

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/382528979>

Further records of the deep-water scalpellid *Catherinum proximum* (Pilsbry, 1907) (Cirripedia, Scalpellomorpha, Scalpellidae) off western Baja California, Mexico Nuevos registros de...

Article · July 2024

CITATIONS

0

READS

41

3 authors:



[Michel Edmond Hendrickx](#)

Universidad Nacional Autónoma de México

298 PUBLICATIONS 3,928 CITATIONS

[SEE PROFILE](#)



[Gianna Innocenti](#)

University of Florence

113 PUBLICATIONS 767 CITATIONS

[SEE PROFILE](#)



[Charlotte Seid](#)

University of California, San Diego

14 PUBLICATIONS 126 CITATIONS

[SEE PROFILE](#)

Further records of the deep-water scalpellid *Catherinum proximum* (Pilsbry, 1907) (Cirripedia, Scalpellomorpha, Scalpellidae) off western Baja California, Mexico

Nuevos registros del escarpélido de aguas profundas *Catherinum proximum* (Pilsbry, 1907) (Cirripedia, Scalpellomorpha, Scalpellidae) frente a Baja California, México

Michel E. Hendrickx^{1,4}, Gianna Innocenti² and Charlotte Seid³

¹ Unidad Académica Mazatlán, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, P.O. Box 811, Mazatlán, 82000, Sinaloa, Mexico

² Museo di Storia Naturale, Sezione di Zoologia ‘La Specola’, Università degli Studi di Firenze, via Romana 17, I-50125 Firenze, Italy

³ Benthic Invertebrate Collection, Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093

⁴ Corresponding author: michel@ola.icmyl.unam.mx

ABSTRACT

The deep-sea barnacle *Catherinum proximum* (Pilsbry, 1907) has been rarely recorded from the eastern Pacific since it was described. It has been previously reported in three localities, between Point Conception, California, USA, and Panama. During a deep-water survey six specimens of this species were collected at 2046 m depth off Baja California, western Mexico, below the lower limit of the core of the Oxygen Minimum Zone, in the following environmental conditions: dissolved O₂, 1.60 ml/l; temperature, 2.26°C; salinity, 34.62; sediments 11% clay, 87% lime, and 2% sand; organic matter content, 7.86%. Additional material available from the Scripps Institution of Oceanography Benthic Invertebrate Collection is also reported.

Key words: Eastern Pacific, deep sea, barnacles

RESUMEN

Desde su descripción, el cirrípedo de aguas profundas *Catherinum proximum* (Pilsbry, 1907) ha sido escasamente registrado en el Pacífico Este. Es conocido de tres localidades, desde Point Conception, California, USA, hasta Panamá. Durante un estudio en aguas profundas, seis especímenes fueron recolectados en 2046 m de profundidad, frente a Baja California, en la costa oeste de México, por debajo del límite inferior de la Zona del Mínimo de Oxígeno, en las siguientes condiciones ambientales: O₂ disuelto, 1.60 ml/l; temperatura, 2.26°C; salinidad, 34.62; sedimentos 11% arcilla, 87% limo y 2% arena; contenido en materia orgánica, 7.86%. Se reporta material adicional contenido en la ‘‘Scripps Institution of Oceanography Benthic Invertebrate Collection’’.

Palabras clave: Pacífico Este, cirrípedos, aguas profundas

INTRODUCTION

The barnacles belong to the subclass Thecostraca, which is divided in three superorders: Acrothoracica, Rhizocephala and Thoracica (Chan et al. 2021). The superorder Thoracica is composed of stalked and sessile species, occurring in shallow and deep water (Chan et al. 2009). They attach to hard substrates (e.g., rocks, floating objects, ship hulls) and to other animals (e.g., hydrozoans, bryozoans, corals, arthropods, shells, echinoderms, turtles, whales) (Buhl-Mortensen & Hoeg 2013, Shalaeva 2014, Buhl-Mortensen & Assel 2021). Scalpellidae cirripeds are part of the very diverse group of stalked barnacles. They comprise about 330 species in more than 30 genera inhabiting shallow and deep waters (Buhl-Mortensen & Hoeg 2013, Buhl-Mortensen & Assel 2021).

Because it is time-consuming and requires large ocean-going vessels, deep-water samples are not readily available in institutions and museum collections. In some cases, deep-water species are known from only one or very few specimens that were originally collected and described, and never reported again. Deep-water stalked barnacles are no exception and in many cases records are extremely limited in number (Shalaeva 2014).

In a recent study, seven species of stalked barnacles were reported from western Mexico, including the rare deep-water *Barbascalpellum sanctaebarae* (Pilsbry, 1907) which was collected in this area for the first time (Hendrickx & Innocenti 2019). The same authors presented a list of 11 species of "Lepadiformes" (currently included in Lepadoidea) and six species of Scalpelliformes stalked barnacles reported for western Mexico (Hendrickx & Innocenti 2019). A small series of specimens of yet another deep-water species belonging to the speciose genus *Catherinum* Zevina, 1978, was overlooked during this previous study and is reported herein. This species, *Catherinum proximum* (Pilsbry, 1907) (subfamily Amigdoscalpellinae Gale, 2015), inhabits mainly deep water in the eastern Pacific Ocean. The formally published records of *C. proximum* that include new material are sparse, and the last one dates back to 1929 (MacDonald, 1929). In this short note we record *C. proximum* from Baja California, update the knowledge about its distribution, and provide environmental conditions in which it was collected.

MATERIAL AND METHODS

Specimens were collected with a benthic sledge (2.9 m wide x 0.9 m high) during the XVI-B cruise of the TALUD project, aimed at collecting deep-water invertebrates and fishes off western Mexico. Sampling was performed aboard the R/V *El Puma* of the Universidad Nacional Autónoma de México (UNAM) (see Hendrickx 2012). Specimens were identified and sexed following the available literature (Pilsbry 1907, Zevina 1978). The total length (TL), carapace width (CW), and capitulum length (CL) were measured using a digital caliper (0.01 mm). The material examined has been deposited in the Regional Collection of Marine Invertebrates in Mazatlán (ICML-EMU), Mexico, and in the Crustacean Collection of the Zoological Museum of the Florence University (MZUF), Italy. Other abbreviations are: AMNH, American Museum of Natural History, New York, USA; SIO-BIC, Scripps Institution of Oceanography Benthic Invertebrate Collection, La Jolla, USA; St., station; USNM, United States National Museum (Smithsonian Institution), Washington, USA.

RESULTS AND DISCUSSION

Taxonomy

Class Thecostraca Gruvel, 1905

Subclass Cirripedia Burmeister, 1834

Infraclass Thoracica Darwin, 1854

Superorder Thoracicalcareia Gale, 2015

Order Scalpellomorpha Buckeridge & Newman, 2006

Superfamily Scalpelloidea Chan, Dreyer, Gale, Glenner, Ewers-Saucedo, Pérez-Losada, Kolbasov, Crandall & Høeg, 2021

Family Scalpellidae Pilsbry, 1907

Subfamily Amigdoscalpellinae Gate, 2015

Catherinum Zevina, 1978

The genus *Catherinum* currently contains 47 species, of which two are fossils (Chan et al. 2021, WoRMS editorial board 2024).

Catherinum proximum (Pilsbry, 1907)

(Figs. 1, 2, 3A)

Scalpellum proximum Pilsbry, 1906 (1907): 197, pl. VI, figs. 9–11; Moore 1911: 282; MacDonald 1929: 536, pl. 1, figs. 1–3, pl. 2, fig. 5; Hartman & Barnard 1958: 99.

Verum proximum.— Zevina, 1981: 229, fig. 166; Young, 2007: 69 (list); Beaulieu, 2001: 154 (Table 4).

Material examined. TALUD XVI-B cruise, station 15 (29°40.4'N, 116°06'W), May 29, 2014, four specimens (TL 12.9–17.3 mm; CW, 5.0–7.0 mm; CL, 10.4–13.5 mm), 2010–2046 m, benthic sledge (ICML-EMU-12987); same station, same date, 2 specimens (TL 15.6 mm, 21.1 mm; CW, 6.1 mm, 7.6 mm; CL, 11.6 mm, 14.7 mm, respectively) (MZUF-690).

Additional material examined. The holdings of SIO-BIC contain one lot confirmed as *Catherinum proximum* and two lots identified as *Catherinum* cf. *proximum*, each lot containing a single specimen (Tables 1, 2; see text below).

Confirmed distribution. From off Point Conception, California, USA, to off Panama (7°5'30"N, 79°40'W), 1608–4100 m depth.

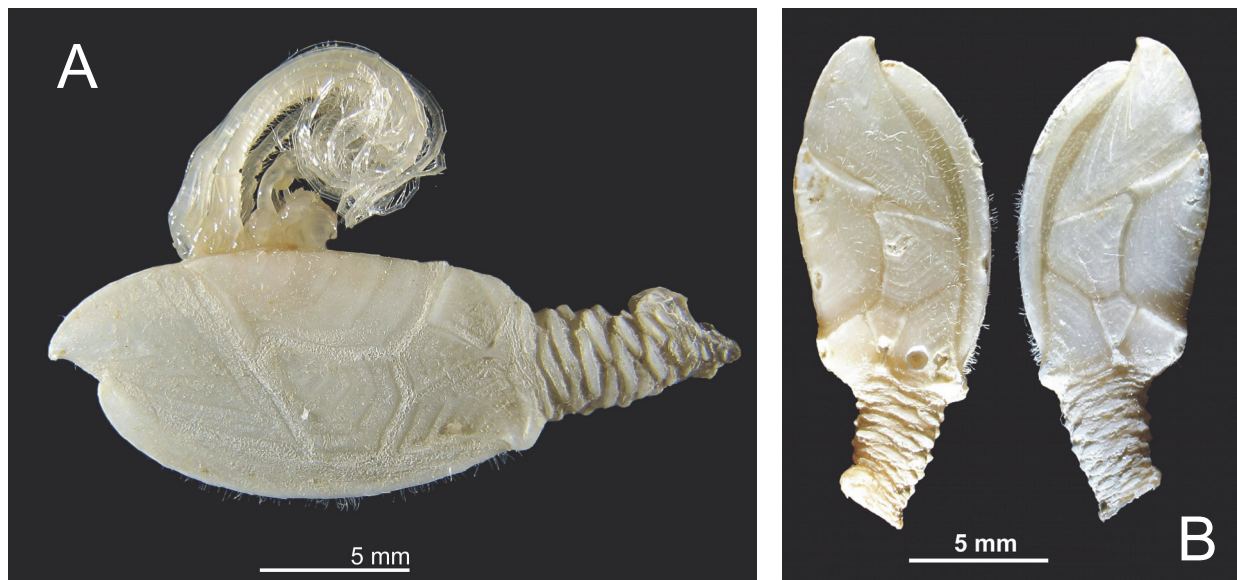


Figure 1. *Catherinum proximum* Pilsbry, 1907. A. Lateral view (MZUF-690). B. Lateral view of both faces (ICML-EMU-12987).

Remarks. The unique specimen used in the original description was collected off San Diego (type locality, *Albatross* station 4387, 32°29'30"N, 118°05'W), California, USA (USNM-32422), in 1000 fathoms (ca. 1829 m),

on an annelid tube (Pilsbry 1906) (Table 1). The specimens from the TALUD XVI-B cruise examined herein (Figs. 1, 2) fit with all diagnostic characters described by Pilsbry (1907) and in subsequent descriptions (MacDonald 1929, Zevina 1981), including the following main characteristics: capitulum with 13 well calcified white plates, scutum of irregular quadrangular shape, tergum of scalene shape, with the apex recurved, and the infra-median lateral hourglass shaped with the lower part smaller than the upper part.

Catherinum proximum has been reported successively by Moore (1911: 282), MacDonald (1929: 536), Hartman & Barnard (1958:99), and Beaulieu (2001) (see text below; Table 2). The record by Moore (1911), however, indicated the same *Albatross* sampling station as for the type material (i.e., st. 4387) used by Pilsbry (1906), but with a slightly different position (i.e., 32°32'40"N, 118°04'20"W) and a different depth (1059 fathoms or 1937 m). The log records of the *Albatross* indicate that there were two stations "4387" (4387a and 4387b) with a slightly different location (United States Bureau of Fisheries, 1904). In his monograph of cirripeds taken by the *Albatross* off Panama, MacDonald (1929) reported material (as *Scalpellum proximum*) taken at St. 3392 (10°07'05"N, 79°40'36"W), in 1270 fathoms (2322 m). Hartman & Barnard (1958: 99) briefly cited *Scalpellum proximum* but referred to the publication by Moore (1911). The most recent record is by Beaulieu (2001: Table 4) who found 20 specimens (cited as *Verum proximum*) on stalks of deep-water sponges collected at 4100 m depth, off Point Conception (34°45'N, 123°W), California. Therefore, the previous, confirmed published records are only from three localities: the type locality, off California, and off Panama (Table 1).



Figure 2. Specimens of *Catherinum proximum* attached to what is probably a piece of black coral (ICML-EMU-12987).

There were two lots initially identified as *Catherinum* cf. *proximum* and one identified as *C. proximum* in the holdings of the SIO Benthic Invertebrate Collection, in La Jolla, California (Tables 1, 2). Of these, only the lot C6624 (Fig. 3A, Table 1), identified by H.A. Pilsbry, fits well with the description of *C. proximum*. This unpublished record would place this species in a locality (28°23'N, 116°14'W) near to the locality where our material was collected (29°40.4'N, 116°06'W). Photographs of specimens of the other two lots, collected off northern Oregon (SIO-BIC C9249, Fig. 3B) and off Kaktovik, Beaufort Sea, Alaska (SIO-BIC C9267, Fig. 3C), were examined and we hereby propose to maintain the tentative identification as *C. cf. proximum* as they show a scutum with an evident triangular projection toward the tergum, a character not evident in the specimens identified as *C. proximum* (Figs. 1, 2, 3A). A molecular approach could be decisive in the identification of this morphotype, but the formalin-fixed museum specimens were unsuitable for genetic work.

Of the two species of Scalpellomorpha reported for western Mexico by Hendrickx & Innocenti (2019), the only deep-water species is *B. sanctaebarae* (depth range, 757–1088 m). In their list of species previously

reported for western Mexico, Hendrickx & Innocenti (2019: table 1) reported three additional deep-water species: *Neolepas zeviniae* Newman, 1979, *Hamatoscalpellum californicum* (Pilsbry, 1907), and *Gymnoscalpellum larvale* (Pilsbry, 1907). *Catherinum proximum* is the fifth deep-water species of ghost barnacle occurring in western Mexico. The latter may have a wider distribution along the eastern Pacific coast than what is currently recorded, but due to the low sampling efforts in deep sea the distribution of this species is still poorly known.

Table 1. Records of *Catherinum proximum* available to date in published works or in collections. ND, no data.

Locality	Identified by	Catalogue	Position	Depth	Notes
Albatross Station 4387, off San Diego (type locality)	H.A. Pilsbry	USNM 32422	32°29'30"N, 118°05'W	1829 m	Type. Collected 1904-03-22. On an annelid tube
Albatross Station 5689, off Guadalupe Island, Mexico	H.A. Pilsbry	SIO-BIC C6624	28°23'N, 116°14'W	1608 m	Collected 1911-04-24; ex AMNH Crustacea 5364
Albatross Station 3392, off Panama	R. MacDonald	None	7°5'30"N, 79°40'W	2322 m	MacDonald 1929. Collected 1893-08-19 (see Townsend, 1901)
Albatross Station 4387, off southern California	? H.A. Pilsbry	None	32°32'40"N, 118°04'20"W	1954 m	Moore 1911. Collected 1904. Probably the type used by H.A. Pilsbry
San Clemente Basin, California, USA	ND	None			Hartman & Barnard 1958 (referencing Moore, 1911)
Off Point Conception, California, USA	W. Newman	None	34°45'N, 123°W		Beaulieu 2001. On sponge stalks, 4100 m depth

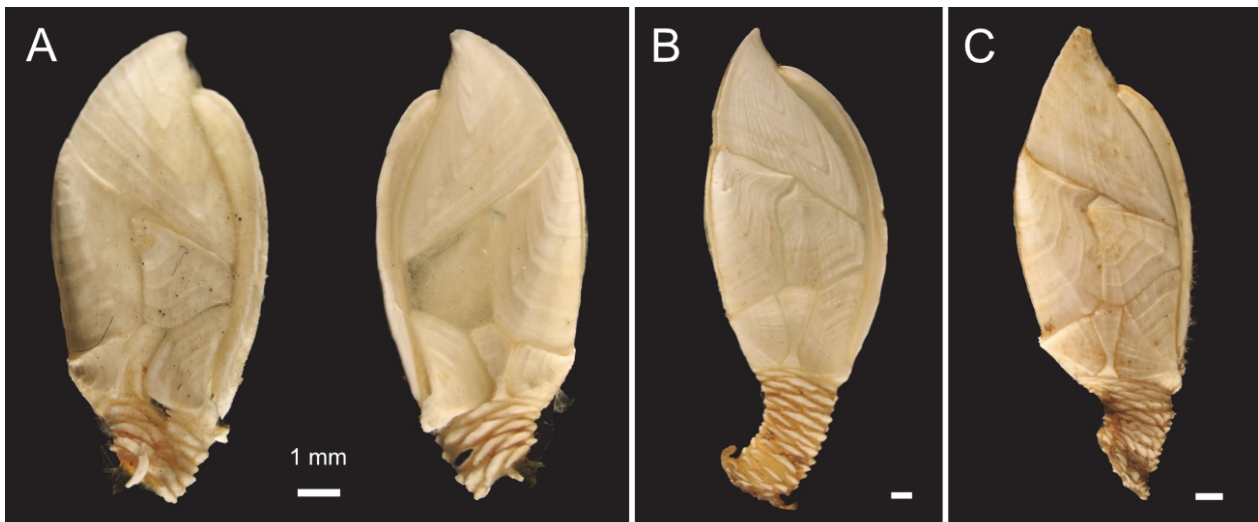


Figure 3. A. Preserved specimen of *Catherinum proximum* from northern Mexico (SIO-BIC C6624). B, C. Preserved specimens of *Catherinum* cf. *proximum*, (B) from northern Oregon (SIO-BIC C9249) and (C) from the Beaufort Sea (SIO-BIC C9267). Scale is 1 mm in all figures.

Table 2. Records of *Catherinum* cf. *proximum* available to date in museum collections.

Locality	Identified by	Catalogue	Position	Depth	Notes
Off northern Oregon, USA	M.A. Alspach	SIO-BIC C9249	44°42.9'N, 127°28.0'W	2600 m	R/V <i>Acona</i> , otter trawl, collected 1963-08-15; ex Oregon State University Department of Oceanography accession number 14-19
Off Kaktovik, Beaufort Sea, Alaska, USA	R. Van Syoc	SIO-BIC C9267	70°43.1'N, 143°42.8'W	464 m	R/V <i>Glacier</i> , otter trawl, collected 1972-08-05; ex Oregon State University Department of Oceanography accession number 449-45

Habitat and ecology. The type specimen of *C. proximum* was attached to an unidentified annelid tube (Pilsbry 1906). In his study on the Polychaeta collected by the *Albatross* off southern California, Moore (1911) reported specimens of *C. proximum* (cited as *Scalpellum proximum*) on old tubes of *Hyalinoecia tubicola* (O.F. Müller, 1776) collected on green mud in 1059 fathoms (1954 m) (*Albatross* station 4387, 32°32'40"N, 118°04'20"W); no temperature data available. Station 4387 of the *Albatross* cruises, however, is the station from where Pilsbry (1906) described *Scalpellum proximum* and it will therefore appear that Moore (1911) was referring to the same material.

The material cited by MacDonald (1929) off Panama was taken at 1270 fathoms (2322 m), on hard bottom, with water temperature of 36.8°F (about 2.7°C). The material in the holding of the SIO-BIC, presumably identified by H.A. Pilsbry (i.e., lot C6624), was taken in 879 fathoms (1608 m).

Material reported by Beaulieu (2001) on sponges stalks came from a much deeper locality, 4100 m, the deepest record available so far for *C. proximum*.

The TALUD XVI-B material was collected in the following environmental conditions (measured near bottom): 2010–2046 m depth; dissolved O₂, 1.60 ml/l; temperature, 2.26°C; salinity, 34.62. Sediments at the sampling locations were made of 11% clay, 87% lime, and 2% sand, with an organic matter content of 7.86%. Three of the specimens collected during this study were attached to a piece of dark stalk (Fig. 2). Bribiesca-Contreras et al. (2022) reported the presence of *Catherinum* cf. *novaezelandiae* (Hoek, 1883), in the Clarion-Clipperton zone, attached to a stalk of a glass sponge at 5241 m depth. Comparison of photographs from Bribiesca-Contreras et al. (2022: fig. 7) with our material (Fig. 2) show some similarity but the specimens in this study could more likely be attached to a piece of dead, black, soft coral. Pitriana et al. (2020), for example, reported the presence of *Paralepas minuta* (Philippi, 1836) attached to a dead stem of gorgonian collected in 336–346 m depth.

ACKNOWLEDGEMENTS

Shiptime aboard the R/V “El Puma” was provided by the Coordinación de la Investigación Científica, UNAM, Mexico. The TALUD XVI-B cruise and the TALUD project were partly supported by CONACyT grant 179467. We thank Yves Samyn (Belgium) for his help with transfer of material to Florence, Italy, and Oleg Poltarukha (Russia) and Marcos Tavares (Brasil) for their help with literature. We also thank José Salgado Barragán for taking and processing photographs for figures 1B and 2 and Mercedes Cordero Ruiz for the final edition of this manuscript.

REFERENCES

- Beaulieu, S.E. 2001. Life on glass houses: sponge stalk communities in the deep sea.— *Marine Biology* 138: 803–817.
- Bribiesca-Contreras, G., T.G. Dahlgren, D.J. Amon, S. Cairns, R. Drennan, J.M. Durden, M.P. Eléaume, A.M. Hosie, A. Kremenetskaia, K. McQuaid, T.D. O’Hara, M. Rabone, E. Simon-Lledó, C.R. Smith, L. Watling, H. Wiklund, & A.G. Glover. 2022. Benthic megafauna of the western Clarion-Clipperton Zone, Pacific Ocean.— *ZooKeys* 1113: 1–110.
- Buhl-Mortensen, L., & J.T. Høeg. 2013. Reproductive strategy of two deep-sea scalpellid barnacles (Crustacea: Cirripedia:

- Thoracica) associated with decapods and pycnogonids and the first description of a penis in scalpellid dwarf males.— *Organisms Diversity & Evolution* 13: 545–557.
- , & A. Hassel. 2021. Distribution and habitat of Scalpellidae (Cirripedia: Thoracica) in the Norwegian and Barents Seas.— *Marine Biology Research* 17 (3): 223–233.
- Chan, B.K.K., R.E. Prabowo, & K.S. Lee. 2009. Crustacean fauna of Taiwan: barnacles, Volume 1 – Cirripedia: Thoracica excluding the Pyrgomatidae and Acastinae. *Biotica Taiwanica*. National Taiwan Ocean University, Keelung, Taiwan, R.O.C. 297 pp.
- , N. Dreyer, A.S. Gale, H. Glenner, C. Ewers-Saucedo, M. Pérez-Losada, G.A. Kolbasov, K.A. Crandall, & J.T. Høeg. 2021. The evolutionary diversity of barnacles, with an updated classification of fossil and living forms.— *Zoological Journal of the Linnean Society* 193 (3): 789–846.
- Gale, A.S. 2015. Phylogeny of the deep-sea cirripede family Scalpellidae (Crustacea, Thoracica) based on shell capitular plate morphology.— *Zoological Journal of the Linnean Society* 176 (2): 266–304.
- Hartman, O., & J.L. Barnard. 1958. Benthic fauna of deep basins.— *Allan Hancock Pacific Expeditions (Reports)* 22: 1–99.
- Hendrickx, M.E. 2012. Operaciones oceanográficas en aguas profundas: los retos del pasado, del presente y del proyecto TALUD en el Pacífico mexicano (1989–2009). Pp. 23–104, *in* Biodiversidad y comunidades del talud continental del Pacífico mexicano. Zamorano, P., M.E. Hendrickx, & M. Caso (eds.). Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT), Instituto Nacional de Ecología (INE). 468 pp.
- , & G. Innocenti. 2019. Goose barnacles (Cirripedia, Thoracica, Lepadiformes and Scalpelliformes) from western Mexico.— *Cahiers de Biologie Marine* 60: 59–68.
- MacDonald, R. 1929. A report on some cirripeds collected by the S.S. "Albatross" in the Eastern Pacific during 1891 and 1904.— *Bulletin of the Museum of Comparative Zoology* 69 (15): 525–538.
- Moore J.P. 1911. The polychaetous annelids dredged by the US "Albatross" off the coast of southern California. III. Euphrosynidae to Goniadidae.— *Proceedings of the Academy of Natural Sciences of Philadelphia* 63 (2): 234–318.
- Pilsbry, H. 1906 (1907). Cirripedia from the Pacific coast of North America.— *Bulletin of the Bureau of Fisheries* 26: 191–204.
- Pitriana, P., D.S. Jones, L. Corbari, & K. von Rintelen. 2020. New insights gained from museum collections: Deep-sea barnacles (Crustacea, Cirripedia, Thoracica) in the Muséum National d'Histoire Naturelle, Paris, collected during the Karubar expedition in 1991.— *Zoosystematics and Evolution* 96: 649–698.
- Shalaeva, K. 2014. An illustrated catalogue of the scalpellid barnacles (Crustacea Cirripedia Scalpellidae) collected during the HMS Challenger expedition and deposited in the Natural History Museum, London.— *Zootaxa Monograph* 3804 (1): 1–63.
- Townsend, C.H. 1901. Dredging and other records of the United States Fish Commission steamer Albatross. Extracted from U.S. Fish Commission Report for 1900: 389–562, plates I to VII. Government Printing Office, Washington, D.C. <https://doi.org/10.5962/bhl.title.83603>
- United States Bureau of Fisheries. 1904. Original logbooks of the Albatross: #5 California coast, dr 4383 to dr 4408, hy 4797 to hy 4803, Mch 18th to Apl 9th 1904. <https://doi.org/10.5962/bhl.title.98083>
- WoRMS Editorial Board (2024). World Register of Marine Species. Available from <https://www.marinespecies.org> at VLIZ. Accessed 2024-03-29. doi:10.14284/170
- Young, P.S. 2007. The Scalpellomorpha (Crustacea, Cirripedia), with a list of extant species (except the Calanticidae).— *Galathea Report* 21: 7–73.
- Zevina G.B. 1978. A new classification of the Scalpellidae Pilsbry (Cirripedia, Thoracica). 2. Subfamilies Arcoscalpellinae and Meroscalpellinae.— *Zoologicheskii Zhurnal* 9: 1343–1352 [in Russian].
- . 1981. Barnacles of the suborder Lepadomorpha (Cirripedia, Thoracica) of the World Ocean. Part I. Family Scalpellidae. *Guides to the Fauna of the USSR*, Zoological Institute, Academy of Sciences of the USSR, 127 "Nauka", Leningrad. 407 pp. [in Russian].