material obtained from the study of marine mammals by the Hel Marine Station, University of Gdańsk in 1989–1999. The study material included four white-beaked dolphins and two striped dolphins from the Polish zone of the Baltic Sea waters (Table 1). All were dead when obtained: one was stranded (specimen no. 7D), and others were bycaught – two in pelagic trawl nets (4D and 5D) and three in bottom set nets (1D, 2D and 6D).

The gastrointestinal tracts, i.e. stomachs and intestines, were subjected to parasitological analysis. After dissecting the stomachs and intestines, the collected helminths were fixed in a mixture of glacial acetic acid and 40% formaldehyde (19:1), and then preserved in 70% ethanol. The nematodes were then cleared using glycerin for microscope examination [10,11].

Results and Discussion

Nematodes were found in three of the white-beaked dolphins and one striped dolphin. Of these, *Anisakis simplex* (Rudolphi, 1809) (Ascaridida: Anisakidae) (138 specimens in both dolphin species) was predominant over *Contracaecum* sp. (Ascaridida: Anisakidae) (one specimen in a white-beaked dolphin) (Table 1).

This is the first identification of these nematodes in dolphins as vagrant species in the Baltic Sea. Furthermore, it is the first record of the presence of *Contracaecum* in *L. albirostris* throughout its entire distribution area.

Other genera and species of Anisakidae nematodes have been recorded in earlier studies of dolphins, including five species of *Anisakis* (*A. berlandi* Mattiucci, Cipriani, Webb, Paoletti, Marcer, Bellisario, Gibson et Nascetti, 2014; *A. pegreffii* Campana-Rouget et Biocca, 1955; *A. nascetti* Mattiucci, Paoletti et Webb, 2009; *A. simplex*, *A typica* (Diesing, 1860)), *Pseudoterranova decipiens* (Krabbe, 1878) and *Contracaecum* spp. [e.g. 4,5,12–22]. However, as reflected in our present findings, *Contracaecum* nematodes have been rarely found to be parasites for this host group: thus far, specimens of nematodes identified as *Contracaecum* sp., larvae and adult stages, have been only found in *S. coeruleoalba* from the Mediterranean Sea [17]. Among marine mammals, pinnipeds are viewed as typical hosts for these nematodes [16].

In contrast, *A. simplex* is an Arctic-Boreal species with a wide range of hosts. Its final hosts are marine mammals, mainly Cetacea (e.g. Balenopteridae, Delphinidae, Kogiidae, Monodontidae, Physeteridae, Ziphiidae), but some Pinnipedia are also infected [21,23]. Eggs are introduced to the water with the faeces of infected mammals. Second stage (L2) or third stage (L3) larvae then develop and, after hatching, the L2 or L3 larvae are ingested by crustaceans, particularly by those of the Euphasiacea. Subsequently, the crustaceans are ingested by numerous fish species, particularly planktivorous species, and cephalopods, which in turn constitute an infection source for larger predatory fish, in which the parasites accumulate. After consumption, these fish and cephalopods are populated by L3 larvae, invasive for mammals, which then molt to form L4 larvae and adults [21,24–26].

As these nematodes are of zoonotic importance, being known to cause anisakiosis in humans [21,27–31]. It is important to understand their full host range, and to monitor their source of origin and possible dispersal routes and circulation in ecosystems. Such studies should also include its potential hosts, as well as its final hosts, of which relatively little is known.

Furthermore, it is important to recognize threats to the populations of increasingly rare marine mammals, which are facing a growing threat of extinction [9]. Global phenomena such as climate change are of key importance, as these influence a range of factors, resulting in reduced water salinity, changes in temperature, habitat degradation, and changes in the trophic structure and availability of food (e.g. distribution or abundance of prey). These factors have an averse effect on the health of marine mammals, resulting in disturbed immunity and greater susceptibility to disease [9,32,33], which in turn favors the development of parasitoses. Although the mechanism of anisakiasis development has been best characterized for humans [e.g. 29–31,34,35], studies have indicated the possibility of lesions occurring in dolphins, such as gastric ulceration, fibrosis, jejunitis, and even chronic granulomatous and ulcerative dermatitis [4,13,36–39]. Regarding the dolphins included in the present study, the genus *Anisakis* is known to

have a pathogenic effect on *S. coeruleoalba* [4,13,38,40–42].

It should be emphasized that such comprehensive research of the Anisakidae, examining its effects on different hosts from a variety of locations and habitats, utilizing the advances of numerous disciplines, fits perfectly into the One Health concept for achieving the optimal health of people, animals and the environment.

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