

# Historical development of research and current state of bryozoan diversity in the Chukchi Sea

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1. Introduction
2. Pioneer studies by Swedish and Norwegian researchers: 1800s to early 1900s
3. Studies by American scientists: 1913–1978
4. Studies by Russian scientists: 1910–2001
5. Recent studies of bryozoans in the Chukchi Sea: 1995–present
6. Current state of bryozoan diversity in the Chukchi Sea with some remarks
7. Acknowledgements

## **1. Introduction**

The Chukchi Sea is a marginal sea of the Arctic Ocean between Chukotka and Alaska. The sea is named after the Chukchi people, who are indigenous inhabitants on its shores. It is bounded by Wrangel Island on the west and Beaufort Sea on the east (Figure 1). It is connected to the Bering Sea and the Pacific Ocean by the narrow (approximately 92 km wide) and very shallow (depth of 30–59 m) Bering Strait. Because of its high latitude position and very shallow character (more than half of the total area is less than 50 m) the sea is covered by ice for long periods of time and is navigable for only four months of the year between July and October.

Chukchi Sea is an extremely interesting and important area for several reasons. It is one of the most abundant marine ecosystems in the world owing to nutrient-rich waters, supplied from the south<sup>1</sup>. This makes the area an important source of nutrients, heat and freshwater for the nearby Arctic Ocean. Arctic marine benthic communities are composed of species of Pacific and/or Atlantic origin as well as endemics.<sup>2,3</sup> The last major glaciation of the Arctic occurred approximately 18,000 years ago and ended 6000 years ago. Ice sheets covered much of the Arctic continental shelf and only the present areas of the Chukchi, Beaufort Seas and East Siberian Seas were largely unglaciated yet almost

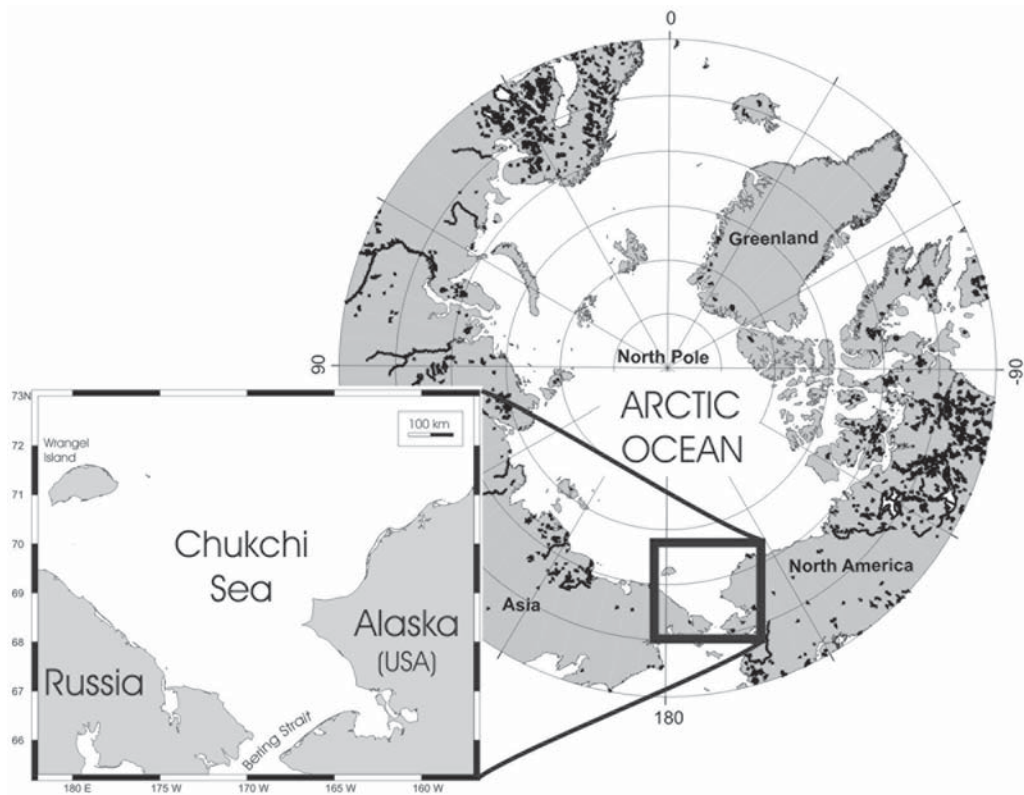


Figure 1. Location of Chukchi Sea within the Arctic.

entirely emergent.<sup>4</sup> This resulted in the recolonisation of many parts of the Arctic shelves by benthic fauna and flora over the last 6000–14000 years.<sup>5</sup> Thus, the Arctic is considered to be a geologically young environment, which is still being colonised by marine organisms from lower latitudes.<sup>6</sup> The Chukchi Sea, because of its link to Pacific Ocean via Bering Strait, can be thought of as a gateway to the Arctic Ocean. All colonizers of the Arctic of Pacific origin first have to establish themselves in this region in order to progress with colonization of more distant areas. Consequently, knowledge about the biodiversity of this area is very important and can provide us with the answers to many scientific questions, particularly with respect to the origin and evolution of Arctic biota. This historical compilation presented here focuses on bryozoans, one of the most diverse rocky bottom organisms of the Chukchi Sea and in general of the Arctic.

In spite of the Bryozoa being one of the most species-rich groups in the Chukchi Sea, this group has not been the focus of many investigations. Such investigations as have been undertaken, have over one hundred years of history. Yet, our knowledge of species diversity in this sea is still far from being complete.

The first effort to collect bryozoans of the Chukchi Sea was undertaken by the Swedish expedition on R/V *Vega* in 1878–1889. Later in the 20th century, studies on bryozoans



Figure 2. Anton Stuxberg.

have been carried out by mainly due to the efforts of both Russian and American scientists. The nationality of these latter scientific expeditions reflects the geopolitical structure of the area. Coastal waters of the Chukchi Sea belong territorially to both Russia and the United States of America. In the main part of the last century, studies by US and Russian scientists were conducted independently. American bryozoologists studied coastal areas of the Northern coast of the Alaskan Peninsula. Russian expeditions covered coastal areas of the Siberia, the Bering Straight area and the eastern and central parts of the sea. In the beginning of the 21st century the efforts of Russian and American researchers were combined to study of this important area, focusing on the southern part of the Chukchi Sea. This study aims at presenting a brief historical account of bryozoan studies undertaken in the area. More importantly we present current knowledge of bryozoan diversity in the Chukchi Sea, combining results of both Russian and American scientist as well as additional new data.

## **2. Pioneer studies by Swedish and Norwegian researchers: 1800s to early 1900s**

Swedish zoologist Anton Stuxberg (Figure 2) provided the first published information about bryozoans from the Chukchi Sea. This first record was the result of his research conducted during the *Vega* (Figure 3) expeditions along the Siberian Coast of the Chukchi Sea between 1875 and 1878, led by the famous Swedish explorer Nordenskiöld. Unfortunately, only a small part of the material from the Chukchi Sea was identified by him. In his comprehensive publication<sup>7</sup> he mentioned only *Alcyonidium mamillatum* Alder (st. 96, 97) from the area of Chukchi Sea. The remaining bryozoan samples from *Vega* expedition were delivered to the Zoological Institute in Saint-Petersburg (Russia) where they were subsequently identified by the scientist/taxonomist German Kluge. A list



Figure 3. R/V Vega.

of his determinations was published in 1952<sup>8</sup> containing 39 species. The species were collected at eight stations from the *Vega* expeditions and all of them were located near the Siberian coast at a depth range of one to eight metres (Figures 4, 5). Six species belonged to order Cyclostomata, 25 species to Cheilostomata, and two species to Ctenostomata (Table 1).

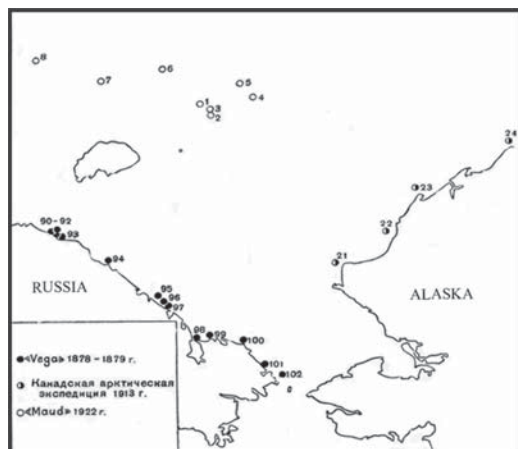


Figure 4. Map of benthos stations sampled by Swedish expedition on R/V Vega in 1878–1879, Canadian Arctic Expedition (1913) and Norwegian Polar Expedition on R/V Maud in 1922 (after Ushakov<sup>37</sup>).

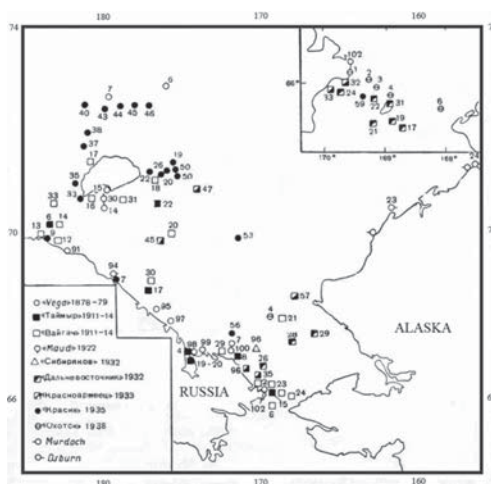


Figure 5. Locations in Chukchi Sea where bryozoan individuals were found during Russian expeditions between years 1911 and 1938 (after Kluge<sup>38</sup>).

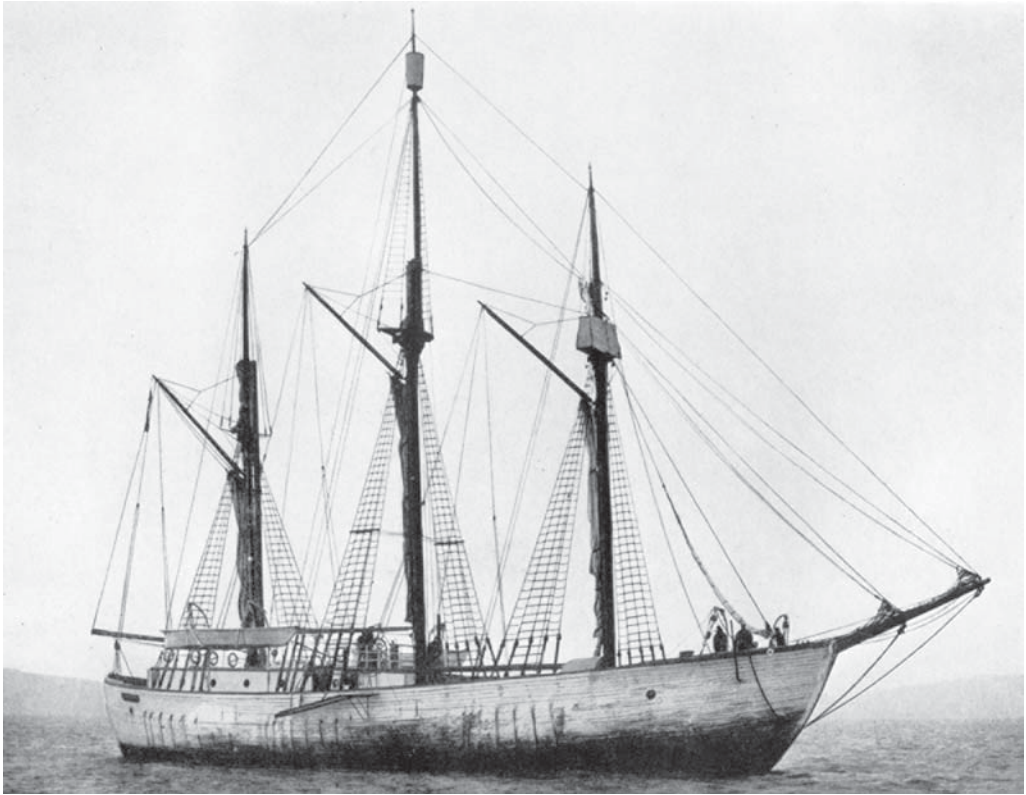


Figure 6. Maud – the ship used by Norwegian Polar Expedition between years 1918 and 1925.

In 1929 Nordgaard<sup>9</sup> published further lists of bryozoans collected by Norwegian polar expeditions on board the vessel *Maud* (1918–1925) (Figure 6). Although the scientific effort of this expedition was not small (see Figures 4, 5, 7) he recorded only three species from the northern part of the Chukchi Sea: *Eucratea loricata* L., *Serratiflustra serrulata* Busk and *Myrionzoella crustaceum* (Smitt).

## 2. Studies by American scientists: 1913–1978

New data about bryozoan fauna of this region appeared more than 30 years after Stuxberg's publication. In 1923,<sup>10</sup> Osburn (Figure 8) published the results of collections by Canadian Arctic Expeditions (1913–1918) in the American sector of the Chukchi Sea and at one station near the Siberian coast. Twenty two bryozoan species were identified along the American coastal sector: five species of cyclostome, one ctenostome, and 16 cheilostomes. *Tubulipora flabellaris* (Fabricius), *Crisia eburnea* (L., 1758), *Crisia denticulata* (Lamarck), *Entalophoroecia deflexa* (Couchin), *Eucratea loricata* (L.), *Tegella armifera* (Hincks), *Bidenkapia spitsbergensis* (Bidenkap), *Cauloramphus cymbaeformis* Hincks, *Caberea ellisi* Fleming, *Scrupocellaria scabra* (Van Beneden),

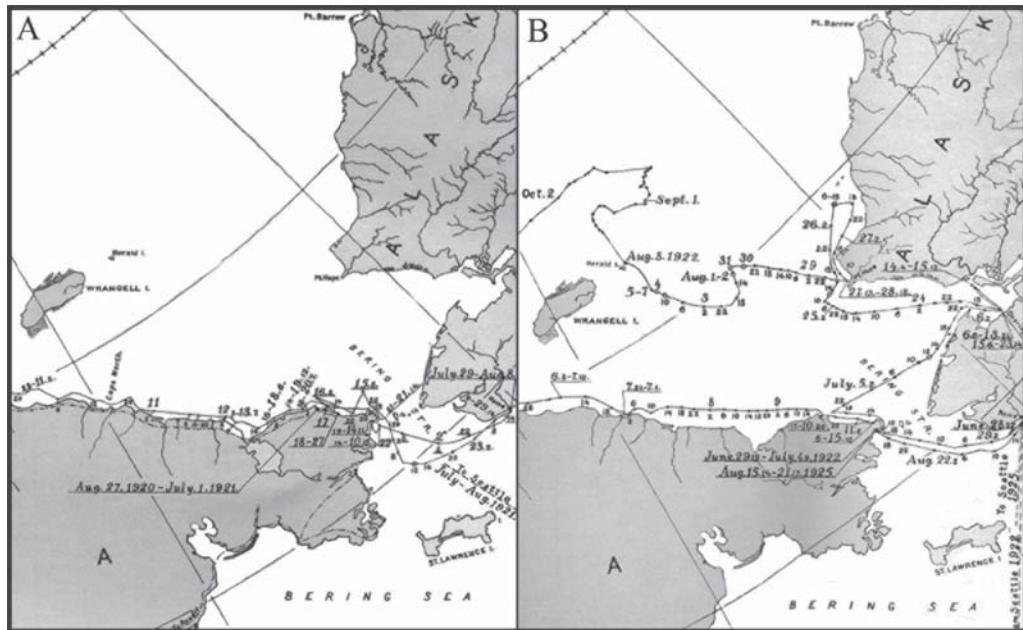


Figure 7. Route of the Maud in the Chukchi Sea area during 1918–1921 (A) and 1922–1925 (B) (after Sverdrup<sup>39</sup>).

*Cystisella saccata* Busk, *Rhaphostomella bilaminata* (Hincks), *Hippoporina reticulatopunctata* (Hincks), *Celleporina incrassata* (Lamarck) were found opposite the Icy Cape. *Securiflustra securifrons* (Pallas) and *Arctonula arctica* (M. Sars) were recorded near the Cape Sabine. Other species were found close to the north-western coast of Alaska (69° 40' N, 163° 10' W); *Fungella dalli* Kluge, 1955, *Eucretea loricata* (L.), *Dendrobeatia murrayana* (Johnston) and *Celleporella hyalina* (L.). Only four species were listed (*Eucretea loricata* L., *Carbasea carbasea* (Ellis and Solander), *Smittina bella* (Busk) and *Myriapora subgracilis* (D'Orbigny) at Cape Franklin, located near Point Barrow.

In a later publication, Osburn<sup>11</sup> remarked that the Arctic bryozoan fauna on the northern coast of Alaska (near Point Barrow) were considerably more diverse than previously recorded. He identified 110 species of bryozoans (Table 1), collected by Professor G.E. MacGinitie from the Arctic Research laboratory at Point Barrow. Identifications of the material were presented in the famous monographs published by Osburn in 1950, 1952 and 1953.<sup>12-14</sup> Among the 110 species, six were new to science (*Tubulipora hastingssae*, *Plagioecia ambigua*, *Euritina arctica*, *Bidenkapia spitsbergensis alaskensis*, *Hincksina gotica*, *Parasmittina alaskensis*).

Based on his studies of the Arctic-American area, Osburn<sup>15</sup> concluded that the bryozoan fauna of this region share an affinity with both with Atlantic and Pacific Bryozoa. Moreover, he noticed that some species have a circumpolar distribution.

In 1978 a few new records of bryozoans were added by Feder and Jewett.<sup>16</sup> During that



Figure 8. Raymond Osburn.

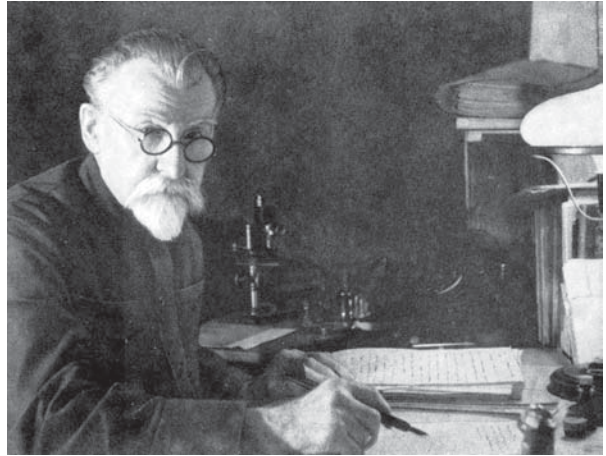


Figure 9. German Kluge.

investigation seven bryozoan taxa were found (Kotzebue Sound, located to the north of the Seward Peninsula) however, only three species were identified to species level: *Alcyonidium disciforme* Smitt, *Alcyonidium vermiculare* Okada and *Flustrellidra gigantea* Silen. The presence of both Pacific (*A. vermiculare*) and Arctic species (*A. disciforme*) established as a fact the influence of both Arctic and Pacific biotas on the origin of bryozoan fauna of the Chukchi Sea.

### 3. Studies by Russian scientists: 1910–2001

The most detailed and comprehensive bryozoan study in the Chukchi Sea and in the Arctic as a whole was carried out by the Russian bryozoologist G. Kluge (Figure 9). The material used for his investigations was collected from various localities in the Chukchi Sea during eight Russian expeditions between 1910 and 1938 (Figure 5). His broad investigation of the area resulted in a taxonomic count of 125 species and subspecies inhabiting the Chukchi shelf area, of which 16 were new to science. These were *Borgella tumulosa*, *Boverbankia composita*, *Tegella inermis*, *T. arctica* var. *retroversa*, *T. anguloavicularis*, *Callopora amisavicularis*, *C. obesa*, *Dendrobeania orientalis*, *D. pseudolevinseni*, *Bugulopsis peachi* var. *beringi*, *Hippoporella fastigiatoavicularis*, *Smittina tuberosa*, *S. beringia*, *Schizoporella stylifera* var. *perforata*, *Hippodiplosia tchukotkensis*, *Porella tumida*, *Cheilopora sincera* var. *orientalis*, *Celleporina nordenskjoldi*. In his study,<sup>17</sup> Kluge mentioned, that the presented species list of the Chukchi Sea is most likely not complete. As he pointed out this was mostly due to low sampling effort (not all samples in Kluge's disposal were being treated). His suggestion proved to be right. In studies of the bryozoan fauna from the American side of the Chukchi Sea conducted by Osburn<sup>18-21</sup> a few new species records previously not known from the area were added. Kluge was not familiar with Osburn's investigations due to later receipt of his publications into Russian libraries. As a result Osburn's data are not included in the

most comprehensive monograph of Arctic bryozoans *Bryozoa of the Northern Seas of the USSR*, the posthumous work of Kluge.<sup>22</sup>

In the first half of the last century, a large number of Russian expeditions were carried out in the Chukchi Sea. Investigations of different systematic groups in the collected material, including bryozoans, confirmed a strong influence of Arctic Seas and the Pacific Ocean on the Chukchi Sea fauna.<sup>23</sup> In 1975 benthic samples were collected along the Siberian Coast by the expedition conducted on vessel R/V *Academician Korolev*. The expedition worked in offshore waters. In 1976 a voyage of Zoological Institute of the Russian Academy of Sciences led by A.N. Golikov also undertook biological studies in the Chukchi Sea. Benthic samples were collected by scuba divers in shallow waters around Wrangel Island and in the Roger Inlet. In 1989 a large expedition on R/V *D. Laptev* provided biological samples from the open part of the Chukchi Sea.

Strong influence of Arctic Seas and the Pacific Ocean on the Chukchi Sea bryozoan fauna was confirmed during studies of distribution and their biogeography in the Arctic region (based on Kluge's data) conducted by Gontar and Denisenko<sup>24</sup> as well as Gontar.<sup>25</sup> Unfortunately, as in Kluge's case<sup>26</sup> (see above) Osburn's data<sup>27</sup> from the Alaskan coast was not taken into account during preparation of two mentioned contemporaneous studies.<sup>28, 29</sup>

#### **4. Recent studies of bryozoans in the Chukchi Sea: 1995–present**

The first international expedition with participation of both Russian and American scientists was held on the American ship, R/V *Alpha-helix*, in 1995. Specimens of bryozoans collected during those trips were identified by V. Gontar at the beginning of 2000s. The results of her identifications are kept in an archive at the Zoological Institute. In 2004, a collaborative project between Russian (Zoological Institute, St Petersburg) and American (NOAA) scientists conducted shared investigations in the Chukchi Sea. This project will continue until 2012. At the present, the material is in the process of being sorted and bryozoan identifications are still not completed. A map with recent sampling effort by those expeditions is presented on Figure 10.

#### **5. Current state of bryozoan diversity in the Chukchi Sea with some remarks**

A survey of the literature revealed the known bryozoan fauna of Chukchi Sea to be 165 species (20 cyclostomes, 12 ctenostomes, and 133 cheilostomes) (Table 1). However, current knowledge of bryozoan diversity in the Chukchi Sea including additional studies of our own unpublished data and supplementary sampling revealed higher levels of diversity than previously recorded. At the present, a tally of the bryozoan fauna indicates that there are 189 species (26 cyclostomata, 15 ctenostomata, 148 cheilostomata) (Table 1).





Figure 10. Sampling stations of various expeditions carried out by Russian and multinational expeditions between years 1976 and 2005.

Numerous expeditions to the area collected bryozoan material sporadically without any special focus on bryozoan fauna. This resulted in low numbers of bryozoan being identified at sampling stations.<sup>30-33</sup> Moreover, in many cases bryozoans were ignored or were identified only to phylum level.<sup>34</sup> There are examples of investigations where bryozoans are listed but their identification was not determined by a specialist, and therefore may not be reliable.<sup>35</sup> As a result of the limited study effort in Chukchi Sea, its physical isolation and the lack of information flow between Russian and American bryozoologists, some investigations have concluded that the bryozoan fauna of the area is impoverished in comparison to other Arctic regions.<sup>36</sup> However, as this brief study indicates it might not be the case.

This compilation has indicated that our knowledge about bryozoan fauna in the Chukchi Sea is still incomplete yet diversity is higher than previously thought. These results point out the need for taxonomic revision of many taxa with the use of a scanning microscope or even better with the additional use of molecular techniques, as this is likely to result in even higher number of species recorded in that area. This study also demonstrates that lack of communication among scientists working in isolation whether because of personal preference or political complexities, as in the case of previous studies in the Chukchi Sea may lead to biased conclusions.

## 6. Acknowledgements

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*Table 1. Current knowledge of Chukchi Sea bryozoan species diversity. 1' -species identified by V. Gontar (archive data, 1" -species collected in the Chukchi Sea during "Vega" expedition in 1878-1879, \* - species noted for Bering Strait only. † - species identified from recently collected samples.*

Species	Osburn (1923)	Osburn (1955)	Kluge (1952, 1962)	Feder & Jewett (1978)	Gontar & Denisenko (1989)	Gontar (2001)	Recent samples†
<i>Crisiella producta</i> (Smitt, 1865)			1"				
<i>Crisia arctica</i> (M. Sars, 1863)		1	1"			1	
<i>Crisia denticulata</i> (Lamarck, 1816)	1	1	1"				
<i>Crisia eburnea</i> (L., 1758)	1	1	1		1	1	
<i>Crisia klugei</i> (Ryland, 1967)					1	1	
<i>Diplosolen obelia</i> (Johnston, 1838)		1					
<i>Diplosolen obelia</i> var. <i>arctica</i> Waters, 1900			1		1	1	1
<i>Oncousoecia canadensis</i> (Osburn, 1933)		1				1	1
<i>Oncousoecia diastoporides</i> Norman, 1869		1			1	1	1
<i>Oncousoecia polygonalis</i> (Kluge, 1915)			1			1	1
<i>Tubulipora flabellaris</i> (Fabricius, 1780)	1	1	1		1	1	
<i>Tubulipora intermedia</i> (Donoghue, 1923)		1					
<i>Tubulipora hastingsae</i> Osburn, 1952		1					
<i>Tubulipora ventricosa</i> Busk, 1875			1"				
<i>Plagioecia grimaldi</i> (Jullien, 1903)		1					
<i>Plagioecia ambigua</i> Osburn, 1953		1					
<i>Entalophoroecia deflexa</i> (Smitt, 1866)		1	1"				
<i>Lichenopora radiata</i> (Audouin, 1828)			1		1	1	
<i>Lichenopora canaliculata</i> (Busk, 1876)		1					
<i>Patinella verrucaria</i> (Fabricius, 1780)		1	1"		1	1	1
<i>Disporella crassiuscula</i> (Smitt, 1867)			1			1	1
<i>Disporella hispida</i> (Fleming, 1828)		1					
<i>Borgella (Borgiola) pustulosa</i> (Osburn, 1953)		1					
<i>Borgella tumulosa</i> Kluge, 1952			1				
<i>Fungella dalli</i> Kluge, 1955			1		1	1	
<i>Fasciculiporoides americana</i> (d'Orbigni, 1853)			1"		1	1	
<i>Alcyonidium disciforme</i> Smitt, 1872		1	1				1
<i>Alcyonidium gelatinosum</i> (L., 1767)		1	1"				1
<i>A. gelat.</i> var. <i>anderssoni</i> Abrikossov, 1932			1		1	1	1
<i>A. gelat.</i> var. <i>pachydermatum</i> Kluge, 1962							1'

Species	Osburn (1923)	Osburn (1955)	Kluge (1952, 1962)	Feder & Jewett (1978)	Gontar & Denisenko (1989)	Gontar (2001)	Recent samples†
<i>Alcyonidium mamillatum</i> Alder, 1857			1"		1	1	1
<i>Alcyonidium mytili</i> Dalyell, 1847		1	1		1	1	1
<i>Alcyonidium enteromorpha</i> Soule, 1951		1					
<i>Alcyonidium vermiculare</i> Okada, 1925			1	1	1	1	1
<i>Alcyonidium pedunculatum</i> Robertson, 1902		1					
<i>Flustrellidra cervicornis</i> (Robertson, 1900)			1				
<i>Flustrellidra corniculata</i> (Smitt, 1872)			1				1
<i>Flustrellidra gigantea</i> (Silen, 1947)		1		1			
<i>Bowerbankia composita</i> Kluge, 1952			1				1
<i>Bowerbankia gracilis</i> var. <i>aggregata</i> O'D, 1926		1					
<i>Vesicularia fasciculata</i> (Soule, 1953)		1					
<i>Eucratea loricata</i> (L., 1758)	1	1	1"		1	1	1
<i>Eucratea loricata</i> var. <i>arctica</i> (Kluge, 1915)			1"			1	1
<i>Eucratea loricata</i> var. <i>cornuta</i> (Osburn, 1932)			1"			1	
<i>Eucratea loricata</i> var. <i>macrostoma</i> (Ortmann, 1890)			1"				
<i>Electra arctica</i> (Borg, 1931)		1	1		1	1	1
<i>Carbasea carbacea</i> (Ellis et Solander, 1886)		1	1"	1	1	1	1
<i>Carbasea nordenskjoldi</i> (Kluge, 1929)			1"		1	1	1
<i>Serratiflustra serrulata</i> (Busk, 1880)		1	1"			1	1
<i>Securiflustra securifrons</i> (Pallas, 1766)		1	1		1	1	1
<i>Chartella membranaceotruncata</i> (Smitt, 1868)		1	1		1	1	1
<i>Hincksina gotica</i> (Busk, 1856)		1					
<i>Microporina articulata</i> (Fabricius, 1821)		1					
<i>Callopora craticula</i> (Alder, 1857)		1	1"		1	1	1
<i>Callopora lata</i> (Kluge, 1907)							1
<i>Callopora lineata</i> (L., 1767)		1	1"		1	1	1
<i>Callopora obesa</i> Kluge, 1952			1		*		
<i>Callopora aurita</i> (Hincks, 1877)		1					
<i>Callopora smitti</i> Kluge, 1946						1	
<i>Callopora weslawski</i> (Kuklinski et Taylor, 2006)		1	1			1	1
<i>Cauloramphus cymbaeformis</i> (Hincks, 1877)	1	1	1"		1	1	
<i>Cauloramphus spiniferum</i> (Johnston, 1832)			1				1
<i>Cauloramphus intermedius</i> Kluge, 1962			1		1	1	1
<i>Tegella retroversa</i> (Kluge, 1952)			1		1	1	1
<i>Tegella amissavicularis</i> (Kluge, 1952)			1		1*		
<i>Tegella anguloavicularis</i> Kluge, 1952		1	1		1		1
<i>Tegella arctica</i> (D'Orbigny, 1850)		1	1		1	1	1
<i>Tegella armifera</i> (Hincks, 1880)	1	1	1"		1		1
<i>Tegella inermis</i> (Kluge, 1952)			1		*		
<i>Tegella unicornis</i> (Fleming, 1828)		1	1			1	
<i>Bidenkapia spitsbergensis</i> (Bidenkap, 1897)	1	1	1		1	1	1
<i>Bidenkapia spitsbergensis</i> var. <i>alaskensis</i> Osburn, 1950		1					
<i>Septentriopora nigrans</i> (Hincks, 1882)	1	1	1		1	1	1
<i>Doryporella spatulifera</i> (Smitt, 1868)		1	1		1	1	1
<i>Amphiblestrum trifolium</i> var. <i>quadrata</i> (Hincks, 1880)		1	1		1	1	1
<i>Bugula tschkotskensis</i> Kluge, 1952			1		1	1	
<i>Bugula pacifica</i> (Robertson, 1905)		1					

Species	Osburn (1923)	Osburn (1955)	Kluge (1952, 1962)	Feder & Jewett (1978)	Gontar & Denisenko (1989)	Gontar (2001)	Recent samples†
<i>Dendrobeatia fessa</i> (Kluge, 1955)			1		1	1	
<i>Dendrobeatia flustroides</i> (Packard, 1863)			1"				1
<i>Dendrobeatia fruticosa</i> (Packard, 1863)	1		1		1	1	1
<i>Dendrob. fruti.</i> var. <i>quadridentata</i> (Loven, 1834)	1		1				
<i>Dendrobeatia levinseni</i> (Kluge, 1924)			1				
<i>Dendrobeatia murrayana</i> (Johnston, 1847)	1	1	1		1	1	1
<i>Dendrobeatia pseudolevinseni</i> Kluge, 1952			1		1	1	1
<i>Dendrobeatia multiseriata</i> (O'Donoghue, 1925)		1					
<i>Dendrobeatia pseudomurrayana</i> Kluge, 1955			1		1	1	
<i>Semibugula birulai</i> Kluge, 1929			1"				
<i>Caberea ellisi</i> Fleming, 1780	1		1				
<i>Notoplites sibirica</i> (Kluge, 1929)			1		1	1	1
<i>Scrupocellaria arctica</i> (Busk, 1855)			1				1
<i>Scrupocellaria minor</i> (Kluge, 1915)					1	1	
<i>Scrupocellaria scabra</i> (Van Beneden, 1848)	1		1		1	1	1
<i>S. scabra</i> var. <i>paenulata</i> Norman, 1903		1	1"		1	1	
<i>Tricellaria gracilis</i> (Van Beneden, 1848)		1	1		1	1	1
<i>Tricellaria gracilis</i> var. <i>inermis</i> Kluge, 1962			1			1	
<i>Tricellaria ternata</i> (Ellis et Solander, 1786)		1	1				
<i>Tricellaria erecta</i> (Robertson, 1900)		1					
<i>Tricellaria pribilofi</i> (Robertson, 1905)		1					
<i>Tricellaria peachi</i> (Busk, 1851)			1		1	1	1
<i>Tricellaria beringia</i> (Kluge, 1955)			1				
<i>Membraniporella crassicosta</i> Hincks, 1888		1					
<i>Cribrilina annulata</i> (Fabricius, 1780)		1	1		1	1	
<i>Cribrilina spitsbergensis</i> Norman, 1903		1	1			1	1
<i>Hippochoa divaricata</i> var. <i>arctica</i> Kluge, 1906			1		1	1	1
<i>Plesiothoa expansa</i> Dowson, 1859		1	1		1	1	1
<i>Celleporella hyalina</i> (L., 1767)		1	1"		1	1	1
<i>C. reflexa</i> (Dick, Grisichenko, Mawatari, 2006)							1
<i>Adeonellopsis tuberculata</i> (Busk, 1854)			1"		1		
<i>Ragionula rosacea</i> (Busk, 1856)		1					1
<i>Posterula sarsi</i> (Smitt, 1868)		1	1		1	1	1
<i>Arctonula arctica</i> (M. Sars, 1851)		1	1"		1	1	1
<i>Umbonula patens</i> (Smitt, 1868)		1			1	1	1
<i>Escharoides jacksoni</i> (Kluge, 1900)		1				1	1
<i>Escharella dijmphnae</i> Kluge, 1929			1"				1
<i>Escharella immersa</i> (Fleming, 1828)					1	1	
<i>Escharella levinseni</i> Hayward, 1994		1					
<i>Escharella ventricosa</i> (Hassall, 1842)		1	1		1	1	1
<i>Escharella labiata</i> (Levinsen, 1886)		1					
<i>Escharelloides cancellatum</i> (Smitt, 1868)		1					
<i>Hincksipora spinulifera</i> (Hincks, 1889)		1					
<i>Hemicyclopora polita</i> (Norman, 1864)		1					
<i>Porella acutirostris</i> Smitt, 1868		1	1		1	1	1
<i>Porella patula</i> M.Sars, 1851							1
<i>Porella belli</i> (Dowson, 1859)			1		1	1	1

Species	Osburn (1923)	Osburn (1955)	Kluge (1952, 1962)	Feder & Jewett (1978)	Gontar & Denisenko (1989)	Gontar (2001)	Recent samples†
<i>Porella compressa</i> (Sowerby, 1806)		1	1		1	1	1
<i>Porella concinna</i> (Busk, 1854)		1	1		1	1	1
<i>Porella smitti</i> Kluge, 1907							1'
<i>Porella tumida</i> Kluge, 1955			1		*		
<i>Porella proboscidea</i> (Hincks, 1888)		1					
<i>Porella minuta</i> (Norman, 1869)		1					1
<i>Porella obesa</i> Waters, 1900			1		1	1	1
<i>Porelloides laevis</i> (Fleming, 1828)							1'
<i>Cystisella fragilis</i> (Levinsen, 1914)			1		1	1	
<i>Cystisella saccata</i> Busk, 1856	1	1	1"		1	1	1
<i>Cystisella beringia</i> (Kluge, 1929)		1	1"		1	1	1
<i>Lepraliella contigua</i> (Smitt, 1868)		1	1		1	1	1
<i>Lepraliella hippopus</i> (Smitt, 1868)		1	1		1	1	1
<i>Hippoporella fastigiatoavicularia</i> Kluge, 1952			1		*		1
<i>Rhamphostomella bilaminata</i> (Hincks, 1968)	1	1				1	1
<i>Rhamphostomella sibirica</i> Kluge, 1929			1"			1	1
<i>Rhamphostomella costata</i> Lorenz, 1886		1	1"		1	1	1
<i>Rhamphostomella hincksi</i> Nordgaard, 1906		1	1		1	1	1
<i>Rhamphostomella ovata</i> (Smitt, 1868)		1	1"		1	1	1
<i>Rhamphostomella plicata</i> (Smitt, 1868)			1		1	1	1
<i>Rhamphostomella scabra</i> (Fabricius, 1780)			1		1	1	1
<i>Schizobrachiella stylifera</i> (Levinsen, 1887)		1	1		1	1	1
<i>S. stylifera</i> var. <i>perforata</i> (Kluge, 1952)			1		*		
<i>Harmeria scutulata</i> (Busk, 1855)		1	1				1
<i>Hippoporina harmsworthi</i> (Waters, 1900)			1			1	1
<i>Hippoporina murdochi</i> Kluge, 1962			1				1
<i>Hippoporina reticulatopunctata</i> (Hincks, 1877)	1	1	1"		1	1	1
<i>Hippoporina tschukotkensis</i> Kluge, 1952			1		1	1	
<i>Hippoporina pertusa</i> (Esper, 1797)		1					
<i>Cheiloporina sincera</i> (Smitt, 1868)			1		1	1	1
<i>C. sincera</i> var. <i>praelucida</i> (Hincks, 1888)			1				
<i>Cheiloporina inermis</i> (Busk, 1880)			1			1	
<i>Phylactella pacifica</i> O'Donoghue, 1923			1				
<i>Stomachetosella sinuosa</i> (Busk, 1860)		1					1
<i>Stomachetosella limbata</i> (Lorenz, 1886)					1	1	1
<i>Stomachetosella cruenta</i> (Busk, 1854)		1	1		1		1
<i>Stomachetosella hincksi</i> Powell, 1968					1	1	
<i>Pachyegis groenlandica</i> (Norman, 1894)			1"		1	1	1
<i>Pachyegis princeps</i> (Norman, 1903)		1	1			1	1
<i>Myriapora orientalis</i> (Kluge, 1929)			1		1	1	1
<i>Myriapora subgracilis</i> (D'Orbigny, 1852)		1			1	1	1
<i>Myriozoella crustacea</i> (Smitt, 1868)			1		1	1	1
<i>Myriozoella plana</i> (Dowson, 1868)		1					1
<i>Cylindroporella tubulosa</i> (Norman, 1868)		1	1		1	1	1
<i>Smittina bella</i> (Busk, 1860)	1	1	1		1	1	1
<i>Smittina beringia</i> Kluge, 1952			1				1'
<i>Smittina majuscula</i> (Smitt, 1868)		1			1	1	

Species	Osburn (1923)	Osburn (1955)	Kluge (1952, 1962)	Feder & Jewett (1978)	Gontar & Denisenko (1989)	Gontar (2001)	Recent samples*
<i>Smittina minuscula</i> (Smitt, 1868)		1	1		1	1	
<i>Smittina mucronata</i> (Smitt, 1868)			1		1	1	1
<i>Smittina tuberosa</i> Kluge, 1952			1				
<i>Smittoidea propinqua</i> (Smitt, 1868)							1
<i>Parasmittina jeffreysii</i> (Norman, 1903 )		1	1"				1'
<i>Parasmittina trispinosa</i> (Johnson, 1838)			1"		1	1	1
<i>Parasmittina alaskensis</i> Osburn, 1952		1					
<i>Euritina arctica</i> Osburn, 1950		1					1
<i>Schizomavella lineata</i> (Nordgaard, 1896)							1
<i>Schizomavella porifera</i> (Smitt, 1868)							1
<i>Microporella ciliata</i> (Pallas, 1766)			1		1	1	
<i>Microporella germata</i> (Dick et Ross, 1988)							1
<i>Microporella arctica</i> (Norman, 1903)		1					
<i>Lepralioides nordlandica</i> (Nordgaard, 1905)					1	1	
<i>Cellepora nordenskjoldi</i> Kluge, 1929			1"				1
<i>Celleporina incrassata</i> (Lamarck, 1856)	1	1	1		1	1	1
<i>Celleporina ventricosa</i> Lorenz, 1886		1	1		1	1	1
<i>Buffonellaria biapertura</i> (Smitt, 1873)		1	1		1	1	1

## Notes

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