The occurrence of two species of the family Priapulidae in Faroese waters

Tvey sløg av ættini Priapulidae á føroyskum sjóøki

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Úrtak

Í greinini verður greitt frá tveimum djórasløgum úr ættini Priapulidae, *Priapulus caudatus*, Lamarck, 1816 og *Priapulopsis bicaudatus* (Koren and Danielssen, 1868). Tikið verður saman um navnasøgu, útbreiðslu og hvussu sløgini síggja út og hvussu kann skiljast ímillum hesi bæði sløgini. Hetta er fyrstu ferð, at greitt verður frá *P. bicaudatus* á føroyskum øki.

Í greinini er eisini ein greiningarlykil til eyðmerkingar av sløgunum.

Abstract

In this paper we describe the occurrence of two species from the family Priapulidae in Faroese waters, *Priapulopsis bicaudatus* (Koren and Danielssen, 1868) and *Priapulus caudatus*, Lamarck, 1816. A list of synonyms, all known locations where the species have been found, a reference to a good description of the species and a general description of the distribution of the species is also given. A key to identify the species is also given.

Introduction

Prior to 1968, the phylum Priapulida was considered to be a cold-water macro-benthic taxon represented in the meiofauna only by larval stages. The seven species and four genera were placed in a single family Priapulidae. Beginning with the discovery of *Tubiluchus corallicola* van der Land, 1968, from the shallow waters of Curacao (van der Land, 1968) the number of priapulid taxa has increased to 17 contemporary (no fossil) species, seven genera and three families. Most (eight species) of these new taxa are meiofaunal, with lengths less than 2 mm. All the large macro-faunal priapulids are included in the family Priapulidae and have an adult length from 2 mm to 20 cm, although individuals larger than 10 mm are rare.

The species composition of the benthic macro fauna of the Faroe Islands is fairly well known. Large scale benthic surveys from 1926-27 as well as occasional single samples from late 19th century to about 1930, were published in a comprehensive, six-volume publication, "The Zoology of the Faroes" (ZOF) and included samples from the seashore to about 200 m. depth. Species from all major phyla were reported. Wesenberg-

Figure 1. *Priapulus caudatus* from station KA05 (Kaldbaksfjørður).

Lund (1928) published the Gephyrea-group in which the priapulids were included.

The data in the present paper are based on own identifications based on the material from the BIOFAR program and samples from the work at the Kaldbak Marine Biological Laboratory, as well as collected information from reports and papers about benthic macro fauna in Faroese waters.

In 1988-91 the BIOFAR program sampled more than 600 different stations from the Faroese region covering depths from about 100 m to more than 1500 m. A wide selection of different types of gear was used to obtain the samples.

For the last ten years, a large number of seabed samples have been taken in inshore waters in the Faroe Islands. These are mainly grab samples (Van-Veen type).

From the region southeast of the Faroe Islands a number of seabed sample surveys have been done in relation to environmental descriptions connected to oil exploration activities in this area. The surveys were at depths from 461 m (Kaldbak Marine Biological Laboratory, 2006) to 1180 m in the

Faroe-Shetland Channel (Mannvik and Petersen, 2002).

Data from all available sources with information on benthic macro fauna species from the Faroe area are systematically collected and entered into a database from which data for this paper were extracted.

Materials and methods

The material in this paper consists of all the priapulids from a large number of seabed samples from the waters around the Faroe Islands. The samples cover a depth range from 0-1500 m and have been obtained by different types of gear and from a wide variety of seabed types.

Aside from the early Wesenberg-Lund (1928) and Fischer (1922) samples, all other samples were sieved through a set of 4 mm and 1 mm round-holed sieves before fixation in a 4% formaldehyde-seawater solution buffered in borax. Before preservation in 70% ethanol, the formaldehyde was washed out for at least 24 hours.

All samples were sorted and identified under stereo-microscope and identified to species level.

Results

Priapulus caudatus

Wesenberg-Lund (1928) reported a small

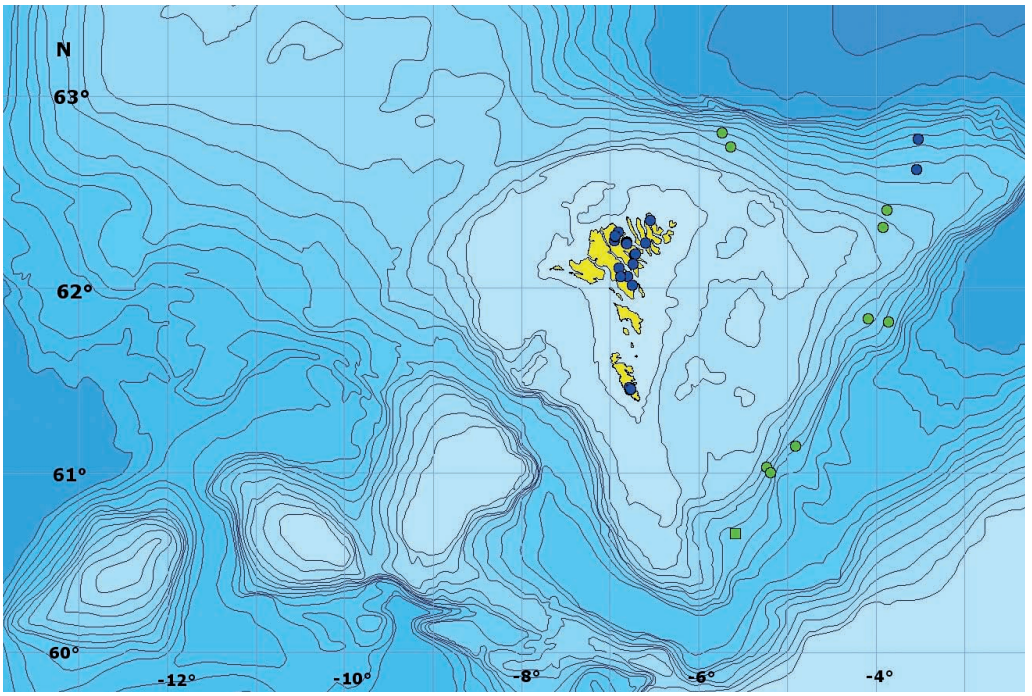


Figure 2. Map showing the occurrence of priapulids in Faroese waters. Green dots are stations with *Priapulopsis bicaudatus* and blue dots are stations with *Priapulus caudatus*. Green square shows Fisher (1922) station with *Priapulopsis bicaudatus*.

number of *Priapulus caudatus* from three shallow-water localities in the Faroes. Seven specimens from the muddy sand at the beach at Viðareiði, one specimen from 43 m depth in Funningsfjørður and also a single specimen (noted as *Priapulus caudatus* Lam. Var. antarcticus) at about 15 meters depth in Klaksvik.

Nørrevang (1990) found two specimens in Funningsfjørður at station FU07.

In this paper, we add 30 new stations with 90 specimens. One of the samples (0.1

Station	Number	Sediment	Lat-N-Start (deg-decimaldeg)	Long-W-Start (deg-decimaldeg)	Depth
167	1	-	62,7800	-3,5200	1032
169	1	-	62,6215	-3,5407	808
371	1	Clay	62,2833	-6,9167	80
372	2	Sand	62,2500	-6,9667	21
2211	1	Clay	62,12741	-6,73816	45
2212	1	Clay	62,12741	-6,73816	45
2215	2	Clay	62,14475	-6,7455	49
2216	2	Clay	62,14475	-6,7455	49
2391	5	Mixed	62,23902	-6,81663	13
2395	1	Mixed	62,23525	-6,81315	14
2396	3	Mixed	62,2408	-6,81017	17
2397	17	Mixed	62,24085	-6,810	17
2398	3	Mixed	62,23965	-6,80752	21
2399	2	Mixed	62,23962	-6,80713	19
2402	11	Mixed	62,23527	-6,80777	26
2403	3	Mixed	62,23528	-6,80785	26
2406	8	Mixed	62,23757	-6,8101	24
2409	0	Mixed	62,24112	-6,81557	6
2513	1	Silty clay	62,10705	-6,90277	30
2005233	1	Clay	62,06005	-6,87795	35
2006037	1	Mixed sand	61,46775	-6,78751	20
2006042	5	Silt	61,45703	-6,76463	20
2006046	1	Silt	61,45255	-6,77285	17
2006047	2	Gravelly sand	61,4526	-6,77391	15
2008032	1	Clay	62,18226	-6,71703	No info
2008033	2	Clay	62,1823	-6,71731	No info
2008034	3	Clay	62,17815	-6,71843	39
2008036	5	Clay	62,176133	-6,72543	37
2008048	1	Gravelly sand	62,27310	-6,94083	35
2008074	1	Sandy clay	62,05998	-6,8003	39
ZOF-1	7	Mud sandy	62,358887	-6,543405	0
ZOF-2	1	-	62,274193	-6,944777	43
ZOF-3	1	-	62,238972	-6,594800	15

Table 1. All stations with *Priapulus caudatus* from Faroese waters. ZOF = Zoology of the Faroes (Wesenberg-Lund, 1928).

Station	Number	Lat-N-Start (deg-decimaldeg)	Long-W-Start (deg-decimaldeg)	Depth
172	1	62,3187	-3,9132	507
230	1	61,1493	-4,9037	703
361	6	61,8383	-4,0833	700
362	1	61,8217	-3,8533	798
481	1	61,0027	-5,1898	604
482	1	61,0323	-5,2323	509
774	1	62,4117	-3,8700	560
750	1	62,8117	-5,7350	600
9018	2	62,7412	-5,6390	503
Fisher (1922)	-	60,6667	-5,5833	652

Table 2. All stations with *Priapulopsis bicaudatus* from Faroese waters.

m^2) had 17 specimens but about half of all the samples had only a single specimen.

Priapulopsis bicaudatus

During the BIOFAR program (1988-1991) (Nørrevang *et al.*, 1994; Tendal *et al.*, 2005) about 600 stations were sampled around the Faroe Islands mostly at depths below 100 m. *Priapulopsis bicaudatus* was found at nine stations at depths from 503 m to 798 m. These are all stations from a complex depth zone of water masses belonging to the cold southward flowing water masses (Hansen and Østerhus, 2000). A total of 15 specimens were found at these nine stations – seven stations with a single specimen, one station with two specimens and one station with six specimens.

Fischer (1922) reported this species from 652 m at 60° 40' N and 5° 35' W. From bathymetric maps of the area it is clear that the position given by Fischer must be deeper than the noted 652 m. If we choose to believe that the depth is correct, which accords well with the actual depth range found in this paper, then the position must be either a bit north of the given position or a bit more to the west. However, if the position is correct, the depth of this position is about 800 m which is about the maximum depth registered in this paper.

Family Priapulidae Gosse, 1855

Characteristics: Macrobenthic worms with body arranged in three parts: the annulated trunk, an anterior introvert, which is separated from the trunk by a small constriction, and a posterior caudal appendage. The pharynx has several rows of teeth arranged in pentagons, and the introvert has 25 longitudinal rows of scalids. The annulated trunk has various papillae with or without posterior warts; the mono- or bicaudal tail can be smooth or clearly segmented. There are two retractors; the larvae have flattened bilateral lorica; external fertilization.

There are three contemporary genera: *Priapulus* Lamarck, 1816; *Priapulopsis* Koren and Danielssen, 1875 and *Acanthopriapulus* van der Land, 1970. In Faroese waters there are two genera: *Priapulus* and *Priapulopsis*.

Phylum PRIAPULIDA

Family Priapulidae
Genus *Priapulus*
Priapulus caudatus Lamarck, 1816

Synonyms:

Priapus humanus Linnaeus, 1758
Holothuria priapus Linnaeus, 1767
Hirudo annulis Olafsen, 1772
Priapula priapus de Blainville, 1826
Priapula caudata de Blainville, 1826
Priapula caudata Guérin-Méneville, 1829-1844
Priapulus vulgaris Cuvier, 1836
Priapulus hibernicus McCoy, 1845
Priapulus brevicaudatus Ehlers, 1861
Priapulus glandulifera Ehlers, 1861
Lacazia hibernica de Quatrefages, 1865
Priapulus multidentatus Möbius, 1873
Priapulus intermedius Lenz, 1878
Priapulus pygmaeus Verrill, 1885
Priapulus pygmaeus Verrill, 1885
Priapulus humanus de Guerne, 1888
Priapulus pygmaens Collin, 1901
Priapulus caudatus var. *antarticus* Skorikov, 1902
Priapulus caudatus var. *kristinebergensis* Hérubel, 1904
Priapulus caudatus var. *mofjordinensis* Hérubel, 1904
Priapulus priapus Derjugin, 1906
Priapulus caudatus var. *multidentatus* Fischer, 1913
Priapulus tuberculatospinosus japonicus Murina and Starobogatov, 1961
Priapulus profundus Sanders and Hessler, 1962

Good description: Wesenberg-Lund (1930).
Previous records: Wesenberg-Lund (1928), ZOF-1, ZOF-2, ZOF-3 (see table 1) and FU07 (Nørrevang, 1990).
BIOFAR stations: 167, 169, 371, 372, 2211, 2212, 2215, 2216, 2391, 2395-2399, 2402, 2403, 2406, 2409, 2513, 2005233, 2006037, 200642, 2006046, 2006047, 2008032-2008034, 2008036, 2008048, 2008074.
Temperature: -0.85 to 12 °C.
Salinity: 34.92 to 35.200 ‰.
Depth range in general: intertidal - 7500 m.
Depth range in Faroese waters: 0 - 1032 m.
Bottom type: Soft sediments in general.
General distribution: This is a northern circumpolar arctic-boreal species; with a wide distribution in the Northern hemisphere from the high Arctic to low boreal waters. It has been found in the waters of Greenland, Spitzbergen, Finmark, Iceland, Faroe Islands, Ireland, Great Britain, Denmark, North America and Canada. It is also known from the Baltic Sea, White Sea, Murman coast, Barentz Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukcha Sea, Alaska, Bering Sea, Okhotsk Sea and Northern Japan, near Hokkaido (Theel, 1906; Wesenberg-Lund, 1925; 1930; Zenkevitch, 1940; Sazepin, 1948; Murina, 1997). A few specimens were found in the Mediterranean Sea at 100 m depth (Guille and Laubier, 1965) and at 38 m depth (Murina, 1981). The most unusual occurrence of this species was in the Kurila-Kamchatka Trench where it was found at a depth of 2670 m (Murina and Starobogatov, 1961). Usually this species prefers depths between 100 - 300 m and can be found in sand, mud or silt.

Family Priapulidae
Genus *Priapulopsis*
Priapulopsis bicaudatus (Koren and Danielssen, 1868).

Synonyms:

Priapulus bicaudatus Danielssen, 1868
Priapulopsis typicus Koren and Danielssen, 1875
Priapuloides bicaudatus de Guerne, 1888
Priapulus atlantisis Sanders and Hessler, 1962

Good description: Wesenberg-Lund (1930).
Previous records: Fisher (1922) at 60° 66' 67 N and 5° 58' 33 W
BIOFAR stations: 172, 230, 361, 362, 481, 482, 750, 777, 9018,
Temperature: -0.6 to 2.0 °C.
Salinity: 34.90 to 34.920 ‰.
Depth range in general: 7 - 2000 m.
Depth range in Faroese waters: 503 - 798 m.
Bottom type: Soft sediments in general.
General distribution: This is a cold-water species with a wide vertical distribution (Adrianov and Malakhov, 1999). Compared to *P. caudatus* the area of distribution of this species is much more restricted. According to Fischer (1922), it was dredged by the "Valdivia expedition" north of the Wyville-Thomson Ridge in the Faroe-Shetland Channel 60° 40' N., 5° 35' W, 652 m, at bottom

temperature 0.1 °C. Later this species was found in the northern parts of the Atlantic; from Finnmark and Spitzbergen in the east to the Davis Strait in the west (Wesenberg-Lund, 1930). In Icelandic waters this species is known from two localities 66° 27' N, 21° W (in Hunafloi Djup) at 150-190 m depth; and also at 66° 20' N, 12° 28' W off Digranes Flak at 180 - 220 m depth (Wesenberg-Lund, 1937b). *P. bicaudatus* was also found during the investigation of the Norske Nordhavsexpedition in the eastern locality at 72° 30' N, 36° 39' E (Wesenberg-Lund, 1930). According to Murina (1997) this species was found at two stations in the Laptev Sea by the R/V Polarstern (1993) at the north coast of Asia. Three specimens in muddy sediments at station 29 (77° 40' 5 N, 102° 7' 3 E , depth 120 m), and one specimen in muddy clay at station 44 (77° 2' 32 N, 126° 25' 31 E, depth 92 - 95 m). Murina and Starobogatov (1961) reported this species from the Kara Sea.

Discussion

Priapulus caudatus must be considered a rare species in Faroese waters. Since 1986, hundreds of seabed samples have been analyzed for macro-fauna and *P. caudatus* was only found in 30 samples. Only four of the specimens can be considered fully grown adults, all the other specimens were small.

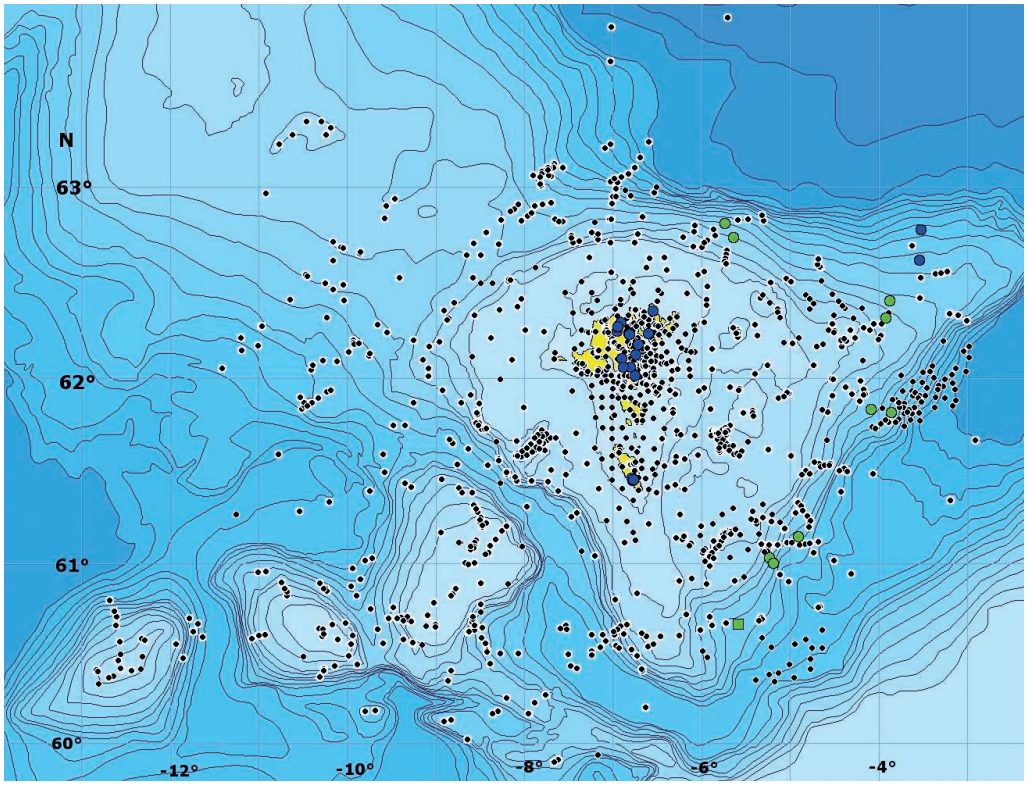


Figure 3. Map showing all stations in the Kaldbak Marine Biological Laboratory database and the occurrence of priapulids in Faroese waters. Green dots are stations with *Priapulopsis bicaudatus* and blue dots are stations with *Priapulus caudatus*. Green square shows Fisher (1922) station with *Priapulopsis bicaudatus*.

Wesenberg-Lund (1937), who investigated *P. caudatus* in East Greenland waters, found them to be spread all over eastern Greenland, but stated that it is evident that they were scarce. This was also the impression from Iceland (Wesenberg-Lund, 1937b).

The majority of the specimens are found in shallow waters. Only two of the stations were from deeper water: one specimen from 808 m and one specimen from 1032 m depth. There is no indication of any error made in identification, labeling or any part of the registration. Large specimens seem to prefer very soft sediments, while smaller specimens generally can be found in soft sediments. It is remarkable that all the specimens from shallow waters are found in the fjords with no findings on the Faroe Plateau. This could be because the seabed fabric of the near shore and plateau are dominated by seabed types not suitable for *P. caudatus*. This is not very likely, however, there are soft bottom areas on the Faroe Plateau and on the slope that have been heavily sampled and did not contain any *P. caudatus*.

Priapulopsis bicaudatus is only registered on the eastern slope of the Faroe Plateau in a relatively narrow depth interval from 507 to 798 m. This is just below the warm northward flowing Atlantic waters, which reach down to about 500 m, in the uppermost part of the colder southward flowing water masses from the Norwegian Sea to the north of the Faroe Islands (Hansen and Østerhus, 2000).

Wesenberg-Lund (1937b) found *P. bicaudatus* to be restricted to the colder waters on the northern and eastern side of Iceland and only found a few specimens at depths from 90 - 220 m.

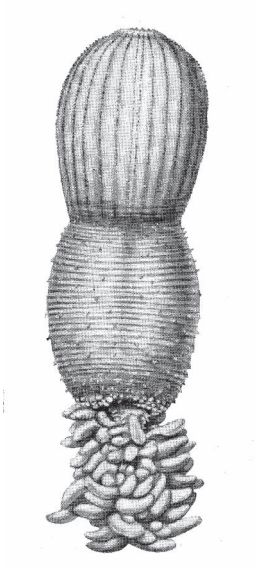
A possible explanation for the rather special distribution in the Faroe area could be the East Icelandic Current (EIC), which more or less flows along the north and eastern side of the Icelandic coast towards the north of the Faroe Islands before making a turn to the north and occasionally extends down into the Faroe side of the Faroe-Shetland Channel (Hansen and Østerhus, 2000). It is tempting to link the Icelandic findings on the north and eastern side of Iceland to these Faroese findings.

Identification key

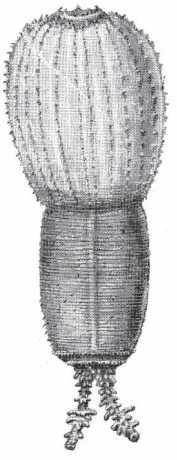
Key to species

1. One caudal appendage. The first (anterior-most) ring of pharyngeal elements consists of 5 large "normal" teeth. Proboscular scalids more or less equal in size.
   In the Faroe area mostly found in soft sediments in warm shallow waters (less than 100 m) but can also be found deeper.
   Priapulus caudatus

2. Two caudal appendages The first (anterior-most) ring of pharyngeal elements consists of 10 minute rudimentary pectinate plates. Proboscular scalids usually arranged into sets of five where the first one is larger than the others.
   Cold water species from below 500 m depth in the Faroe area.
   Priapulopsis bicaudatus



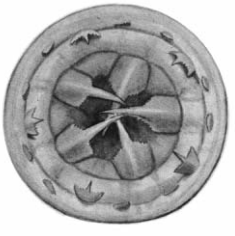
4a. Priapulus caudatus



4b. Priapulopsis bicaudatus

4c. Oral hooks

4d. Introvert scalids



4e. Oral hooks

4f. Introvert scalids

Figure 4. *Priapulus caudatus* (a, c and d). *Priapulopsis bicaudatus* (b, e and f). Pictures from Wesenberg-Lund (1930).

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