ISSN 0704-3716

Canadian Translation of Fisheries and Aquatic Sciences

No. 5603

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Original title: Novyye dannyye po gel'mintofaune belukhi

In: Byulleten' Mosk. ob-va ispt. prirody (Bulletin of the Moscow Society of Naturalists). 63(3): 25-32, 1958

Original language: Russian

Available from:
Canada Institute for Scientific and Technical Information
National Research Council
Ottawa, Ontario, Canada K1A 0S2

1993

13 typescript pages

Government of Canada - Gouvernement du Canada

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2851843	Russian	N. De.	18/VIII/93

Byulleten. M. o-va isp. prirody, otd. biol. (Bulletin of the Moscow Society of Naturalists, biol. sect.), 1958, v. 63 (3), p. 25-32

New data on the helminthofauna of the while whale

by S.L. Delamure and S.Ye. Kleinenberg

The white whale (*Delphinapterus leucas* Pallas) and the narwhal (*Monodon monoceros* Linn.) make up a separate family (or subfamily) which some researchers refer to as Monodontidae, and others Delphinapteridae.

The white whale, or beluga, is distributed only in the northern hemisphere and circumpolar region. It inhabits the northern part of the Atlantic Ocean, including Hudson and Baffin bays, as well as the Barents, Kara and Laptev seas. Judging by the most recent and not yet published data, the white whale is regularly encountered in the Eastern Siberian Sea as well. Farther eastward, it is distributed in the Chukchi Sea, Bering Sea, Sea of Okhotsk, and in the northern part of the Sea of Japan. Therefore, it is possible that the previously conjectured discontinuity of its range in the Eastern Siberian Sea does not exist at all.

A taxonomic revision of the genus *Delphinapterus*, which has always been regarded as monotypic, was carried out in 1937 by S.K. Klumov (1937) and I.I. Barabash who established the Okhotsk, or to be more exact the Far Eastern, white whale as the independent species *D. dorofeevi*. Furthermore, the first of these authors also described the White Sea beluga, *D. freimani*, as an independent species, referring to the typical form described by Pallas (*D. leucas*) as the Kara beluga (Klumov, 1937).

However, this revision was not accepted by zoologists. For example, in the key to mammals of the USSR, N.A. Bobrinsky (1944) writes that the white whale, or beluga, is represented by a single species, the one described by Pallas, and claims that the forms established by S.K. Klumov are unconditionally subspecies. A.G. Tomilin (1951) proceeds in the same way. M.M. Sleptsov (1955) does not even accept the Far Eastern beluga as a subspecies, and regards it as a typical form.

Thus, it can be said that the taxonomy of the white whale has not yet been established. This is extremely sad in that without accurate information about the taxonomic rank of the host, its biology and geographic distribution, we cannot present a comprehensive assessment of its helminthofauna. Nevertheless, we decided to publish the following data, since they are the most recent and can prove useful in further research.

Like other marine mammals, the white whale has always been of interest not only to mammologists, but also to helminthologists as a host of parasites. Helminthological studies have been carried out with white whales caught in the Tatar Strait, the Sea of Okhotsk, off the Pacific coast of North America, in the Bering, Barents and White seas and off the coast of Norway and Western Spitzbergen, but there have never been any white whales dissected from Hudson and Baffin bays, the Kara Sea and the Laptev Sea.

The research into the helminthofauna of the white whale was begun in 1809. So far, Russian and foreign authors have encountered 10 species of helminths (2 trematodes, 7 nematodes and one acanthocephalan) in the white whale.

For example, in 1809, Rudolphi described the extremely common nematode *Anisakis simplex* (Rud., 1809) Baylis, 1920, which parasitizes numerous species of cetaceans and pinnipeds of the northern hemisphere. In 1870, van Beneden described the species *Stenurus pallasii* (v. Beneden, 1870) Dougherty, 1943 as a parasite of white whales.

A common parasite of white whales, *Anisakis kükenthalii* (Cobb, 1889) Baylis, 1920, was described by Cobb in 1889. This species is encountered only in white whales; it has not yet been found in other sea mammals. It should be said that the anisakids of white whales were recently studied in detail by A.A. Mozgov (1949, 1951, 1953), and they were also researched by A.I. Krotov and S.L. Delamure (1952).

In 1934, Price described the nematode *Hadwenius seymouri* Price, 1934, which in 1935 was studied by K.I. Skryabin and R.S. Shultz, and transferred to the genus *Odhneriella* Skrjabin, 1915. This species parasitizes not only white whales. In 1934, K.I. Skryabin and N.K. Andreyeva described the nematode *Crassicauda giliakiana* Skrjabin et Andreeva, 1934, which has so far been encountered only in white whales, and in 1942 K.I. Skryabin published a description of the nematode *Otopho-*

caenurus oserskoi Skrjabin, 1942 which proved to be a representative of a new genus; this nematode parasitizes strictly white whales.

Finally, in 1952, A.I. Krotov and S.L. Delamure described the nematode *Leucasiella mironovi* (Krotov et Delamure, 1952), which also proved to be a representative of a new genus and also parasitized strictly the white whale. The same authors discovered the nematode *Stenurus minor* (Kühn, 1829) and the acanthocephalan *Corynosoma strumosum* (Rud., 1802) in white whales.

In 1956, we examined new original material collected from five white whales in Tarkhanovo (northern part of the western coast of the Kanin Peninsula) in the summer of 1956. Analysis of this interesting material, collected in accordance with the existing regulations, showed that the white whales at Tarkhanovo were parasitized by the trematode *Odhneriella seymouri* and the nematode *Otophocaenurus oserskoi* which had previously been known only as parasites of Okhotsk white whales. *Anisakis kükenthalii,* known for the European north, was found in the same material. Of great interest to us was a new species of pseudaliids from the lungs of white whales, which we named *Stenurus arctomarinus* n. sp.

Description of the species *Stenurus arctomarinus* n. sp.

(see Fig.)

H o s t : *Delphinapterus leucas* Pall.

L o c a l i z a t i o n : lungs.

O c c u r r e n c e : Barents Sea.

M a t e r i a l : a large number of males and females, collected by S.Ye. Kleinenberg during dissection of five white whales harvested between 21 April and 7 July 1956.

Threadlike light yellow nematodes. Cuticle finely cross-striated. Mouth surrounded by papillae.

M a l e . Length of body 67.0-110.0 mm. Width of body: maximum 0.40-0.58 mm, at end of oesophagus 0.342-0.361 mm, before bursa 0.152-0.159 mm. Nerve ring 0.228-0.260 mm from anterior end, postcervical papillae 0.247-0.315 mm from latter. Oesophagus cylindrical, 0.912-0.950 mm long, in posterior region 0.114-0.133 mm wide. Tail with comparatively well-developed bursa 0.095-0.125 mm in length with width of 0.152-0.212 mm.

Bursa 5-lobed, margins of lobes uneven. Ventral costae represented by two stalked papillae 0.030-0.038 mm long with width of 0.007-0.009 mm; ends of rudimentary costae bifurcate. Lateral costae more developed than the rest, 0.076-0.112 mm long, 0.026-0.034 mm wide. Each lateral costa with long stalked papilla 0.038-0.049 mm long and 0.007 mm wide near its base; papilla probably corresponds to posterolateral costa. Dorsal costa 0.049-0.060 mm long and 0.030-0.038 mm wide, tapered distally, with two pointed papillae on the end. Anterior lip of cloaca with very small tuberculate papilla, sometimes discernible in specimen with protracted spicules. Spicules foliate, curved, loosed fused along middle. Spicules 0.133-0.186 mm long and 0.030-0.038 mm wide. Gubernaculum considerably expanded in proximal part, tapered in distal part, 0.060-0.072 mm long, maximum width 0.015-0.019 mm ventrally, 0.009-0.011 mm laterally.

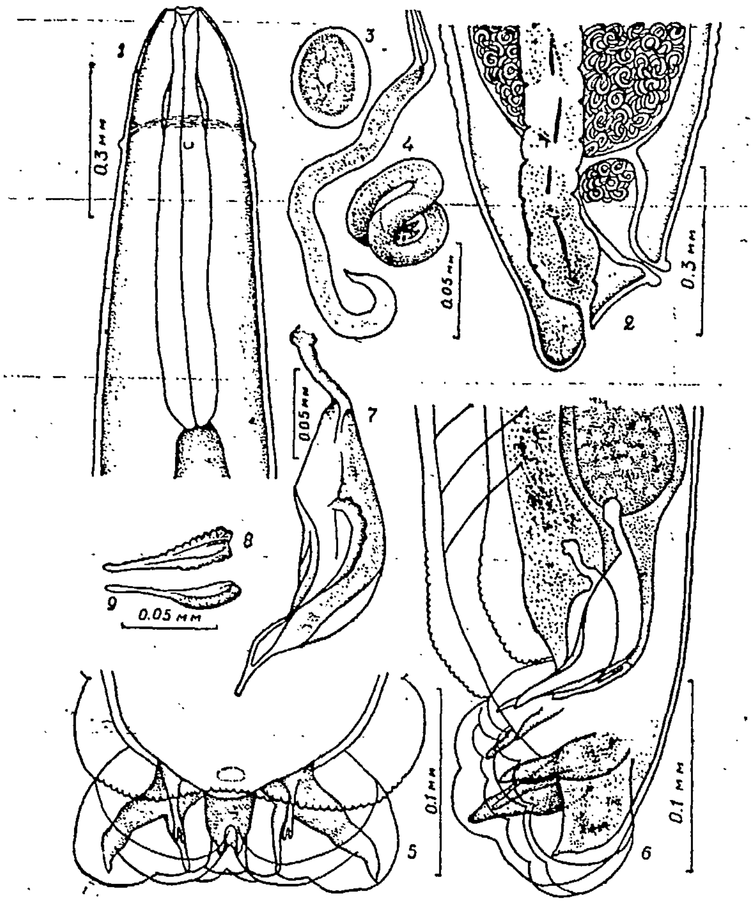
F e m a l e . Length of body 72.0-142.0 mm, maximum width of body 0.492-0.513 mm. Width of body at end of oesophagus 0.361-0.418 mm, at level of vulva 0.266-0.280 mm. Length of oesophagus 0.855-0.912 mm, width 0.095-0.114 mm. Nerve ring 0.211-0.216 mm from anterior end, postcervical papillae 0.220-0.224 mm from latter. Anus occupies subventral position, 0.152-0.190 mm from dorsal wall of body, 0.050-0.076 mm from tip of tail, 0.114-0.133 mm from vulva. Vulva located in front of anus, anterior and posterior lips of vulva almost equal in size (0.007-0.057 mm). Length of vagina 0.266-0.360 mm, width 0.152-0.209 mm; walls of vagina 0.030-0.050 mm thick. Uterus and vagina filled with larvae 0.281-0.304 mm long with width of 0.015-0.016 mm.

At the present time, we know of five species that belong to the genus *Stenurus* Dujardin, 1845, namely *S. minor* (Kühn, 1829) Baylis et Daubney, 1925, *S. auditivus* Hsü et Hoeppli, 1933, *S. globicephalae* Baylis et Daubney, 1925, *S. ovatus* (Linstow, 1910) Baylis et Daubney, 1925, and *S. pallasii* (van Beneden, 1870) Dougherty, 1943.

Our new species is distinguished from all of these species by larger body dimensions, a larger oesophagus, a distinctive structure of the bursa, as well as by the structural characteristics of the females which resemble those of the genus *Halocercus*. Furthermore, our species differs from the above-mentioned ones in a number of other characteristics.

For instance, it is distinguished from *S. minor* by a 5-lobed bursa, the presence of a dorsal lobe in the bursa, bifurcated rudiments of ventral costae, the presence of comparatively large rudiments of posterolateral costae, and a different size and form of the dorsal costa; from *S. auditivus* by spicules that are half the size, a large gubernaculum, and a different structure of the bursa and bursal costae; from *S. globicephalae* by acuminate lateral costae, the presence of longer rudiments of the posterolateral costae, a longer dorsal costa, and a more differentiated bursa; from *S.*

ovatus by a wider and more differentiated bursa, a smaller and different form of gubernaculum, longer rudiments of the posterolateral costae, and a different form of the dorsal costa. Finally, the new species is distinguished from *S. pallasii* by better developed bursal costae and a different structure of the latter.



Stenurus arctomarinus n. sp.:

1 - anterior end of body; 2 - caudal end of female (lateral view); 3 - egg; 4 - larva; 5 - bursa (ventral view); 6 - caudal end of male (lateral view); 7 - spicule; 8 - gubernaculum (ventral view); 9 - lateral view of same

Table 1. Comparison of species of the genus *Stenurus* Dujardin, 1845

Characteristics (dimensions in mm), sex	*S. arctomarinus* (Delamure and Kleinenberg, 1957)	*S. minor* (Delamure, 1955)	*S. ovatus* (Delamure, 1955)	*S. pallasii* (Cobb, 1888)	*S. auditivus* (Hsü and Hoeppli, 1933)	*S. globicephalae* (Baylis and Daubney, 1925)
Length of body, ♂	67-110	17.8-22.3	16.4-21.1	18-22	28.0-35.0	30.0
♀	72-142	22.2-26.0	24.4-39.1	21-28	45.0-55.0	45.0
Width of body at posterior end of oesophagus, ♂	0.34-0.36	0.175-0.215	0.096-0.112			
♀	0.361-0.418	0.234-0.285				
Postcervical papillae from anterior end, ♂	0.247-0.315	0.234-0.300	0.272-0.278			0.35
♀	0.220-0.224	0.260-0.272				
Length of oesophagus, ♂	0.913-0.950	0.418-0.458	0.438-0.536		0.40-0.41	
♀	0.855-0.912	0.429-0.493	0.507-0.585		0.40-0.47	0.56-0.65
Length of bursa	0.095-0.125	0.140-0.198	0.120-0.148			
Width of bursa	0.152-0.212	0.165-0.200	0.104-0.144			
Length of ventral costae	0.030-0.038	0.019-0.022	0.018-0.028			
Length of lateral costae	0.176-0.112	0.057-0.085	0.048-0.068			
Length of dorsal costa	0.049-0.060	0.060-0.065	0.052-0.060			
Length of spicules	0.133-0.186	0.130-0.168	0.164-0.200	1.2	0.38-0.57	0.15
Length of gubernaculum	0.060-0.072	0.049-0.060	0.072-0.088		0.009-0.030	
Distance from vulva to anus	0.114-0.133	0.119-0.136	0.052-0.088		0.007	
Length of larvae	0.281-0.304		0.280-0.380		0.20-0.28	

Legitimacy of the species *Stenurus pallasii* (vasn Beneden, 1870)

The species composition of the genus *Stenurus* Dujardin, 1845, which now consists of 6 species, should be discussed in greater detail (table 1). The point is that only three species, *S. minor* (Kühn, 1829), *S. ovatus* (Linstow, 1910) and *S. arctomarinus* n. sp., have been described adequately; the remaining three, *S. globicephalae* Baylis et Daubney, 1925, *S. auditivus* Hsü et Hoeppli, 1933 and *S. pallasii* (van Beneden, 1870), have been described superficially, especially *S. pallasii*.

This species is referred to by N.A. Cobb (1888), O. Linstow (1910) and H.A. Baylis et K. Daubney (1925), but each time as a representative of a new genus and under the species name "*arcticus*". E.C. Dougherty (1943), having analyzed the synonymy in detail, suggested the name *Stenurus pallasii* (v. Beneden, 1870) for this species and, as it appears, solved the problem concerning the taxonomic rank of this poorly diagnosed species. Meanwhile, in studying new material from white whales, we came across pseudaliids with a bursa very similar at first glance to that of *S. pallasii* as depicted by Linstow (1900). Naturally, this material caught our interest; however, after we examined this and other similar specimens from the same sample in greater detail, we came to the conclusion that these were not *S. pallasii*, but typical representatives of the species *Otophocaenurus oserskoi*. Our material did not include any specimens of *S. pallasii*.

Having further compared the descriptions and drawings of the species *S. pallasii*, *O. oserskoi* and *S. arctomarinus*, we concluded that an error in the description of *S. pallasii* led to the confusion of two helminth parasites of white whales. We suspect that the dimensions of the body and bursa were taken from the species *O. oserskoi*, while the spicules and certain other characters were described from *S. arctomarinus*. This assumption appears even more probable if we consider that both of these species are often encountered simultaneously in the lungs of the same host; analysis of poorly preserved material and body fragments of these species could have given rise to an electic species such as *S. pallasii*. It should also be said that since [scientists] have begun to collect, fix and analyze material more carefully, for more than 50 years now, the species *S. pallasii* has never been encountered by any researcher even though white whales have been subjected to helminthological dissection many times.

Therefore, the species denoted as *S. pallasii* (v. Beneden, 1870) in the literature probably does not exist in nature; in any case, we have significant motives for assuming so. We are dwelling on the legitimacy of the species *S. pallasii* here because our experience has shown that a significant number of the long-established but very poorly diagnosed species of helminths from sea mammals (especially cestodes), at times presented without illustrations, are none other than species that were later described quite well, but under other names. Unfortunately, it is not easy to uncover such facts; it is much easier to move questionable species from one genus to another, as we often do, each time citing indeterminacy of diagnosis as the excuse. Finally, we cannot but note that the species similar to *S. pallasii* make a taxonomist's work extremely difficult, distort the true picture of the helminthofauna of the host, and lead to zoogeographic inaccuracies.

Zoogeographic analysis of the helminthofauna of the white whale

Regarding this study as a supplement to published material on the fauna and geography of helminths that parasitize marine mammals (Delamure, 1955), we naturally attempted to analyze the helminthofauna of the white whale from the zoogeographic point of view. The material that had accumulated enabled us to compare the helminthofauna of the Barents and White Sea white whales with the Okhotsk white whale (table 2). This type of comparison primarily showed that of the 7 genera of helminths recorded for white whales in general, four (*Odhneriella, Anisakis, Otophocaenurus* and *Stenurus*) are represented in the white whales of the White and Barents seas, and all seven are found in the white whales of the Sea of Okhotsk. Of these seven genera that make up the helminthofauna of the Okhotsk white whales, one genus, *Corynosoma,* is known for the zone inhabited by the White Sea and Barents Sea white whales, but it is encountered there in other hosts, whereas two genera, *Leucasiella* and *Crassicauda,* have never been encountered either in white whales, or in any other marine mammals in that area. Moreover, all the genera of helminths from white whales of the White and Barents seas are encountered in the helminthofauna of the Okhotsk white whales. Generally speaking, the helminthofauna of the Okhotsk white whales is more abundant and diverse.

S.L. Delamure (1953, 1955) has already noted that the distribution of helminths of marine mammals in the world's oceans matches the general tendencies of the distribution of free-living animals in these waters. Analysis of the material from white whales of the Barents Sea which, like the White Sea, is located on the boundary of the Arctic Region and Boreal-Atlantic Subregion, as well as a comparison of the helminthofaunas of the white whales from these seas and the Sea of Okhotsk, have confirmed earlier conclusions regarding the qualitative diversity and well-defined endemism of the helminthofauna of sea mammals of the N Pacific as compared with the helminthofauna of sea mammals of the White and Barents seas and the N Atlantic. However, along with the obvious differences, we have also established similarities between the helminthofaunas of white whales from different basins; all are parasitized by four common species, namely *O. seymouri*, *A. kükenthalii*, *A. simplex* and *O. oserskoi*.

Table 2. Comparison of the helminthofaunas of white whales from the White Sea, Barents Sea and Sea of Okhotsk

Genera and species of helminths	Hosts of parasites		
	White whales from White and Barents seas	White whales from Sea of Okhotsk	Others
Odhneriella			
O. seymouri	+	+	
Leucasiella			
L. mironovi		+	
Anisakis			
A. kükenthalii	+	+	
A. simplex	+	+	pinnipeds, baleen and toothed whales
Otophocaenurus			
O. oserskoi	+	+	
Stenurus			
S. minor		+	dolphins
S. arctomarinus	+		
S. pallasii			
Crassicauda			
C. giliakiana		+	bottlenose whale
Corynosoma			
C. strumosum		+	birds, pinnipeds, dolphins

Note: "+" denotes species of helminths that parasitize the given host.

Why is it that the same species of helminths occur in these white whales? First of all, one might think that some contact exists between the populations of Far Eastern white whales and those inhabiting the waters of the Asian and European North. In other words, our data can be regarded as confirmation of the information presented at the beginning of this paper, i.e. the constant discontinuity thought to exist in the area of distribution of the white whale does not actually exist.

Of course, another explanation of this interesting fact is possible, as we have found in the classic works of L.S. Berg (1918, 1947, 1953). Back in 1918, this author showed that an exchange of faunas between the northern part of the Pacific Ocean and the North Atlantic took place in the past. This exchange occurred along the northern coast of Asia in the epochs when the climate in N Asia was warmer than it is today, i.e. during the Pliocene and warm post-glacial periods. As we know, this theory was not only proven by the author himself, but also substantiated later by the investigations of a number of scientists, particularly A.P. Andriashev (1939), A.N. Svetovidov (1944), A.M. Dyakonov (1945) and Ye.F. Gur'yanova (1948) who showed that one of the ways in which the Pacific fauna got into the seas of the European North and the North Atlantic was along the shores of Asia.

Therefore, the facts presented here by us are also reflected in L.S. Berg's theory.

Proceeding further from the claims of a number of authors that the Atlantic fauna shows signs of genetic dependence on the fauna of the Pacific Ocean, as well as our own data to this effect, we are inclined to believe that the species commonly recorded in the helminthofauna of white whales found their way to the West from the East, i.e. from the Pacific Ocean to the Barents and White seas.

In conclusion, it should be said that the further study of helminths that parasitize white whales from different parts of their range can be of some practical use, e.g. in solving the question concerning the isolation of some white whale populations, in obtaining more accurate information about the migration routes of the animals, etc. Furthermore, we must not forget that helminths cause serious infections in white whales and other marine mammals, and, as S.Ye. Kleinenberg (1956) has demonstrated with Black Sea dolphins, are one of the factors that determine their mortality. Therefore, further research into this problem will make it possible to take helminthiases of white whales into consideration when determining the stocks of these commercial animals.

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