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NOTES ON THE GENUS *PANDALINA* IN NORWEGIAN WATERS (CRUSTACEA DECAPODA)

By

LITA GREVE

Museum of Zoology, University of Bergen

ABSTRACT

The paper is a revision of the Norwegian *Pandalina*. Two species, *P. brevirostris* and *P. profunda*, have been found in Norwegian waters. New records are given together with notes on the geographical distribution. *P. brevirostris* is a shallow-water species not found below 180 m. *P. profunda* prefers deeper waters and is not found above 54 m. The systematic characters which separate the two species are discussed.

INTRODUCTION

Prior to 1946 *Pandalina brevirostris* (RATHKE, 1843) was the only species of *Pandalina* known from Scandinavian waters. HOLTHUIS in 1946 described a new *Pandalina* species, *P. profunda*, which is closely related to *P. brevirostris*. *P. profunda* was recorded by HOLTHUIS from four widely scattered localities viz. Barents Sea, 74°16' N, 29°47' E; east of the Shetlands, 61°52' N, 1°42' E; Bergen, Norway, and off the Portuguese coast, 41°13' N, 11°39.6' E.

In order to determine the distribution of *P. profunda* along the Norwegian coast and the upper limit of the depth range of this species, the material in Norwegian museums has been examined and supplemented with new material collected in the vicinity of the Biological Station of the University of Bergen. Unfortunately some of the older museum specimens are so damaged that they can only be determined to genus. These specimens, which include records mentioned in older works on Norwegian *Pandalina* (APPELLÖF, 1906; DONS, 1915; GRIEG, 1927), are not listed below.

INVERTEBRATE
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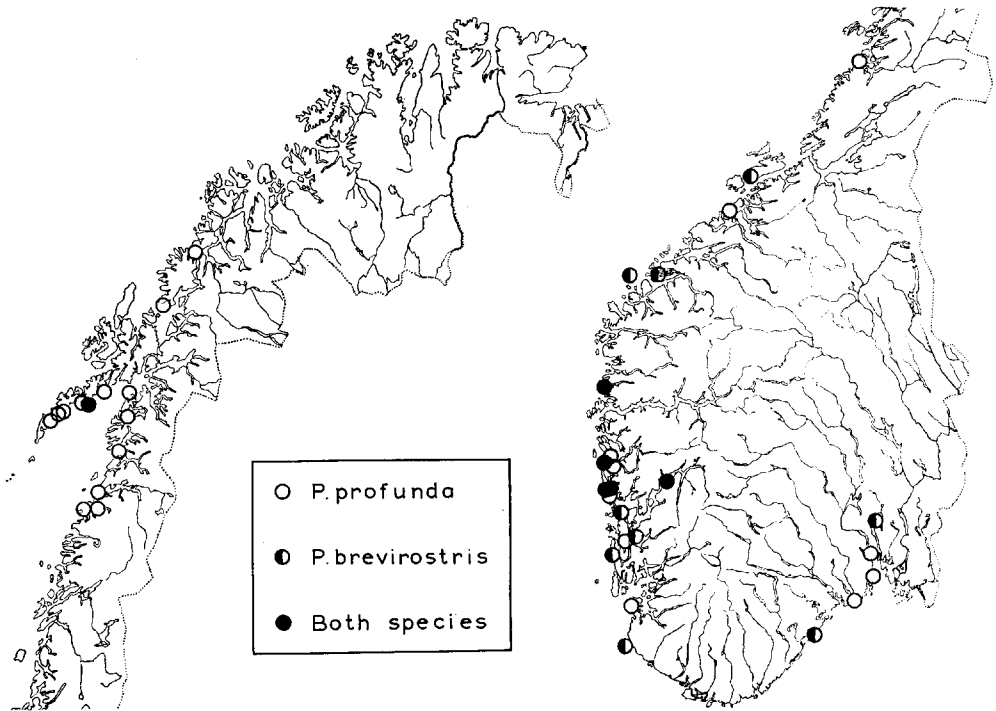


Fig. 1. Horizontal distribution of *Pandalina profunda* and *P. brevisrostris*.

Pandalina brevisrostris RATHKE, 1843

The differences between *P. brevisrostris* and *P. profunda* will be discussed under *P. profunda*.

The Norwegian distribution of *P. brevisrostris* is shown in Fig. 1. The most northerly locality in Norway is Östnesfjorden in Lofoten. Three samples from Malangen all contained specimens of *P. profunda* only, and this often cited locality must thus be excluded. The vertical distribution is given in Table 1. The deepest record is from 180 m, Hjeltefjorden, 17 March 1906. ALLEN (1965), who worked with material from off Northumberland, found *P. brevisrostris* from 1 m to 90 m but most common from 36 m to 54 m.

The life cycle and biology of *P. brevisrostris* have been extensively surveyed by ALLEN (1965).

List of records: Zoological Museum, Oslo, F. 630, F. 4200, F. 4201. — Zoological Museum, Bergen, 5765, 6030, 6291, 6350, 7017, 8989, 8991, 8992, 8993, 8994, 8998, 9322, 10055, 10056, 10057, 12263, 32003, 40447, 48071, 48072, 47073. — Tromsø Museum, 651, 2361.

Pandalina profunda HOLTHUIS, 1946

Taxonomy. HOLTHUIS (1946) points to five main distinctions between *P. profunda* and *P. brevisrostris*. Four of these are morphological characters, the fifth lies in the bathygraphical distribution of the two species and will be discussed under "Distribution". Of the four characters mentioned by HOLTHUIS, only Nos. 2 and 4 are absolute, according to him, while the other two are less universal.

Measurements. The males measured — from tip of rostrum to end of telson — from 15(5) mm to 39(10) mm, and the females from 16(5) mm to 33(9) mm. The numbers in brackets indicate the length from the posterior rim of the eye socket to the posterior lateral edge of the carapace (see ALLEN, 1965). The material is too scanty to give much information on the biology.

Females with eggs were found from late March to September, the eggs' stage of development corresponding with the time of year — slight in the spring months and increasing as the year advanced. The length of egg-carrying females was from 21(6) mm to 33(9) mm.

Colour. The colour of the living animals is like that of *P. brevisrostris* as described by ALLEN (1965).

Distribution. The horizontal distribution along the Norwegian coast is shown in Fig. 1.

The vertical distribution of both species is given in Table 1. My deepest record of *P. profunda* is 530 m, the shallowest from 54—90 m. Table 1 shows an

Table 1. Depth distribution of samples of *Pandalina brevisrostris* and *P. profunda*.

Depth in m	0— 49	50— 99	100— 149	150— 199	200— 249	250— 299	300— 399	400— 499	500— 599
<i>P. brevisrostris</i>	16	5	2	1	0	0	0	0	0
<i>P. profunda</i>	0	1	9	7	8	3	2	0	1

overlapping zone of approximately 150 m, where both species can be found. The bathymetrical distribution is thus no reliable determinant in shallow waters. In some of my samples both species were found together.

List of records: Oslofjorden, Vallö, 54—90 m. Z. M. Oslo¹ F 4203 — Oslofjorden, N of Gråöya (59°42.6'N, 10°32.9'E), 16 June 1953, 106 m, mud, 5 specimens. Museum Leiden 19422. — Oslofjorden, Gråøyrennen (59°41.7'N, 10°33.2'E), 17 June 1953, 111 m, mud, 3 specimens. Museum Leiden 19423. — Oslofjorden, Gråøyrennen (59°41.7'N, 10°33.2'E), 18 June 1953, 150 m, mud, 8 specimens. Museum Leiden 19424. — Breviksfjorden, 29 Nov. 1899, 100—120 m, 1 specimen. Z. M. Berg.² 8997. — Boknfjorden, *Michael Sars* St. 113, 3 July 1908, c. 100 m, 1 specimen. Z. M. Berg. 8996. — Hardangerfjorden, Jondal, 1905—1912, 20—300 m, 4 specimens. Z. M. Berg. 12263. — Hardangerfjorden, Romsasundet (59°40.5'N, 5°47.4'E), Z 107—58³, 12 Nov. 1958, 112—132 m, sandmixed mud, 1 specimen. Z. M. Berg. 48074. — Bergen, 1 speci-

¹ Z. M. Oslo = Zoological Museum, Oslo.

² Z. M. Berg. = Zoological Museum, Bergen.

³ The Hardangerfjord Survey reference number Z 107—58.

men, Z. M. Berg. 6000. — Korsfjorden (60°8.5'N, 5°8'E), Biol. St. 418—64¹, 28 Aug. 1964, 300—50 m, hard-bottom and sand, 2 specimens. Z. M. Berg. 48075. — Håkonsund, 1875, 1 specimen. Z. M. Berg. 2892. — Raunefjorden (60°16'N, 5°8'E), Biol. St. 4—61, 17 Jan. 1961, 240 m, mud, 3 specimens. Z. M. Berg. 48076. — Raunefjorden (60°15'N, 5°9'E), Biol. St. 51—66, 10 March 1966, 240 m, mud, 1 specimen. Z. M. Berg. 48077. — Raunefjorden (60°15'N, 5°9'E), Biol. St. 118—66, 10 May 1966, 240 m, mud, 3 specimens. Z. M. Berg. 48078. — Herløjfjorden (= Herdlafljorden), 7 Aug. 1901, 4 specimens. Z. M. Berg. 6301. — Herløjfjorden, 4 July 1902, 6 specimens. Z. M. Berg. 9327. — Herløjfjorden, 11 Sept. 1907, c. 100 m, 2 specimens. Z. M. Berg. 40447. — Hjeltefjorden, *Michael Sars* St. 4, 17 March 1906, 180 m, 1 specimen. Z. M. Berg. 8993. — *Michael Sars* St. 286 (61°15'N, 1°6'E), 25 June 1906, 170 m, sand, 7.2 C, 1 specimen. Z. M. Berg. 6442. — *Michael Sars* St. 284 (61°43'N, 1°16'E), 25 June 1906, 190 m, 7.7°C, 1 specimen. Z. M. Berg. 6997. — *Michael Sars* St. 284 (61°43'N, 1°16'E), 26 June 1906, 190 m, 7.2°C, 1 specimen. Z. M. Berg. 8990. — *Michael Sars* St. 30 (62°26'N, 3°42'E), 25 May 1905, 200 m, 2 specimens. Z. M. Berg. 6222. — *Michael Sars* St. 21 (61°52'N, 1°08'E), 21 March 1906, 4 specimens. Z. M. Berg. 14059. — Askvoll, Aug. 1891, 100 m, 2 specimens. Z. M. Berg. 32002. — Arnøy (67°11'N, 3°15'E), 30 March 1900, 300—400 m, 2 specimens. Z. M. Berg. 9323. — Mordalsfjord, 3 March 1900, 50—150 m, 1 specimen. Z. M. Berg. 8999. — Østnesfjorden III², 23 March 1900, 130 m, 1 specimen. Z. M. Berg. 6291. — Balstad, Lofoten, 26 March 1900, 150 m, 6 specimens. Z. M. Berg. 6047 and 9329. — Mortsund I², 22 Feb. 1899, 200—250 m, 6 specimens. Z. M. Berg. 9330. — Mortsund, 22 Feb. 1900, 100 m, 1 specimen. Z. M. Berg. 6057. — Sagfjorden, 17 Feb. 1899, 200 m, 1 specimen. Z. M. Berg. 9334. — Mouth of Raftsundet, 6 Feb. 1899, 250—300 m, 1 specimen. Z. M. Berg. 9331. — Skråva, 15 Feb. 1899, 200—400 m, 1 specimen. Z. M. Berg. 9326. — Henningsvær I², 6 March 1899, 180 m, 2 specimens. Z. M. Berg. 6049. — Foldenfjorden (67°37'N, 15°2'E), 6 April 1900, 530 m, 3 specimens. Z. M. Berg. 6046. — Saltenfjord (67°14.5'N, 14°26'E), 5 April 1900, 200—380 m, 10 specimens. Z. M. Berg. 9325. — Ure I², 5 March 1899, 200—250 m, 2 specimens. Z. M. Berg. 6325. — Senja, Gaukvarøy I² (68°41'N, 14°2'E) 11 April 1899, 250 m, 1 specimen. Z. M. Berg. 9328. — Senja, Gaukvarøy II² (68°34'N, 14°17'E), 11 April 1899, 250 m, 2 specimens. Z. M. Berg. 9332. — Malangen III², 14 April 1899, 100—200 m, 1 specimen. Z. M. Berg. 9324. — Malangen III², 14 April 1899, 100—380 m, 2 specimens. Z. M. Berg. 9333. — Malangen, 14 April 1899, 380 m, 1 specimen. Z. M. Berg. 6054. — Some of the above-mentioned material has earlier been mentioned as *P. brevirostris* by APPELLÖF (1906), DONS (1915) and GRIEG (1927).

DISCUSSION

P. profunda is supposed to have larger eyes (difference No. 2) than *P. brevirostris*, but judging from my material, this difference is not easy to measure exactly. Many of my specimens come from shallower waters than HOLTHUIS's animals, which could possibly be a reason for their having smaller eyes, but I have also animals from a depth around only 100 m with very large eyes.

The other absolute difference (No. 4) is the different shape of the dactylus in the two species, and this I consider by far the most important character. I have therefore only included in the list of records specimens which still possessed their third dactylus. (This excluded many of the older samples). Fig. 2A shows a normal dactylus of *P. brevirostris*, Fig. 2C a normal dactylus of *P. profunda*. Some specimens, however, have the dactylus of a shape which places them between

¹ Biological Station (Univ. Bergen) reference number 418—64.

² See NORDGAARD (1905).

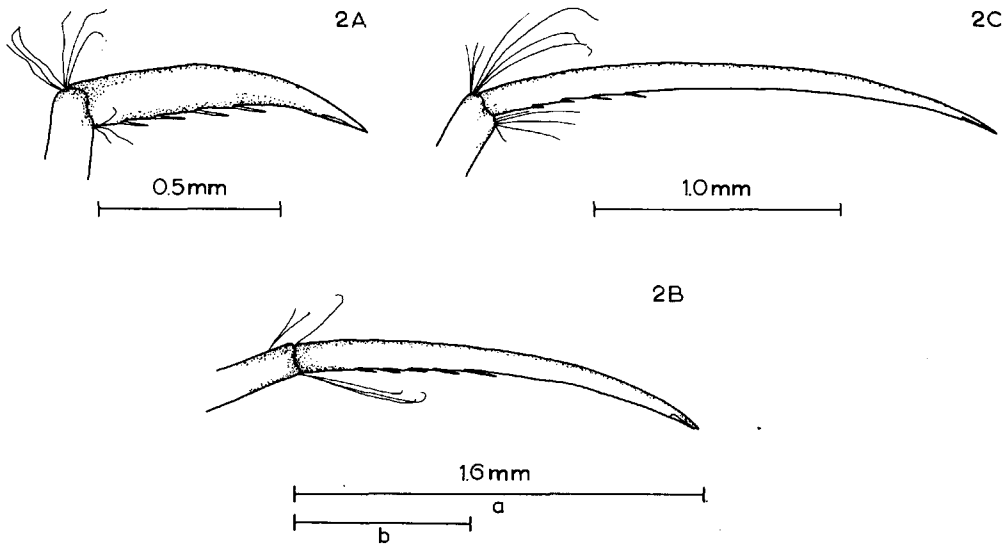


Fig. 2. A normal dactylus of *Pandalina brevisrostris*. B dactylus of an intermediate form between *P. brevisrostris* and *P. profunda*. C normal dactylus of *P. profunda*. *a* total length of the dactylus, *b* part of the dactylus where the spines are dispersed, measured from last spine-root to base of the joint.

the two main types (Fig. 2B). Two measurements are therefore of vital importance for distinguishing the two species: the whole length of the dactylus measured as percentage of the total length of the animal, *a* in Fig. 2B, and the part of the dactylus where the spines are dispersed over the posterior margin, measured from the base of the joint to the last spine-root, *b* in Fig. 2B.

Of each species 30 animals were measured, 20 of these from the bathygraphically overlapping zone. In *P. brevisrostris* the length of the dactylus varied from 2.6% to 5.3% of the total length of the animal, but only one specimen had a dactylus length above 4.5%. In *P. profunda* the variation was from 3.9% to 7.0%, but with only one specimen below 4.5%. In *P. brevisrostris* the length of the posterior spine-covered margin of the dactylus was always distinctly more than 1/2 the total length of the dactylus, in *P. profunda* always less than 1/2 that length.

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