16: Hydrozoa of the Eurasian Arctic Seas

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INTRODUCTION

Hydrozoans comprise one of the four classes in the phylum Cnidaria. Most members of the class have bottom sedentary (seldom pelagic) polypoid and pelagical medusoid stages of the life cycle. The polypoid generation may be an individual organism or a colony with the chitinous (rarely calcareous) skeleton. The polypoid produces the medusoid stage. The medusoid stage is not always represented by a free-swimming medusa, but rather by the medusoid, which remains attached to the colony and produces the sexual stage. Sometimes the typical medusoid or the typical polypoid stage is absent.

The majority of Hydrozoa (nearly 1,600 species) make up the subclass Hydroidea. The subclass Siphonophora comprises nearly 200 species. The siphonophores are colonial, mainly pelagic organisms, with several kinds of polypoid and medusoid zooids specialized for different functions such as feeding, movement, reproduction, and defense. The earliest Hydrozoa are believed to have evolved in the Precambrian as nonskeletal individual polyps. Skeleton-bearing fossils of Hydrozoa and jellyfish remains can be traced to the Cambrian. Recent Hydrozoa inhabit all seas and oceans, from cold polar to tropical waters. They dwell at different depths from the littoral zone to the ocean deeps ($\approx$6.000 m). A number of Hydrozoa inhabit fresh and brackish waters.

Note: This chapter has been reviewed, edited, and rewritten by the Editor, Yvonne Herman.

PREVIOUS STUDIES

The study of hydroids in the Eurasian Arctic seas commenced in 1772, with Lepechin's expedition to the White and Barents seas. In 1780, his article on several species of Sertularia was published, and *Sertularia* (= *Thuiaria*) *obsoleta* was the first Arctic species whose type specimen was discovered off Cape Svyatoi Nos (Barents Sea). The White Sea fauna was studied by Mereschkowsky (1877), Wagner (1885), Schlater (1891), Birulja (1896, 1897*a*, 1898), and Schidlowsky (1902). Also noteworthy are the following publications: M. Sars (1860,

1861, 1863), G. O. Sars (1873), Marenzeller (1878), and D'Urban (1881). They deal with the Barents Sea hydroids. Studies by Thompson (1884) describe the Barents Sea and the Kara and East Siberian seas' fauna (Thompson, 1887). Publications by Kirchenpauer (1884), Bergh (1886), Marktanner-Turneretscher (1890), Bonnevie (1898, 1899), Levinsen (1893), Hartlaub (1900), Jäderholm (1902), and Nordgaard (1904) are devoted to the hydroid fauna in several Arctic seas. We should also mention the reviews by Jäderholm (1908, 1909), the latter based on hydroids deposited in the Swedish Royal Museum.

Reviews by Broch (1910, 1916) on hydroids collected on the *R. V. Helgoland* during the Danish Expedition Ingolf represent important contributions to our knowledge of hydroids of the Arctic seas. In 1897, the study by Birulja on Hydrozoa, Polychaeta, and Crustacea collected in the Yenisei and Ob bays of the Kara Sea was published. This was followed by publications by Knipovitch (1901), Linko (1903, 1904), and Breitfus (1904) on hydroids, chiefly from the Barents Sea. A more comprehensive study of the Barents and Kara seas fauna (including hydroids) commenced in 1898 with the Murmansk Scientific Fishery Expedition (Breitfus, 1906, 1908; Derjugin, 1905, 1906, 1915). Hydroids deposited at the Zoological Museum of the Imperial Academy of Sciences in St. Petersburg collected in the above-mentioned expeditions were used for studies of various regions including the Arctic seas (Linko, 1911, 1912; Kudelin, 1914). Linko's (1912, 1913) studies dealing with the zooplankton of Western Murmansk and the Arctic Ocean mention 11 species of hydromedusae and 2 species of siphonophores. Material collected by the Russian expeditions in Spitzbergen (1899–1901), Murmansk Biological Station (1921) and Drifting Sea Research Institute (PLAVMORNIN, 1921) afforded the opportunity to increase our knowledge of the Barents Sea fauna (Rylov, 1923, 1924, 1927).

Material collected by the Murmansk Biological Station researchers on the *R. V. Alexandr Kovalevsky* (1926) and other collections of the station allowed Spassky to describe 22 new hydroid species from the Kola Bay and the southwestern part of the Barents Sea (1929), thus raising the number of species to 70 (Derjugin, 1915; Tanasijtchuk, 1927). Between 1920 and 1930, a large number of scientific expeditions were carried out in the Arctic seas. It will suffice to mention the most important ones, such as the Kara Expedition on the research vessel *Taimir* (1921), the expedition to Novaya Zemlya organized by the State Hydrological Institute (1923–1927), the expedition to Novaya Zemlya of the Institute of Study of the North on the research vessel *Elding* (1925, 1927), the Czech Expedition of the Institute on Study of the North in 1925 and 1927, the Kara Expedition of the Anglo-Russian Cooperative Union (ARCOS) on the research vessels *Malygin* (1925) and *Sedov* (1926), the expedition of the Yakut Commission of the Academy of Sciences in the Laptev Sea on the research vessel *Polarnaya Zvesda* (1927), the expedition of the Arctic Institute on the *R. V. Sedov* (1929, 1930), the expedition of the State Hydrological Institute to Wrangel Island on the *R. V. Litke* (1929), and the expedition of the Arctic Institute on the *R. V. Lomonosov* (1931). Material collected in these expeditions have added new data to the list of hydroids of the Barents and Kara seas (Vagin, 1934) and to the hydroids from the Franz Josef Archipelago as well as from the Eurasian Arctic seas (Uschakov, 1936, 1937). Uschakov (1925) made interesting observations on seasonal variations of the fauna in the littoral zone of the Kola Bay. He was the first to observe such unique phenomena as the hydroids' ability to tolerate low temperatures and even ice.

Data on the bottom population of the Novosiberian shoals (from the material collected on the *R. V. Malygin* and *Sadko*, 1935, 1937, 1938) permitted Gorbunov (1946) to present data on the vertical distri-

butional patterns and biogeographical distributions of various groups of invertebrates, including 42 hydroids. One should mention Kramp's thorough investigations (1932, 1942, 1943, 1963) of species composition, distributional patterns, and evolution of pelagic and bottom-dwelling hydrozoans in the western Arctic region (the Greenland Coast).

The faunal composition of the Eurasian Arctic seas has been studied in the *Catalog of Fauna and Flora of the Northern Seas of the USSR* edited by Gayevskaya; the chapters on hydroids and hydromedusae were authored by Beresina (1948) and Yashnov (1948), respectively.

In the 1950s, Naumov undertook a study of the hydrozoans of the USSR waters simultaneously with investigations of the Far Eastern and Arctic hydroids and hydromedusae. He used the collections of the above-mentioned expeditions and also those collected on the *R. V. Severnyi Polus* (1946) in the East Siberian and Chukchi seas and on the *R. V. Litke* (1948, 1955), *Ob* (1956), and *Lena* (1957, 1958) in the Greenland, Barents, Kara, and Laptev seas as well as his own collections from the Barents Sea. His study resulted in a fundamental review of hydroids and hydromedusae of the USSR waters (1960) that contain 134 species from the Arctic seas, including the White Sea. In 1967, Stepanjants' review of siphonophores from USSR waters was published; 5 species were reported in the Arctic.

The following investigations discuss the distribution, growth, and feeding of zooplankton including hydromedusae and siphonophores in the Barents Sea: Zelickman (1961, 1966, 1969), Kamshilov and Zelickman (1958), Zelickman and Kamshilov (1960), Zelickman, Gelfand, and Shifrin (1969), and Zelickman and Golovkin (1972).

Collections of the Soviet Drifting Stations (SP) have added new names to the list of Hydrozoa. A new species of siphonophore belonging to the new genus *Rudjakovia plicata* (Margulis, 1982) was discovered in the central sector of the Arctic Basin.

Recently an interdisciplinary expedition undertaken by researchers of the Zoological Institute of the USSR Academy of Sciences, using scuba diving equipment, studied several shoals in the Arctic seas off the Franz Josef Archipelago (Golikov and Averintsev, 1977), off the Novosibirsk Islands (Golikov et al., 1974), and off Wrangle Island (Golikov et al., 1978).

RESULTS

Investigations of the material collected by the Zoological Institute of the USSR Academy of Sciences, in addition to the published data, indicate that the 142 hydrozoan species inhabiting the Eurasian Arctic seas and the adjacent Central Arctic Basin belong to two subclasses: Hydroidea and Siphonophora.

All 7 orders of the class Hydrozoa are represented in this region: Athecata with 37 species, Thecaphora with 91 species, Limnomedusae with 1 species, Trachylida with 5 species, Actinulida with 1 species, Hydrida with 1 species, and Siphonantha with 6 species. A total of 27 families are represented in these regions. It is not the aim of this chapter to discuss taxonomic problems. Table 16-1 (pages 408–419) presents the list of Hydrozoa according to their systematics adapted by the author. This classification follows the opinion of most taxonomists, but includes corrections and additions to reflect data obtained in the last few decades.

All Arctic bottom-dwelling and pelagic Hydrozoa are mentioned in this chapter. Most species of hydromedusae, having a bottom-dwelling polypoid stage, follow the general distribution patterns of bottom-dwelling organisms (with pelagic larvae). Only 10 species of pelagic Hydrozoa (Trachylida and Siphonophora) do not have a bottom polypoid stage (including

the trachymedusa *Ptychogastria polaris* living near the bottom). However, as will be shown, their distribution in the Arctic has the same features as all Hydrozoa discussed in this article.

As shown in Tables 16-1 and 16-2, species composition differs in the various Eurasian Arctic seas. These differences are partially accounted for by the uneven degree of knowledge of these regions. The Barents and Kara seas, which have been studied most thoroughly, have 125 and 77 species, respectively. In the other shelf seas, the results are as follows: Laptev Sea, 54 species; East Siberian Sea, 41 species; Chukchi Sea, 35 species; and the Central Arctic Basin, 12 species. The low diversity is believed to be due to the limited sampling of the deep basin. The absence of information in the basin hinders biogeographic analysis and until more information becomes available most conclusions should be considered tentative. Bearing in mind the limited data available to date we hypothesize that distributional patterns reflect adaptation to various water masses. Here we recognize 8 groups: possibly endemics, Arctic, boreal-Arctic, subtropical-Arctic (using the terminology of Golikov and Averintsev, 1977), boreal, wide-ranging warm water, bipolar, and cosmopolitan taxa.

Possibly Endemics

Included in this group are 9 species not found outside the studied area. As will be seen all species occurred once or twice only; therefore, they are referred to as endemics by inference. Only in the Barents Sea and the adjacent area of the Central Arctic Basin did we observe *Plumularia fragilis* (depth 270 m), *Aglaophenopsis compressa* (220 m depth), and *Schizotricha polaris* (175, 196 m depth). These species inhabit temperatures above zero (1°-4°C) in the Atlantic water, and being representatives of the warm-water Plumulariidae family, they may be present in the North Atlantic also. The same is true for *Thuiaria arctica*, found off the Murmansk coast (at 86 m depth) and between the Medvezhii Island and Spitzbergen (at 38 m depth).

The new species *Rhizogeton nematophorum* (Antsulevich and Polteva, 1986) and Hydractinia (Stylactis) were found in the region of the Franz Josef Archipelago (between 3 m and 20 m water depth and temperatures of about −1°C). The latter was discovered in Kandalaksha Bay of the White Sea (at 16 m depth, in 0°C water temperature).

The Medusa *Calycopsis birulai* was found in surface plankton in all the Eurasian Arctic seas; it is tentatively regarded as an endemic form. The same applies to the recently discovered siphonophora *Rudjakovia plicata* (Margulis, 1982), which is known only from the Central Arctic Basin off the Laptev Sea, from the following depths: 950–0 m, 850–0 m, 500–0 m, 400–0 m, 350–0 m, 200–0 m, and 150–0 m, in temperatures ranging betwen −1°C and 5°C.

Arctic Species

Thirteen species are included in this group. Their boundaries extend westward to the Canadian Arctic Archipelago and Greenland and eastward to the Arctic Alaskan Coast and Bering Sea. Of these, 10 species can be referred to as west-Arctic taxa; they extend eastward as far as the Laptev Sea (*Corymorpha glacialis, C. groenlandica, Sertularia albimaris, Marrus orthocanna*) and Kara Sea (*Acryptolaria borealis* and *Homoeonema platygonon*). Other taxa have not been found in the Arctic region east of the Barents Sea (*Hydractinia serrata, Thuiaria obsoleta, Monocoryne gigantea,* and *Rhizogeton nudum*). The remaining 3 species (*Halitholus yoldia-arctica, Ptychogastria polaris,* and *Aeginopsis laurentii*) seem to have circumpolar distribution and may occur eastward up to the Bering Sea (*Aeginopsis laurentii* found near the coast of Japan; the report by Uchida, 1928, is doubtful). No Arctic species with east-Arc-

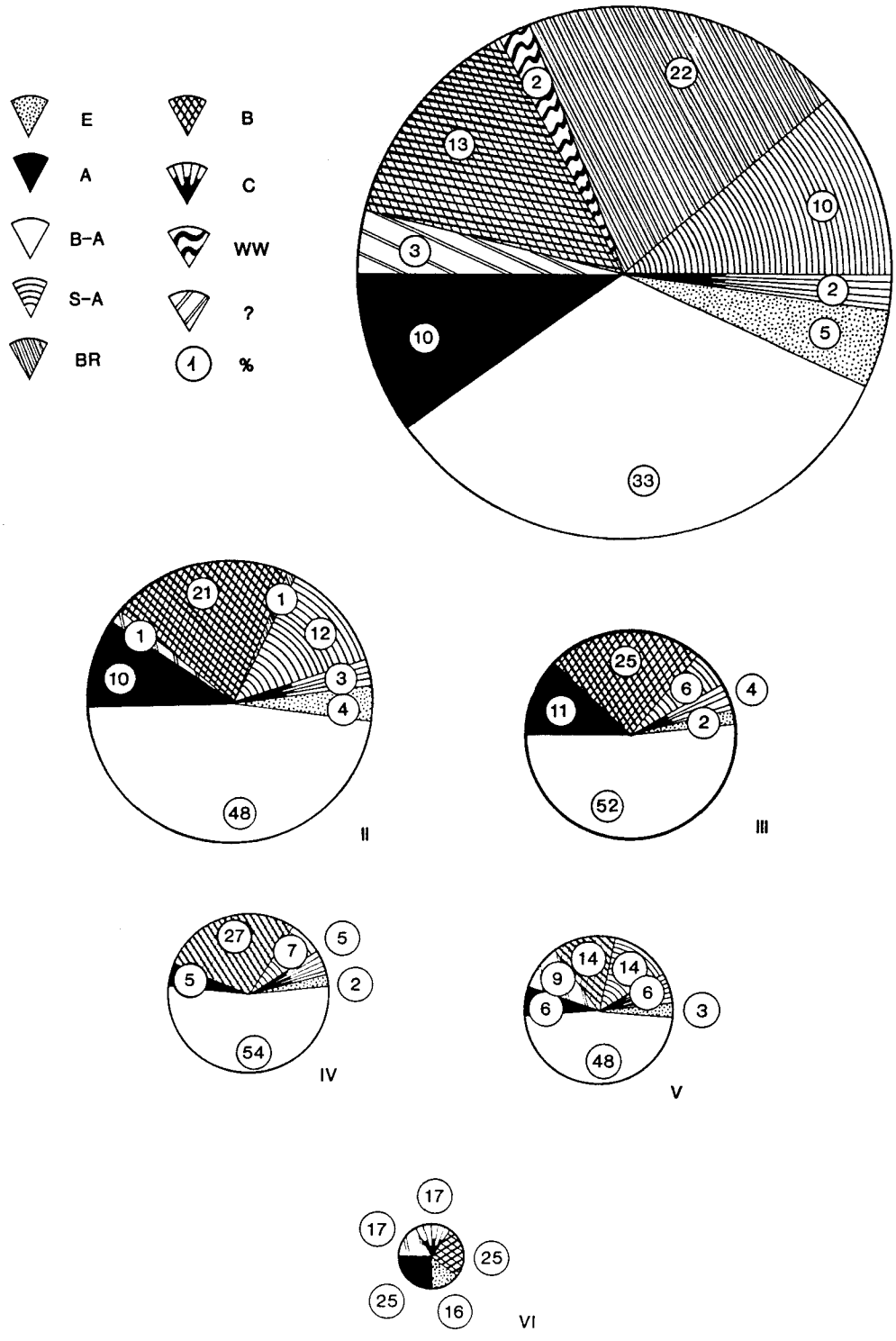


Figure 16-1. Percentage of Hydrozoa in the Eurasian Arctic seas: Barents (I), Kara (II), Laptev (III), East Siberian (IV), Chukchi (V) seas, central part of the Arctic Basin (VI). Key same as in Table 16-1.

tic distribution (Nesis, 1983*a*) are known among Hydrozoa.

A considerable part of the Arctic species were found between the upper sublittoral and the bathyal zone in a rather wide temperature range (−2°C to +4°C) (Table 16-1, Fig. 16-2). *Acryptolaria borealis* is a bathyal species inhabiting the Arctic region within temperature ranges of −1.5°C to +2.8°C. Its presence off the Japanese coasts (Hirohito, 1983) seems doubtful. *Hydractinia serrata,* known from the Greenland waters as a mainly sublittoral species (15–80 m; and temperatures of approximately 0°C), in the Barents Sea was found at a depth of 320 m (at about −1°C). The medusa *Ptychogastria polaris* inhabits the near-bottom zone, and is found in Arctic waters from Labrador up to the Novosibirsk Islands and in the Bering Sea. It lives mostly in temperatures ranging from 0°C to −1.8°C. However, according to Kramp's (1942) data, it may occur at 2.8°C also. The siphonophora *Marrus orthocanna,* found in the Barents Sea up to the central part of the Arctic Basin (the Laptev Sea sector) at depths of 2,000–300 m and 300–197 m, inhabits temperatures from 0°C to −1.8°C. According to Kramp (1963), this species was found off western Greenland in depths ranging from 1,500–1,880 m at temperatures of −0.2°C to −1.7°C. Probably, it is an indicator of the Arctic water masses.

Two Arctic species deserve special consideration: *Corymorpha groenlandica* and *Monocoryne gigantea.* They were found in the Barents Sea between 25 m and 330 m and off the Franz Josef Archipelago in water depths ranging between 25 m and 36 m, where during summer water temperatures do not rise above −0.5°C, and northeast of the Kola Peninsula at depths of 250–330 m, where the temperature is −1°C year-round (*Atlas Okeanov,* 1980). However, Spasskyi (1929) mentioned finding *C. groenlandica* in the region of 70°N and 71°N, 33°33′E at depths of 150 m and 250 m, where temperatures in August were about 3°C. In the Kara and Laptev seas, *C. groenlandica* was found once east of the Franz Josef Archipelago (542 m, and −0.5°C).

In adjacent areas of the Arctic this species has been found several times: northwest of Spitzbergen (756 m, 0.6°C) and in the Davis Strait (180 m, −1°C). During the Ingolf Expedition (Broch, 1916) it was recorded as follows: at 66°23′N, 10°26′W (1,365 m, −0.9°C); at 65°33′N, 10°28′W (895 m, 0.3°C); at 63°36′N, 7°30′W (1,260 m, −0.6°C); and 66°18′N, 25°59′W (600 m, −0.75°C); north of Iceland (795 m, 0–5°C); off Spitzbergen (45 m, approximately −1.0°C); off Liverpool Bay, and in the Beaufort Sea (0–4 m, with temperatures ranging from −1.8°C to +0.5°C) (Broch, 1916; Calder, 1972). The depth range of *Corymorpha groenlandica* extends from the sublittoral zone to the bathyal zone, mainly at negative temperatures, but apparently it tolerates summer warming up to 3°C.

Monocoryne gigantea was seldom encountered. The type species is from 75°12′N and 3°2′E (2,193 m, −1.57°C) (Bonnevie, 1899). In Hudson Bay it was reported at 90–100 m and about −1.5°C (Calder, 1972) and off Alaska at Stevens Pass (Fraser, 1941; Calder, 1972). According to Calder (1972), this species is known from the Barents Sea. There is reason to assume that *Monocoryne gigantea* inhabiting the shelf and abyssal depths requires subzero temperatures. Thus, almost all Arctic hydrozoans inhabit regions where temperatures range between subzero and a few degrees above zero. They can survive in the Atlantic water where the water is warm during the summer. Their distribution in the Greenland Sea, off the Canadian Arctic Archipelago and adjacent regions, suggests that the fauna has originated in the Atlantic Ocean.

It is certain that *Corymorpha groenlandica* and *Monocoryne gigantea,* and possibly *Hydractinia serrata, Ptychogastria polaris, Aeginopsis laurentii,* and *Marrus orthocanna,* inhabiting mostly temperatures below zero but having adapted to positive summer

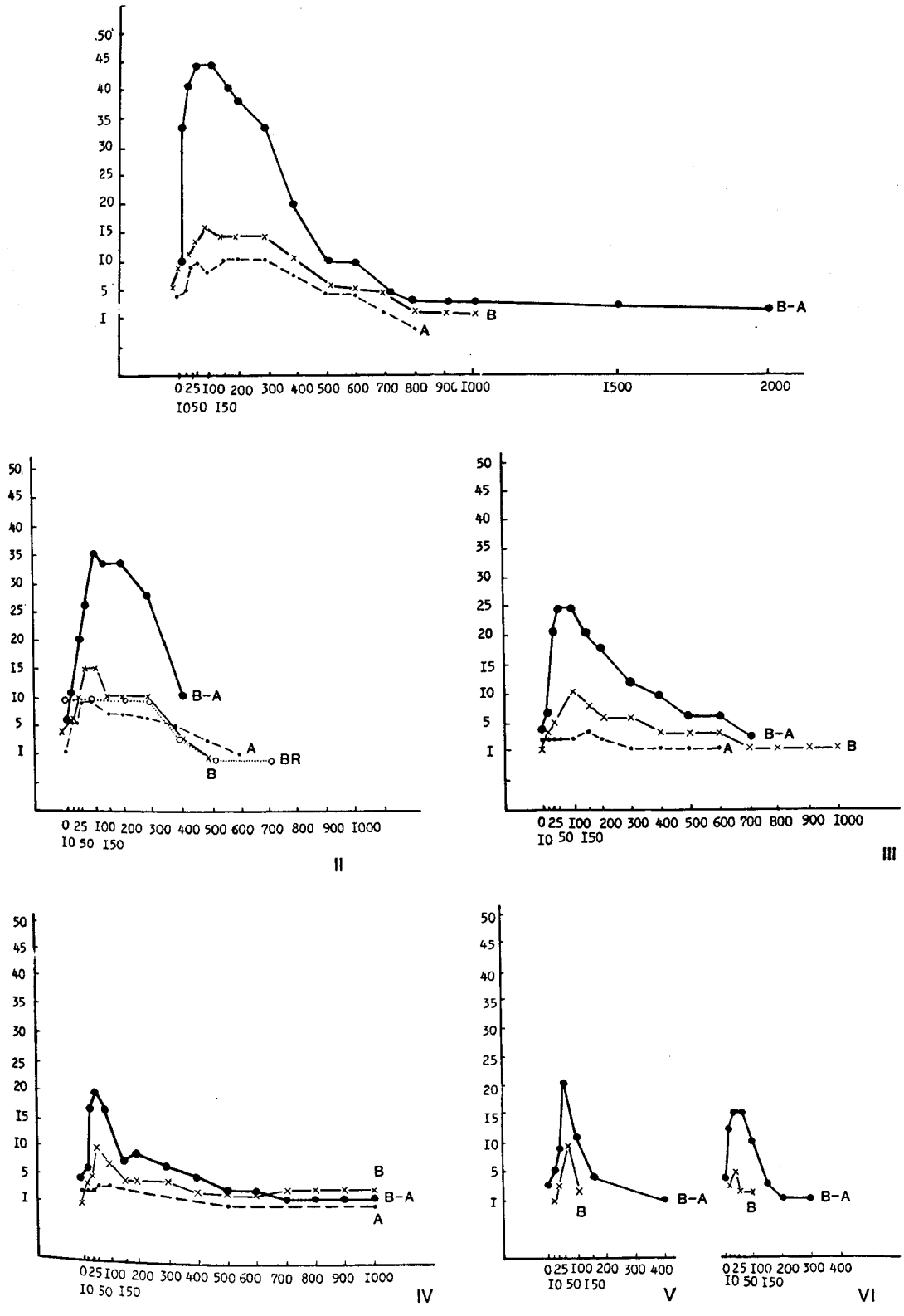


Figure 16-2. Vertical distribution of Hydrozoa (key same as in Table 16-1); all Eurasian Arctic seas (I), Barents (II), Kara (III), Laptev (IV), East Siberian (V), Chukchi (VI) seas. Abscissa: depths in m; ordinate: number of species.

temperatures, may be Arctic autochthonous taxa. Some bathyal Arctic species not found in the studied area but known from Greenland waters (Kramp, 1932) also belong to this group. These are *Hydractinia (Stylactis) arctica* (Jäderholm, 1902; 74° 41'N, 70°30'W, depth 1,200 m, −0.2°C; 72°42'N, 14°49'W, depth 2,000 m, which lives attached to the hydroid *Eudendrium planum*), *Hydractinia (Stylactis) ingolfi* (Kramp, 1932; 60°17'N, 52°05 W, depth 3,229 m, 1.4°C; 59°20'N, 40°48'W, depth 3,192 m, 1.5°C; 61°44'N, 30°29'W, depth 2,137 m, 3°C; 61°39'N, 17°10'W, depth 2,344 m, 2°C, which lives on the ophiurids *Homalophiura tesselata), Eudendrium planum* (Bonnevie, 1838; 74°4'N, 70°30'W, depth 1,200 m, −0.2°C), and *Halisiphonia arctica* (Kramp, 1932; inhabiting the same area attached to *Eudendrium planum*). It is apparent that this group of abyssal Arctic species is endemic to the Arctic and one should expect to find these species in other Arctic regions. *Hydractinia ingolfi* (Kramp, 1943) was not found in this region at shallower depths and at higher water temperatures. It is interesting that a very closely related Antarctic species, *Hydractinia vallini* (Jäderholm, 1926; depth 219–640 m), lives attached to ophiurids of the family *Ophiolepididae* (Smirnov and Stepanjants, 1980).

Boreal-Arctic Species

The largest numbers of species (48) are the boreal-Arctic taxa. They inhabit the Arctic seas and penetrate far westward and eastward in boreal waters. Among the boreal-Arctic species the circumpolar taxa (30) are predominant, inhabiting nearly all Arctic seas (Table 16-1). They were recorded off Greenland and off the Arctic Canadian Archipelago, in the Norwegian Sea, along the North American and European coasts, in the Bering, Okhotsk, and Japan seas, along North America, and even off the Pacific Japanese coasts. In the Arctic waters these species live between the upper sublittoral zone and the bathyal zone, reaching highest abundance between 50 m and 200 m (Fig. 16-2) in water temperatures below 0°C (their temperature range is −2°C to +3°C), surviving summer warming higher than +5°C. At the boundary of their distributional range they often live in regions where annual temperatures are positive.

Candelabrum phrygium, is known from Norwegian waters, off the Lofoten Islands, the Faeroe Islands, Iceland (at 200–1,825 m, about −1°C to +7°C); from the Greenland Sea (2,195 m, −1.57°C); from the southern sector of the North Atlantic Ocean as far as the eastern coast of Scotland; and from the rocky coast of the English Channel, near Roscoff (Korotnev, 1880), where during the summer temperatures exceed 15°C. *C. phrygium* was found along the eastern and western coasts of Greenland (10–35 m, about −1°C to +2°C), in Hudson Bay (90–100 m, about −1°C), in the Barents Sea (68–285 m, about 0°C to −1°C), and in the Kara Sea (12–15 m, about −1.5°C to +4°C). So far this species has not been found in other Arctic seas, but according to recent data (Antsulevich and Polteva, 1986) it was observed off Paramushir Island (Kurile Islands) at depths ranging between 10 m and 130 m and at temperatures from −1°C to +3°C in summer. The area of distribution of this species is boreal-Arctic. This species lives in Arctic waters at temperatures ranging between −1.5°C and +4°C; in boreal waters it may survive in high temperatures. Observations by Korotnev (1880) near Roskoff show that colonies of *C. phrygium* attained complete development in these waters only during the winter months (December-February). In late summer, their hydrorhiza that produce new polyps are found attached to rocks. This species can survive warming since it has adapted to positive temperatures and possesses a mobile larva. It is found in the coastal waters of the boreal Atlantic and Pacific oceans. According to Broch (1918), *C. phrygium* and *Corymorpha*

groenlandica are Arctic relict species in the Atlantic Ocean.

Rhizorhagium roseum, Euphysa tentaculata, Halecium corrugatum, H. marsupiale, and *Tulpa speciosa* are not found in the Arctic east of the Kara Sea, but are known from the temperate waters of the Atlantic and Pacific oceans (*Halecium marsupiale* has not been reported from the North Atlantic). These boreal-Arctic species live in temperatures ranging from −1.5°C to +3°C. Nevertheless, their precise distributional range is difficult to determine because of the limited data. However, the medusa *Euphysa tentaculata,* being present in the Arctic region as far as the Greenland coast, may have penetrated through the Davis Strait and the Canadian Straits to the western Canadian coast (Kramp, 1942) where it has been found repeatedly (Arai and Brinckmann-Voss, 1980).

Euphysa tentaculata may be called a western boreal-Arctic taxon. Six other hydrozoa are western boreal-Arctic species: *Coryne lovenii, Mitrocomella polydiademata, Cuspidella grandis, Hydrallmania falcata, Cladocarpus integer,* and *Polynemertesia gracillima;* their eastward distribution in the Arctic is limited by the Laptev or Kara seas (except for the last two taxa, which are limited to east of the Barents Sea). To the west, these species are widely represented in temperate waters along the coast of North America and Europe. In the Arctic, they inhabit low temperatures above zero and can survive in temperatures as low as −1.8°C. In boreal waters they occur at temperatures higher than 6°C. Representatives of the warm-water family Plumulariidae—*Cladocarpus integer* and *Polynmertesia gracilima*—inhabit the following Arctic regions: Barents and Greenland seas; the Davis Strait; the coasts of Norway, Iceland, and Newfoundland in above zero temperatures (1° −6°C).

Seven other species are referred to as the eastern boreal-Arctic group: *Sertularia tolli, S. similis, S. cupressoides, Sertularella pellucida, Abietinaria turgida, Thuiaria cylindrica,* and *Halecium speciosum.* These species as a rule are not distributed in the Arctic west of the Chukchi and East Siberian seas, and do not occur at depths greater than 40–50 m (commonly at depths of ≈ 20m). *S. tolli* and *S. cupressoides* are found in the Kara Sea and *S. pellucida* was discovered off Spitzbergen. All these species are absent from the Atlantic Ocean but are represented in the Far East seas and in the North Pacific.

The following taxa were found in the Canadian Arctic Archipelago: *Halecium speciosum* in Hudson Bay in 20–106 m (Calder, 1970, believes that *H. ornatum* observed by Broch in 1910 off Spitzbergen is in fact *H. speciosum*); *Sertularia similis,* one of the most common species in all the straits of this archipelago (Calder, 1970); and *Abietinaria turgida,* recovered once (Calder, 1970) off Ellaf Ringnes Island (Queen Elizabeth Islands) at a depth of 46 m. Their presence in the Canadian Archipelago and absence from the Atlantic Ocean make the Canadian Arctic Archipelago the eastern boundary in their distribution.

Also found are the seven eastern boreal-Arctic species that inhabit the Arctic region chiefly in negative temperatures (from −0.5°C to −1.8°C), though they survive summer warming (e.g., *Sertularia similis* in the southern Chukchi Sea lives at 4°C). Eastern boreal-Arctic Hydrozoa discovered in the shoals of the Arctic seas at temperatures below zero cannot be regarded as indigenous to the Arctic (contrary to Nesis' opinion, 1983*b*), since many (*Sertularia similis, Sertularia tolli, Albietinaria turgida*) have been observed not only in the northern part of the Bering and Okhotsk seas but dominate in the sublittoral zone of the Kurile Islands in relatively high summer temperatures. This group is believed to be of Pacific origin (Kramp, 1963, p. 88), and these species are found off the western Greenland coast.

Subtropical-Arctic Species

Thirteen species considered subtropical-Arctic are ecologically very similar to the

previous group differing from them by their wider distributional ranges. These species occur in nearly all Arctic seas, inhabiting the upper sublittoral to upper bathyal zones. They are eurythermal, present in the Atlantic as far as Maine, New Jersey, and Florida, and off the European coast as far as Spain and the Azores. They were recovered in the Mediterranean as well. In the Pacific Ocean, representatives of subtropical–Arctic species can be found in the South Kurile Strait, off Japan, in the Yellow Sea, and off California. Within the Arctic region, species belonging to this group (e.g., *Campanulina lacerata* and *Thuiaria thuia*) were found only in the Barents Sea. The three species whose distribution in the Arctic is represented only by the medusoid stage are *Tubularia prolifer, Euphysa aurata,* and *Rathkea octopunctata.* In spite of their eurythermy, these species occur more frequently at positive temperatures than do representatives of other groups. *Lafoea grandis* occurs in the Kara Sea at depths of 200–360 m and at temperatures of 0°–5°C. Nevertheless, all species of this group live in the Laptev, East Siberian, and Chukchi seas generally at below 0°C.

Bipolar Species

Seventeen bipolar species inhabit the Arctic Basin, the temperate waters of the Northern Hemisphere, the temperate waters of the Southern Hemisphere, the sub-Antarctic (Patagonian shelf, Crozet, Heard, Kerguelen, Southern Orkney Islands, Falkland Islands, etc.), and even the Antarctic Coast. Most (Table 16-1) inhabit all or almost all Arctic seas under conditions similar to those of pan-Arctic boreal–Arctic and subtropical–Arctic species; they are eurybiontic immigrants in the Arctic. Some forms are characteristic of the recent Arctic fauna (e.g., *Obelia longissima, Moderia plicatile, Sertularella tricuspidata,* and *Abietinaria abietina*).

In temperate waters these species inhabit positive temperatures (up to 17°C–20°C). Only a few records are known in the Southern Hemisphere. Noteworthy is *Tubularia indivisa.* It was reported in the Arctic along with *Tubularia regalis* (Jäderholm, 1909; Broch, 1910, 1916; Kramp, 1943; Calder, 1972). In the opinion of these authors, these two species can be differentiated by the presence of longitudinal ribs in the female gonophores in *T. regalis* and their absence in *T. indivisa.* The first is regarded as an Arctic taxon. It was found in the White, Barents, and Kara seas, off the eastern and western coasts of Greenland, off the Canadian Arctic Archipelago, between the Faroes Islands and Scotland, and off the Norwegian coasts. *T. regalis* was discovered in the same waters and also off the east and west coasts of North America, off South Iceland, in the Caribbean region of West Africa, in the Mediterranean Sea, in the Southern Hemisphere off the Kerguelen Islands, Crozet, and southern Georgia. Naumov (1960) lumped *T. regalis* and *T. indivisa* into one species. Until specimens with ribs on female gonophores are found in Arctic waters, it appears reasonable to adopt Naumov's point of view and regard *T. indivisa's* distributional area as bipolar.

Boreal Species

Boreal species (28) are widely distributed in boreal waters. In the study area, they have been reported almost exclusively from the Barents Sea. Among the boreal species, 9 are amphiboreal and 19 belong to the North Atlantic group (Table 16-1). These species inhabit the Barents Sea from the littoral to the upper bathyal zone, invariably in water with positive temperatures.

Wide-ranging Warm-water Species and Cosmopolitan Species

Three species occurring in the Barents Sea (*Obelia geniculata, Clytia gracilis,* and *Physophora hydrostatica*) can be characterized as

wide-ranging warm-water taxa, since their distributional areas include, apart from boreal waters, the African, New Zealand, and Mediterranean coasts. Two species, the hydroid *Lafoea dumosa* and the siphonophora *Dimophyes arctica*, can be regarded as cosmopolitans (Stepanjants, 1975, 1980).

DISCUSSION AND CONCLUSIONS

The distributional ranges were not established for 9 species (Table 16-1). As shown in Tables 16-1 and 16-2 and in Figure 16-1 and the maps, the majority of Arctic species consist of boreal-Arctic representatives (about 50 percent in each sea), bipolar (about 20 percent), and subtropical-Arctic (about 15 percent) forms. The bipolar term is tentative. An attempt to separate specimens of species found in the two hemispheres by traditional taxonomic methods is difficult. The percentage of boreal species is relatively high (19 percent); with the exception of one, they occur only in the Barents Sea, constituting 21 percent of the Hydrozoa Barents Sea species.

Endemic Arctic Hydrozoa, consisting of "probably" endemic forms (9 species), and 13 Arctic species contribute only 15 percent to every sea and 15 percent to the whole area. To the Arctic endemic taxa, one should probably add 4 abyssal species known so far only from the Greenland Sea Basin and the adjacent areas of the North Atlantic. Endemic genera and endemic families of Hydrozoa are unknown from the Arctic. However, there is an exception, a recently discovered genus of siphonophora *Rudjakovia* (Margulis, 1982), found so far only in the Arctic and therefore regarded possibly as an endemic form.

There are two bipolar genera, Monocoryne and Candelabrum, and 1 bipolar family, Myriothelidae, represented in the Arctic and Antarctic, as well as in the temperate waters of both hemispheres. Unlike the Arctic hydroid fauna, the Antarctic group is characterized by a high level of endemism (56 percent of the total number of hydroid species occurring in Antarctic; Stepanjants, 1979). Furthermore, 4 endemic siphonophore species are known from the Antarctic waters. Endemic genera are also known for this region: 2 Hydroidea and 3 Siphonophora. Endemic Hydroidea families are absent from both the Antarctic and the Arctic oceans. However, in the opinion of several scientists (e.g., Totton, 1965), there is one Antarctic family of siphonophore Pyrostephidae. Such low endemism of high taxonomic rank (genera and families) in the Arctic and the Antarctic is a characteristic feature of the Hydrozoa fauna. It indicates a low level of isolation of cold-water Hydrozoa and also a relatively young age of the fauna of the polar regions.

The vertical distribution of Hydrozoa is most obvious in the Barents and Kara seas, where not only shelf but also slope faunas were investigated in detail. In the eastern Arctic, mainly coastal and island shoals were studied; from deep water there are few collections: *Sadko* (1935, 1937); *Severnyi Polus* (1940); *Litke* (1948, 1955); *Ob* (1956); *Lena* (1957, 1958); and *SP-2*, *SP-3*, and *SP-4* (1950–1954). However, as shown in Table 16-1 and Figure 16-2, Hydrozoa were observed from littoral to abyssal depths. As expected, species diversity is highest on the shelf between 50 m and 200 m, with maximum species diversity in the 50–100 m zone. This is seen in Figure 16-2*A* for whole area and in Figure 16-2*B,C,D* for each area. Table 16-1 shows that 60 species were found only on the shelf, 6 of them only in the upper sublittoral and 2 only in the littoral zone. Most species are boreal and 2 are endemic.

Half of the Arctic Hydrozoa species have wide depth ranges. Figure 16-2 shows that the maximum number of species occur at depths of 50–300 m; their number declines sharply with depth. This pattern is distinct in the Barents Sea. In the Kara Sea, the peak is between 50 m and

200 m. Eastward, the depth of maximum species diversity is 100 m (Laptev Sea) and 50 m (East Siberian and Chukchi seas). This pattern is in accord with Nesis' (1983*a*,*b*) opinion concerning the differences in the depths preference and degree of eurybathic of west-Arctic and east-Arctic species.

Thirteen Hydrozoa (bathyal) species were observed only on slopes and a few in the lower boundary of the shelf up to slope. Six of them belong to the warm-water family Plumulariidae. They live in the bathyal depth of the Barents Sea with constant low positive temperatures. The same is true for other boreal species such as *Zygophylax pinnata* and *Bonneviella grandis*. Four species were observed in bathyal depth in the studied region, though in other areas they were reported from the shelf (*Acryptolaria borealis* and *Halecium reversum*), in sublittoral zones (*Hydractinia serrata*), and near surface (*Ptychogena lactea*) at negative as well as at low positive temperatures. The typical bathyal siphonophora *Marrus orthocanna* inhabits depths with 0°C and lower temperatures. It is apparently an indicator of the Arctic waters.

True abyssal species were not observed in the studied area. However, 4 species (*Hydractinia arctica, H. ingolfi, Eudendrium planum,* and *Halisiphonia arctica*) are found only in the abyssal zone of the Greenland Sea (1,200–3,229 m). They may occur in other regions of the Arctic as well. Five species, Arctic *Corymorpha groenlandica, Monocoryne gigantea, Ptychogastria polaris, Aeginopsis laurentii* and boreal-Arctic *Candelabrum phrygium,* inhabit the Arctic from the sublittoral to the bathyal zones. Occasionally they were found at depths greater than 2,000 m. As discussed above, their depth preference in different areas is chiefly related to their preference of negative temperatures.

One hundred forty-two species of pelagic and bottom-dwelling Hydrozoa, 136 Hydroidea, and 6 Siphonophora are known from the Barents, Kara, Laptev, East Siberian, and Chukchi seas as well as from the Central Arctic Basin adjacent to these seas. Most Eurasian Arctic Hydrozoa

Table 16-1. Distribution of Hydrozoa in the Eurasian Sector of the Arctic Ocean Showing Range of Depths (m)

Species	Barents Sea		Kara Sea	
	P	*M*	*P*	*M*
	1	2	3	4
HYDROIDEA				
ATHECATA				
CLAVIDAE				
Clava multicornis (Forskal, 1775)	0–10	—		
Rhizogeton nudum Broch, 1909	35	—		
Rhizogeton nematophorum (Antsulevich, 1986)			7–20	—
BOUGAINVILLIIDAE				
Dicoryne conferta (Alder, 1856)	35–225	—		
Bougainvillia principis (Steenstrup, 1850)		250–0 125–65 10–0		

P = polypoid generation; M = medusoid generation; blank spaces indicate that the species was not found in this region; dashed line (—) indicates absence of the given generation of the species; bullet (•) indicates that the given generation of the species is unknown but its presence is anticipated. In the Biogeography column A = Arctic; wA = west Arctic; B-A = boreal-Arctic; wB-

are eurybathic species, widely distributed in the Arctic and in the temperate waters of the Atlantic and Pacific oceans. They can be referred to as boreal-Arctic and bipolar taxa. In the Arctic, they live at temperatures ranging from ≈2 degrees below zero to a few degrees above zero and can survive considerable summer temperature rise and even live at constant temperatures above zero on the boundaries of their distribution ranges. There are several species with western (43) and eastern (7) distributional ranges, living in conditions similar to those of pan-Arctic species, each having well-defined bathymetric ranges. Species whose distribution to the east is limited by the Kara and Laptev seas live between the upper sublittoral and bathyal zones (occasionally deeper); however, species whose distribution is limited to the west by the above-mentioned seas do not descend below 50 m and occur mostly in the upper sublittoral zone.

In the Eurasian Arctic, 15 percent of the Hydrozoa are endemic. Most survive summer warming and can live in the Atlantic water mass at temperatures above zero. Seven species (*Rhizogeton nematophorum, Hydractinia serrata, Corymorpha groenlandica, Monocoryne gigantea, Ptychogastria polaris, Aeginopsis laurentii,* and *Marrus orthocanna*) have been found principally in waters with negative temperatures. There is only 1 possibly endemic siphonophore genus (Rudjakovia) in the Arctic and there is no endemic family in the Arctic.

The distributional ranges and ecological characteristics of Arctic Basin species suggest that almost the entire recent hydrozoan fauna consists of immigrants. As a result of their eurybiontic character these taxa adapted to the rigorous environment and became widely dispersed. Similar conclusions are drawn on the Actiniaria Arctic fauna (Grebelnyi, 1980).

The extremely low level of species endemism and lack of endemism of higher-rank taxa, as well as the low number of indigenous Arctic taxa, point to the young age of the Arctic Hydrozoa fauna. The degree and rank of endemism, as well as the composition and evolution of the arctic hydrozoan fauna, do not allow us to treat the Arctic Basin as an independent biogeographic region.

Laptev Sea		*East Siberian Sea*		*Chukchi Sea*		*Central Arctic Basin*		
P	*M*	*P*	*M*	*P*	*M*	*P*	*M*	*Biogeography*
5	6	7	8	9	10	11	12	13
								aBR wA E
								aBR
								aBR

A = west boreal-Arctic; eB-A = east boreal-Arctic; S-A = subtropical-Arctic; BR = boreal; aBR = Atlantic boreal; B = bipolar; K = cosmopolitans; WW = widely distributed warm-water species; E = endemic taxa;? = uncertain distributional range.

Table 16-1. *(continued)*

Species	Barents Sea		Kara Sea	
	P	M	P	M
	1	2	3	4
Bougainvillia superciliaris (L. Agassiz, 1849)	10–20	10–0 50–0		50–0
Rathkea octopunctata (M. Sars, 1835)		175–0 5–0		10–0
Rhizorhagium roseum M. Sars, 1877	35–135	—		
PANDEIDAE				
Halitholus yoldia-arcticae (Birula, 1897)	12–370	25–0	6–180	140–0
Catablema vesicaria (A. Agassiz, 1862)	•	170–0 50–25	•	124–0
Calycopsis birulai (Linko, 1913)	•	25–0	•	18–0
HYDRACTINIIDAE				
Hydractinia allmani Bonnevie, 1898	68–320	—	18–628	—
Hydractinia carica Bergh, 1887	4–180	—	34	—
Hydractinia monocarpa Allman, 1876	8–60	—	34	—
Hydractinia echinata (Fleming, 1828)	15–20	—	34	—
Hydractinia serrata Kramp, 1943	308–320	—		
Hydractinia carnea (M. Sars, 1846)	7–36	—		
Hydractinia (Stylactis) sp.			3–20	—
EUDENDRIIDAE				
Eudendrium rameum (Pallas, 1766)	16–360	—	8–290	—
Eudendrium ramosum (L., 1758)	185–208	—	20–178	—
Eudendrium capillare Alder, 1857	19–245	—		
Eudendrium annulatum Norman, 1864	42	—		
CORYMORPHIDAE				
Corymorpha glacialis M. Sars, 1859	5–165	—	0.3	—
Corymorpha groenlandica (Allman, 1876)	25–333	—	542	—
Euphysa aurata Forbes, 1848		20–0	1–24	
Euphysa flammea (Linko, 1904)	•	373–0	•	140–0
Euphysa tentaculata Linko, 1904	•	0		
TUBULARIIDAE				
Tubularia prolifer (L. Agassiz, 1862)		100–0		200–0
Tubularia simplex Alder, 1862	15–23	—		
Tubularia larynx Ellis et Solanderf, 1786	35–38	—		
Tubularia indivisa L., 1758	12–288	—	35–360	—
Plotocnide borealis Wagner, 1885	•	25–0	•	200–100
CORYNIDAE				
Coryne lovenii (M. Sars, 1846)	45–213	—	6.5–17	—
Sarsia tubulosa (M. Sars, 1835)	58	29–0		25–10
Sarsia princeps (Haeckel, 1879)		250–0		262–0

P = polypoid generation; M = medusoid generation; blank spaces indicate that the species was not found in this region; dashed line (—) indicates absence of the given generation of the species; bullet (•) indicates that the given generation of the species is unknown but its presence is anticipated. In the Biogeography column A = Arctic; wA = west Arctic; B-A = boreal-Arctic; wB-

Laptev Sea		*East Siberian Sea*		*Chukchi Sea*		*Central Arctic Basin*		
P	*M*	*P*	*M*	*P*	*M*	*P*	*M*	*Biogeography*
5	6	7	8	9	10	11	12	13
								S-A
								S-A
				0–52				B-A
51–60	9–30		3–20	46	20			A
•	12–0	•	41–36					B-A
			25–0					
•	?	•	9	•	?			E
38,1542	—	35	—					B-A
		35	—	35	—			B-A
19–51		35	—					B-A
		54	—	50–152	—			S-A
								wA
								aBR
								E
38	—	21–41	—					B-A
47–60	—							B
				15–20	—			S-A
				7–40	—			B-A
10	—							wA
432	—					756		wA
16								S-A
•	30,51	•	124–0					B-A
•	0							B-A
								S-A
								BR
28–230	—							B
10	—	21	—	2–25	—			B
•	200–0	•	50–10	•	100–0			B-A
					30–10			
								wB-A
	72–10		25–10					B
186–58								B-A

A = west boreal–Arctic; eB-A = east boreal–Arctic; S-A = subtropical–Arctic; BR = boreal; aBR = Atlantic boreal; B = bipolar; K = cosmopolitans; WW = widely distributed warm-water species; E = endemic taxa;? = uncertain distributional range.

Table 16-1. *(continued)*

Species	Barents Sea		Kara Sea	
	P	M	P	M
	1	2	3	4
MYRIOTHELIDAE				
Candelabrum phrygium (Fabricius, 1780)	68–285	—	12–15	—
Monocoryne gigantea (Bonnevie, 1898)	?	—		
THECAPHORA				
MELICERTIDAE				
Melicertum octocostatum (M. Sars, 1935)		40–0		
CAMPANULINIDAE				
Calicella syringa (L., 1767)	0–377	—	12–178	—
Staurophora mertensii (Brandt, 1835)	19–120	215–0	148	
Cuspidella grandis Hincks, 1864	200–265	—	42–520	—
Mitrocomella polydiademata (Romanes, 1876)	—	325–0		
Ptychogena lactea A. Agassiz, 1865	•	343–74	•	455–520
Tiaropsis multicirrata (M. Sars, 1835)	10–20	30–0		
Tetrapoma quadridentata (Hincks, 1874)	9–260	—	16	—
Opercularella nana Hartlaub, 1897	0–66	—		
Campanulina lacerata (Johnston, 1847)	0	—		
Lafoeina maxima (Levinsen, 1893)	8–280	—	8–55	—
Lafoeina tenuis G. O. Sars, 1874	33–130	—		
Modeeria rotunda (Quoy et Gaimard, 1827)	50–65	—	102	—
Modeeria plicatile (M. Sars, 1863)	28–384	—	14–570	—
Halopsis ocellata A. Agassiz, 1863	•	5–0		
CAMPANULARIIDAE				
Obelia flexuosa (Hincks, 1861)	10–0	—		
Obelia loveni (Allman, 1859)	0–176	—		
Obelia sp. 1 aff. *flexuosa*				
Obelia sp. 2 aff. *loveni*				
Obelia geniculata (L., 1758)	0–60	25–0		
Obelia longissima (Pallas, 1766)	8–300	25–0	8–100	
Clytia gracilis (M. Sars, 1851)	22–30			
Campanularia volubilis (L., 1758)	5–257	—	16	—
Campanularia groenlandica Levinsen, 1893	10–215		360	
Campanularia integra McGillivray, 1842	16–308		20–120	—
Tulpa speciosa (Clark, 1876)	5–170	—	16–360	—
Rhizocaulus verticillatus (L., 1758)	25–343	—	14–185	—
LAFOEIDAE				
Filellum serpens (Hassal, 1848)	15–275	—	34–106	—
Grammaria abietina (M. Sars, 1851)	10–325	—	20–364	—
Grammaria immersa Nutting, 1901	20–271	—	20–57	—
Acryptolaria borealis (Levinsen, 1893)	192	—	360–570	—
Lafoea dumosa (Flemming, 1820)	8–477	—	14–570	—

P = polypoid generation; M = medusoid generation; blank spaces indicate that the species was not found in this region; dashed line (—) indicates absence of the given generation of the species; bullet (•) indicates that the given generation of the species is unknown but its presence is anticipated. In the Biogeography column A = Arctic; wA = west Arctic; B-A = boreal-Arctic; wB-

Laptev Sea		*East Siberian Sea*		*Chukchi Sea*		*Central Arctic Basin*		
P	*M*	*P*	*M*	*P*	*M*	*P*	*M*	*Biogeography*
5	6	7	8	9	10	11	12	13
								B-A
								wA
								BR
38–48	—	38	—	20	—			B
33–48		35–60		76–68				B
51	—							wB-A
•	10–0							wB-A
•	1455–282							B-A
				0–9				S-A
54	—	34	—					B-A
								aBR
				20?				S-A
9–220	—	10–50	—	2–68	—			B-A
								aBr
								B
38–1073	—	146	—		—	130–280	—	B
								aBR
								aBR
								aBR
				5	—			?
				22,23	—			?
								WW
19–43	20–10	7–58	15	2–52				B
								WW
45	—	45	—					S-A
18.5	—							B-A
38–48	—	41–54	—					B
								B-A
19–30	—	48	—	20	—			B-A
19–64	—	45–47	—					B
19–520	—	47–59	—					B-A
30–60	—	35	—					B-A
								wA
19–1073	—	24–54	—	35–61	—	184–477	—	K

A = west boreal–Arctic; eB-A = east boreal–Arctic; S-A = subtropical–Arctic; BR = boreal; aBR = Atlantic boreal; B = bipolar; K = cosmopolitans; WW = widely distributed warm-water species; E = endemic taxa;? = uncertain distributional range.

Table 16-1. *(continued)*

Species	Barents Sea		Kara Sea	
	P	M	P	M
	1	2	3	4
Lafoea grandis Hincks, 1874	12–477	—	204–360	—
Lafoea pocillum Hincks, 1868	12–59	—	14–19	—
ZYGOPHYLAXIDAE				
Zygophylax pinnata (G. O. Sars, 1874)	130–620	—		
BONNEVIELLIDAE				
Bonneviella grandis (Allman, 1876)	161–347	—		
SERTULARIIDAE				
Abietinaria abietina (L., 1758)	2–435	—	12–410	—
Abietinaria filicula (Ellis et Solander, 1786)	9–100	—		
Abietinaria turgida (Clark, 1876)				
Abietinaria fusca (Johnston, 1847)	150	—		
Abietinaria costata (Nutting, 1901)	?	—		
Abietinaria pulchra (Nutting, 1904)	9–300	—	12–542	—
Diphasia fallax (Johnston, 1847)	20–237	—		
Diphasia rosacea (L., 1758)	?	—		
Dynamena pumila (L., 1758)	0–270	—		
Hydrallmania falcata (L., 1758)	9–293	—	82–155	—
Tamarisca tamarisca (L., 1758)	60–190	—		
Sertularella gigantea Mereschkowsky, 1878	15–220	—	15–570	—
Sertularella rugosa (L., 1758)	12–58	—		
Sertularella tenella (Alder, 1857)	20	—		
Sertularella tricuspidata (Alder, 1856)	5–300	—	11–520	—
Sertularella pellucida Jäderholm, 1908	?	—		
Sertularia albimaris Mereschkowsky, 1878	2–605	—	3–6	—
Sertularia cupressina L., 1758	19–120	—	360	—
Sertularia cupressoides Clark, 1876			9,10	—
Sertularia mirabilis (Verrill, 1873)	9–187	—	16	—
Sertularia plumosa (Clark, 1876)	16–290	—	12–27	—
Sertularia similis Clark, 1876				
Sertularia tenera G. O. Sars, 1874	6–395	—	17–610	—
Sertularia tolli (Jäderholm, 1908)			40	—
Thuiaria articulata (Pallas, 1766)	14–293	—	17–225	—
Thuiaria laxa Allman, 1874	18–322	—	10–360	—
Thuiaria thuja (L., 1758)	12–250	—		
Thuiaria cupressoides (Lepechin, 1783)	42–106	—		
Thuiaria carica Levinsen, 1893	9–256	—	40–360	—
Thuiaria alternitheca Levinsen, 1893			55–64	—
Thuiaria obsoleta (Lepechin, 1781)	40–18	—		
Thuiaria breitfussi (Kudelin, 1914)	35–62	—		
Thuiaria arctica (Bonnevie, 1899)	86	—		
Thuiaria cylindrica Clark, 1876				

P = polypoid generation; M = medusoid generation; blank spaces indicate that the species was not found in this region; dashed line (—) indicates absence of the given generation of the species; bullet (•) indicates that the given generation of the species is unknown but its presence is anticipated. In the Biogeography column A = Arctic; wA = west Arctic; B-A = boreal-Arctic; wB-

Laptev Sea		*East Siberian Sea*		*Chukchi Sea*		*Central Arctic Basin*		
P	*M*	*P*	*M*	*P*	*M*	*P*	*M*	*Biogeography*
5	6	7	8	9	10	11	12	13
								S-A
64	—							S-A
								aBR
								BR
		54	—					B
								BR
		18	—	?	—			eB-A
								aBR
								?
21–360	—	35–61	—	20–72	—			B-A
								aBR
								aBR
								aBR
25	—							wB-A
								aBR
19–30	—	54	—					B-A
								BR
								BR
19–45	—	43–45	—	5–53	—	698	—	B
		54	—					eB-A
16–64	—							wA
								aBR
				6–36	—			eB-A
19	—							B-A
38–64	—	22–42	—	3–65				B-A
				5–47	—			eB-A
19–220	—	12–65	—	24–59	—			B-A
19	—							eB-A
38–64	—							B
		58	—					B-A
								S-A
				36	—			?
18–64	—	35–54	—					B-A
57	—	16,17	—					B-A
								wA
								?
								E
				5,6	—			eB-A

A = west boreal–Arctic; eB-A = east boreal–Arctic; S-A = subtropical–Arctic; BR = boreal; aBR = Atlantic boreal; B = bipolar; K = cosmopolitans; WW = widely distributed warm-water species; E = endemic taxa;? = uncertain distributional range.

Table 16-1. *(continued)*

Species	Barents Sea		Kara Sea	
	P	M	P	M
	1	2	3	4
HALECIIDAE				
Halecium beani Johnston, 1847	1–297	—	46–207	—
Halecium curvicaule Lorenz, 1886	15–192	—	9–360	—
Halecium speciosum Nutting, 1901				
Halecium halecinum (L., 1758)	55–310	—		
Halecium corrugatum Nutting, 1899	22–252	—	14?	—
Halecium labrosum Alder, 1859	18–294	—	16	—
Halecium tenellum Hincks, 1861	30–295	—	72–178	—
Halecium marsupiale Bergh, 1887	11–245	—	128	—
Halecium birulai Spassky, 1929	5–160	—		
Halecium muricatum (Ellis et Solander, 1786)	10–340	—	22–246	—
Halecium groenlandicum Kramp, 1911	50–164	—	180	
Halecium reversum Nutting, 1901			125–360	
PLUMULARIIDAE				
Plumularia fragilis Hamman, 1882	270	—		
Schizotricha variabilis Bonnevie, 1899	349	—		
Schizotricha polaris Naumov, 1960?	175	—		
Polynemertesia gracillima (G. O. Sars, 1874)	55–66	—		
Nemertesia antennina (L., 1758)	110–220	—		
Aglaophenopsis compressa (Bonnevie, 1899)	220	—		
Cladocarpus integer (G. O. Sars, 1874)	149–220	—		
Cladocarpus pourtelessii Verrill, 1879	120	—		
Cladocarpus formosus Allman, 1874	270	—		
LIMNOMEDUSAE				
OLINDIIDAE				
Monobrachium parasitum Mereschkowsky, 1877	20–308	—	30	—
TRACHYLIDA				
RHOPALONEMATIDAE				
Aglantha digitale (O.F. Müller, 1776)	—	370–0 5–0 270–260	—	200–100
Homoeonema platygonon Browne, 1903			—	280–200 50–25
Halicreas bigelowi (Kramp, 1947)				
PTYCHOGASTRIIDAE				
Ptychogastria polaris Allman, 1878	—	384–25	—	147–120
AEGINIDAE				
Aeginopsis laurentii Brandt, 1835	—	10–0 325–0 270–360	—	5–0 260–0 200–100

P = polypoid generation; M = medusoid generation; blank spaces indicate that the species was not found in this region; dashed line (—) indicates absence of the given generation of the species; bullet (•) indicates that the given generation of the species is unknown but its presence is anticipated. In the Biogeography column A = Arctic; wA = west Arctic; B-A = boreal-Arctic; wB-

Laptev Sea		East Siberian Sea		Chukchi Sea		Central Arctic Basin		
P	M	P	M	P	M	P	M	Biogeography
5	6	7	8	9	10	11	12	13
38-1070	—							B
								B-A
				9-11	—			eB-A
								BR
								B-A
		54	—	20	—			S-A
		54	—					B
								B-A
								?
20-57	—	35-142	—	5-30	—			B-A
180	—							B-A
								?
								E
								E
						196	—	E
								wB-A
								aBR
								E
								wB-A
								aBR
								BR
				10-72	—			B-A
—	1360-0			—	225-0			B-A
								wA
						—	3700-0	?
							3255-990	
							300-0,50-0	
—	2500-35							A
—	0,10-0	—	40-25	—	10-0,25-0	—	25-0	A
	280-0		25-0		137-0		3700-0	
							2000-870	

A = west boreal-Arctic; eB-A = east boreal-Arctic; S-A = subtropical-Arctic; BR = boreal; aBR = Atlantic boreal; B = bipolar; K = cosmopolitans; WW = widely distributed warm-water species; E = endemic taxa;? = uncertain distributional range.

Table 16-1. *(continued)*

Species	Barents Sea		Kara Sea	
	P	*M*	*P*	*M*
	1	2	3	4
ACTINULIDA				
HALAMMOHYDRIDAE				
Halammohydra schulzei Remane, 1927	—	0		
HYDRIDA				
HYDRIDAE				
Protohydra leuckarti Greef, 1870	0	—		
SIPHONOPHORA				
SIPHONANTHA				
PHYSOPHORIDAE				
Physophora hydrostatica Forskal, 1775	100–50			
AGALMIDAE				
Marrus orthocanna (Kramp, 1942)	?			
Rudjakovia plicata Margulis, 1982				
PRAYIDAE				
Nectopyramis diomedea Bigelow, 1911				
DIPHYIDAE				
Muggiaea bargmannae Totton, 1954				1360–0
Dimophyes arctica (Chun, 1897)	150–0			135–0 223–0

P = polypoid generation; M = medusoid generation; blank spaces indicate that the species was not found in this region; dashed line (—) indicates absence of the given generation of the species; bullet (•) indicates that the given generation of the species is unknown but its presence is anticipated. In the Biogeography column A = Arctic; wA = west Arctic; B-A = boreal-Arctic; wB-

Table 16-2. Biogeographic Distribution of Hydrozoa in the Eurasian Arctic Seas

Sea	Number of Species													
	E	*wA*	*A*	*wB-A*	*eB-A*	*B-A*	*S-A*	*aBR*	*BR*	*B*	*K*	*WW*	*?*	*Total*
Barents	6	9	3	6	1?	34	13	19	9	16	2	3	4	125
Kara	3	5	3	3	2	32	9	1	—	16	2	—	1	77
Laptev	1	3	3	3	1	24	3	—	—	14	2	—	—	54
East Siberian	1	—	2	—	2	20	3	—	—	11	2	—	—	41
Chukchi	1	—	2	—	5	12	5	—	—	5	2	—	3	35
Central Arctic Basin	2	2	1	—	—	—	—	—	—	3	2	—	2	12

Key as in Table 16-1.

Laptev Sea		*East Siberian Sea*		*Chukchi Sea*		*Central Arctic Basin*		
P	*M*	*P*	*M*	*P*	*M*	*P*	*M*	*Biogeography*
5	6	7	8	9	10	11	12	13
								aBR
								BR
								WW
						197–300		wA
						2000–300 1000–0,950–0 850–0,500–0 400–0,300–0 200–0,150–0		E
						2000–0,800– 300,260–0		?
993–0,360–0 1360–0,200–0		900–200,160–100 100–0		420–0,225–175		967–0,200–0 ?		B K

A = west boreal–Arctic; eB-A = east boreal–Arctic; S-A = subtropical–Arctic; BR = boreal; aBR = Atlantic boreal; B = bipolar; K = cosmopolitans; WW = widely distributed warm-water species; E = endemic taxa;? = uncertain distributional range.

APPENDIX

Plates 16-I, 16-II, 16-III

Illustrations of representative Arctic Hydroidea and Siphonophora. (After Naumov, 1960 and Stepanjants, 1967.)

Maps 16-1, 16-2, 16-3

Biogeographic distribution of Hydrozoa

B-A: boreal–Arctic
B: bipolar
S-A: subtropical–Arctic
BR: boreal
K: cosmopolitans
A: Arctic
E: endemic taxa
WW: widely distributed warm-water species
wB-A: west boreal–Arctic
eB-A: east boreal–Arctic

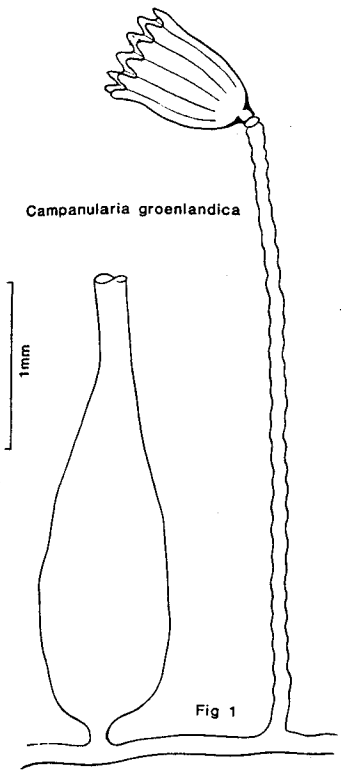


Fig 1

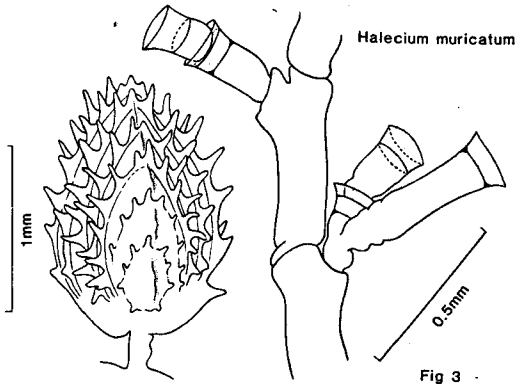


Fig 3

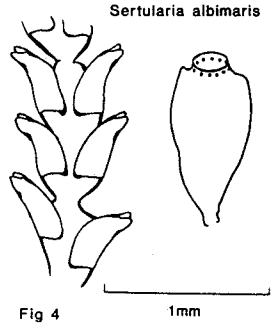


Fig 4

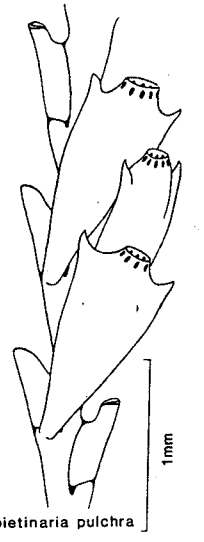


Fig 5

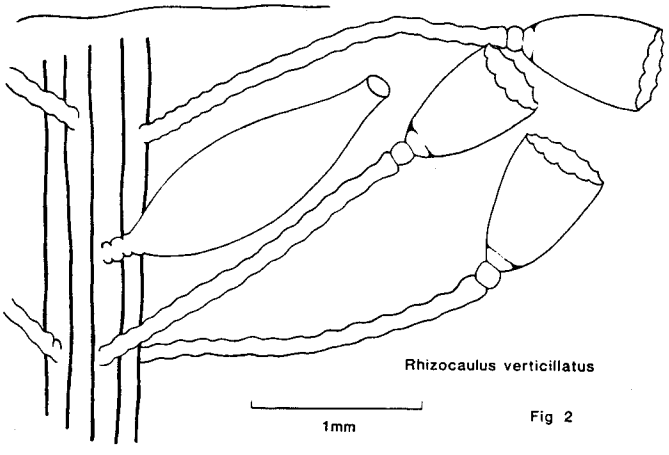


Fig 2

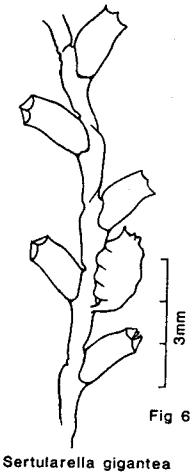


Fig 6

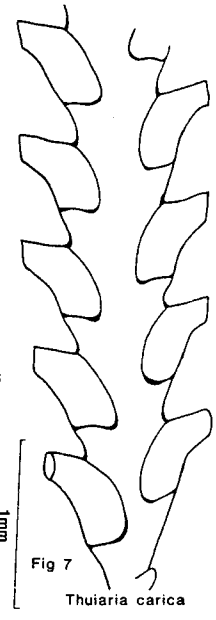
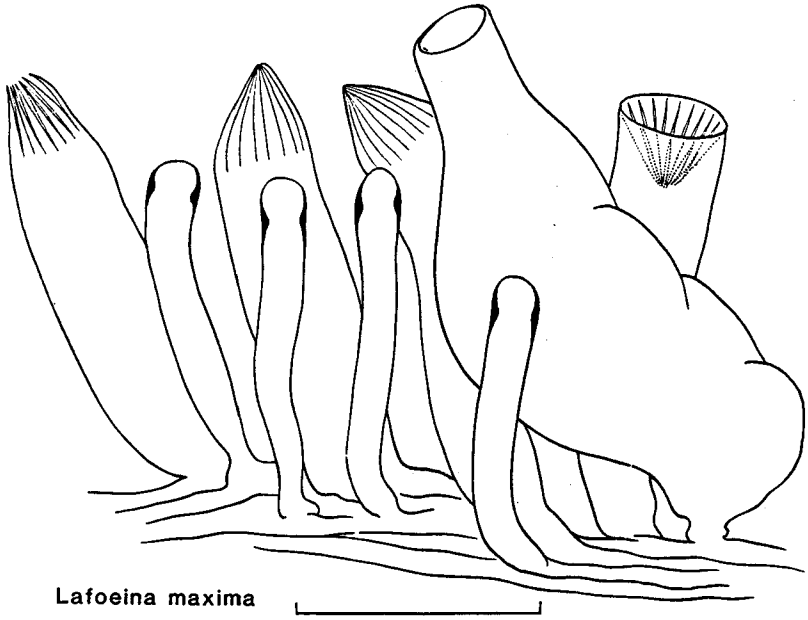


Fig 7

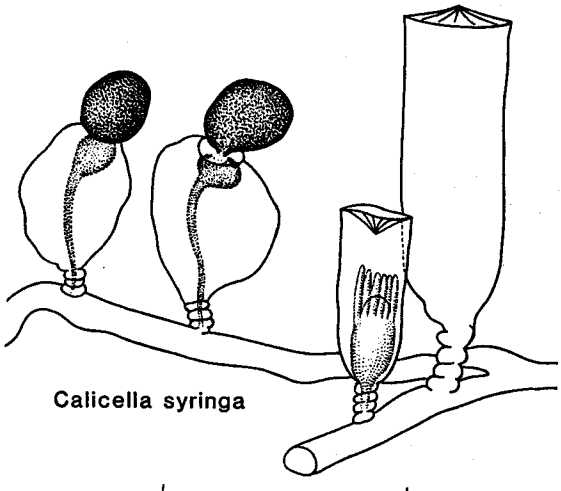
PLATE 16-I



Lafoeina maxima

Fig 1

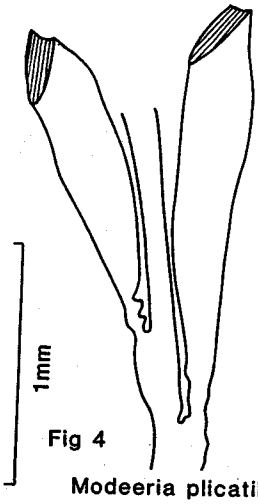
0.5mm



Calicella syringa

Fig 2

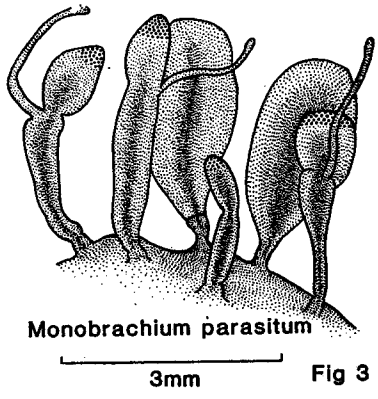
5mm



1mm

Fig 4

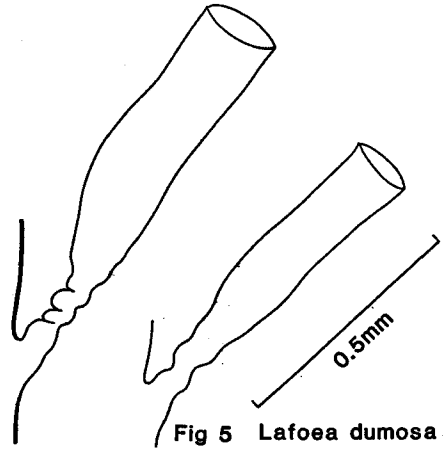
Modeeria plicatile



Monobrachium parasitum

3mm

Fig 3



0.5mm

Fig 5 Lafoea dumosa

PLATE 16-II

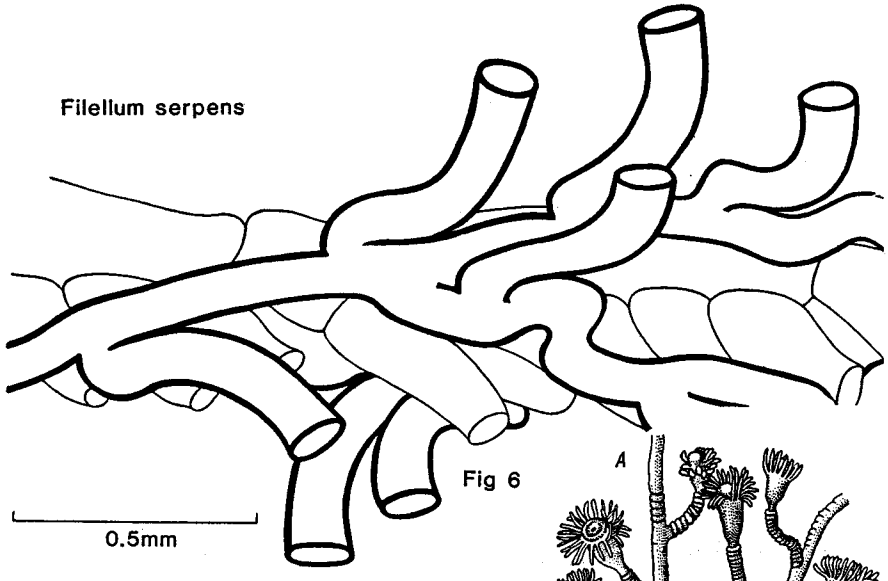
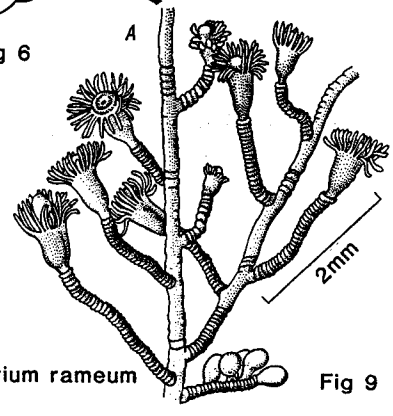


Fig 6



Eudendrium rameum

Fig 9

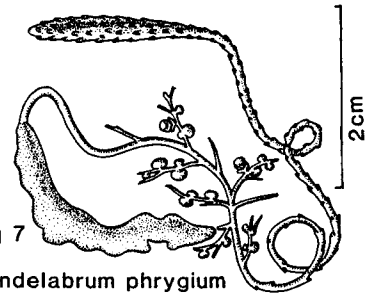


Fig 7

Candelabrum phrygium

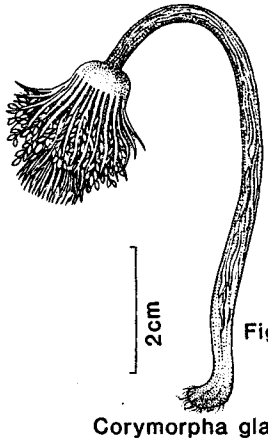
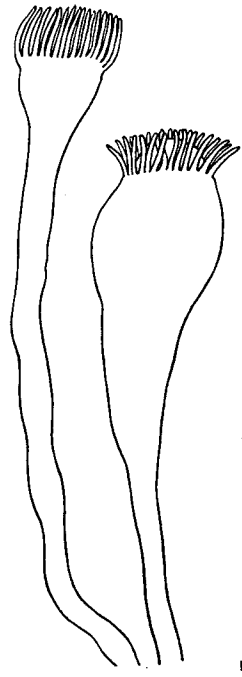


Fig 8

Corymorpha glacialis



Hydractinia allmani

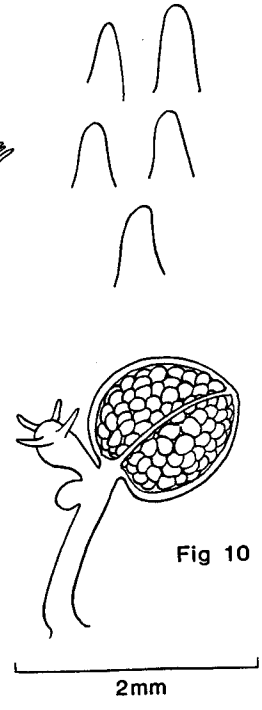
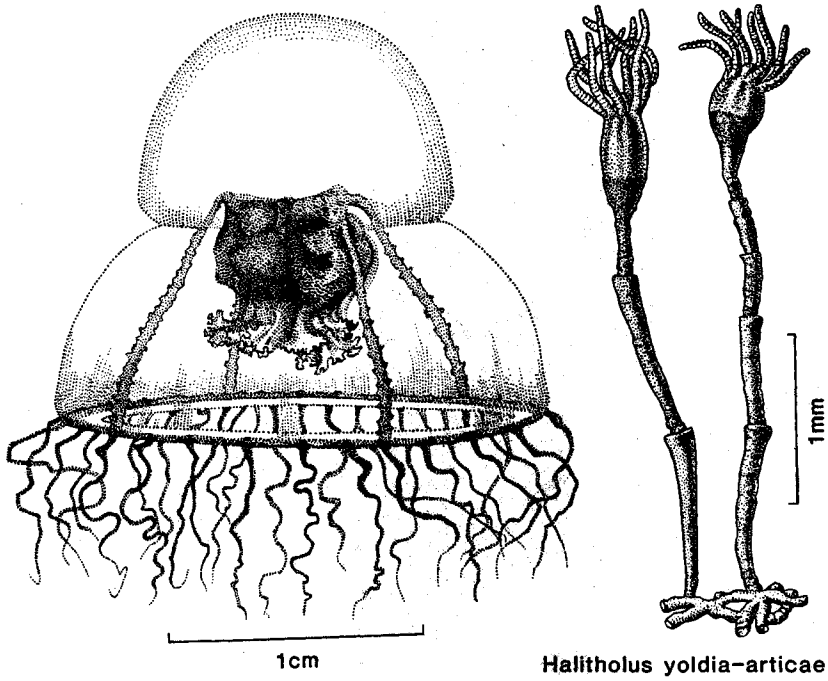


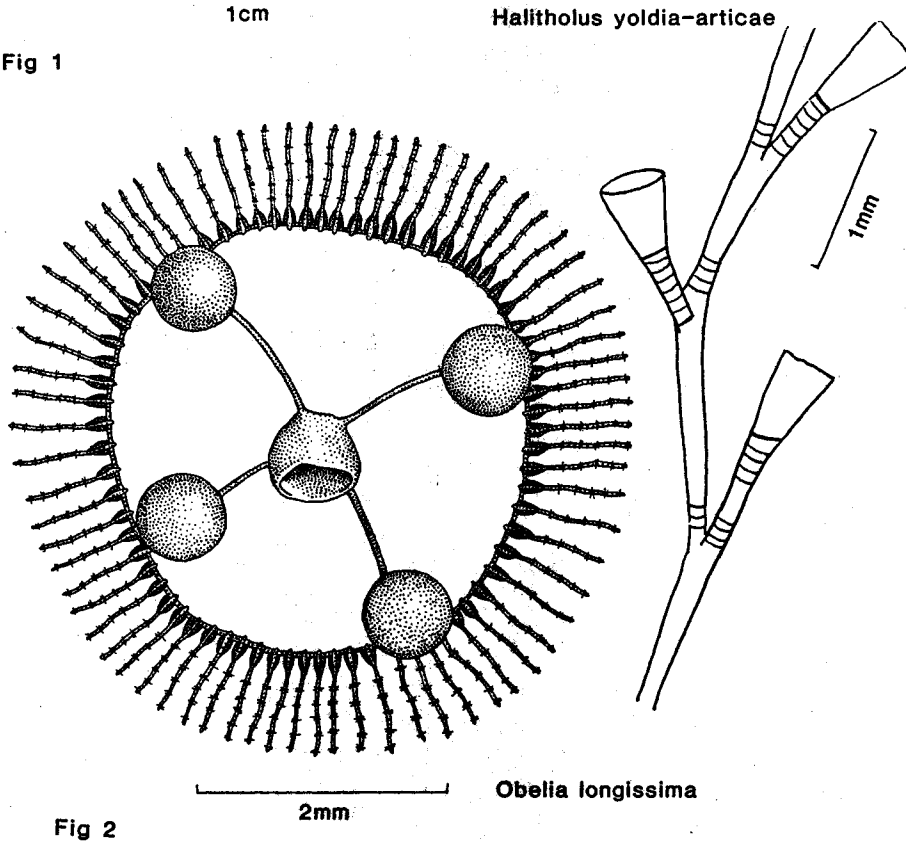
Fig 10

PLATE 16-II



Halitholus yoldia-articae

Fig 1



Obelia longissima

Fig 2

PLATE 16-III

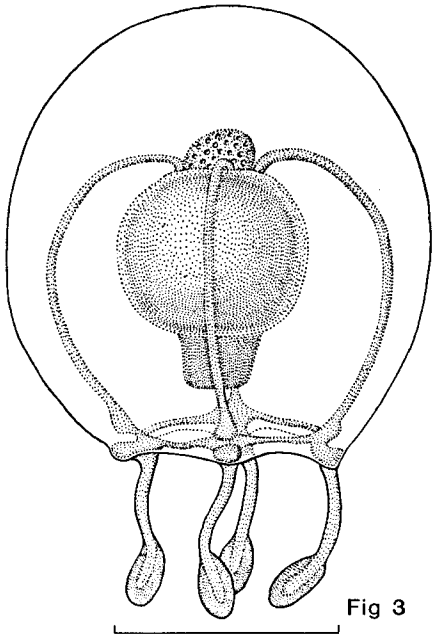


Fig 3

Plotocnide borealis

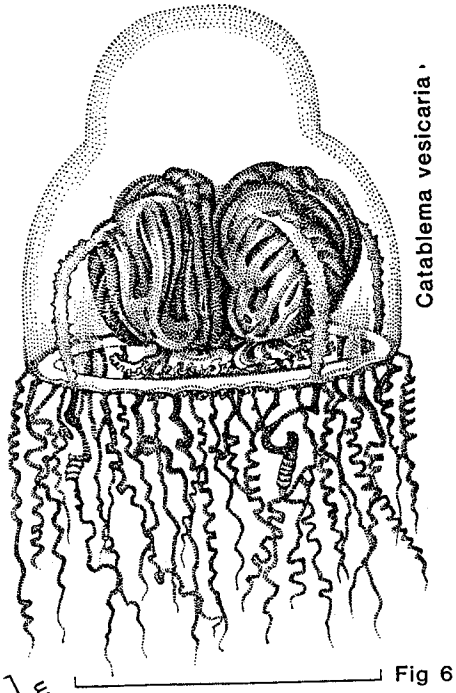


Fig 6

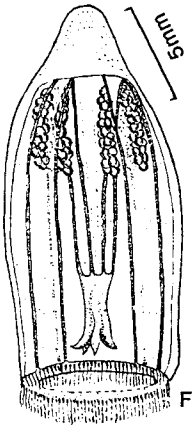


Fig 5

Aglantha digitale

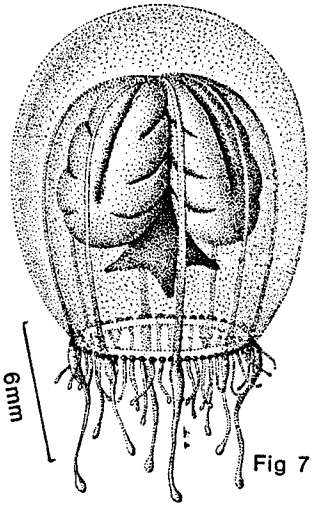
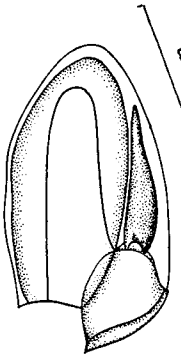


Fig 7

Calycopsis birulai



Dimophyes arctica

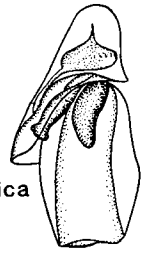
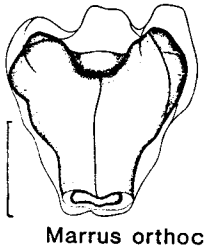


Fig 4



Marrus orthocanna

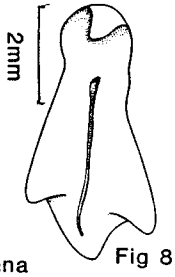
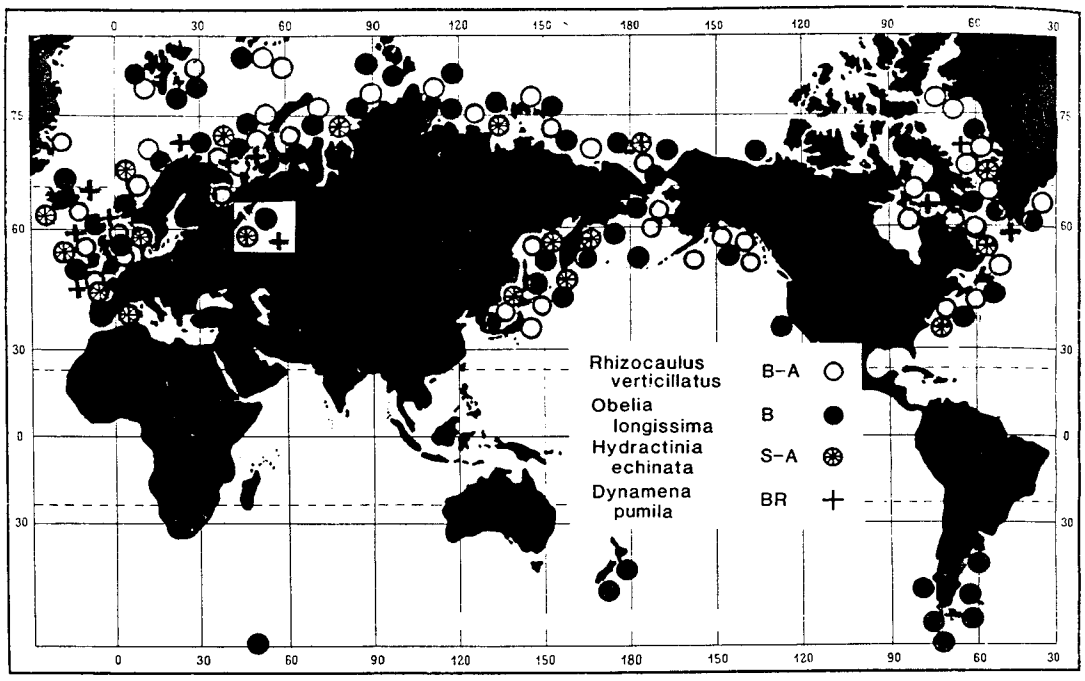
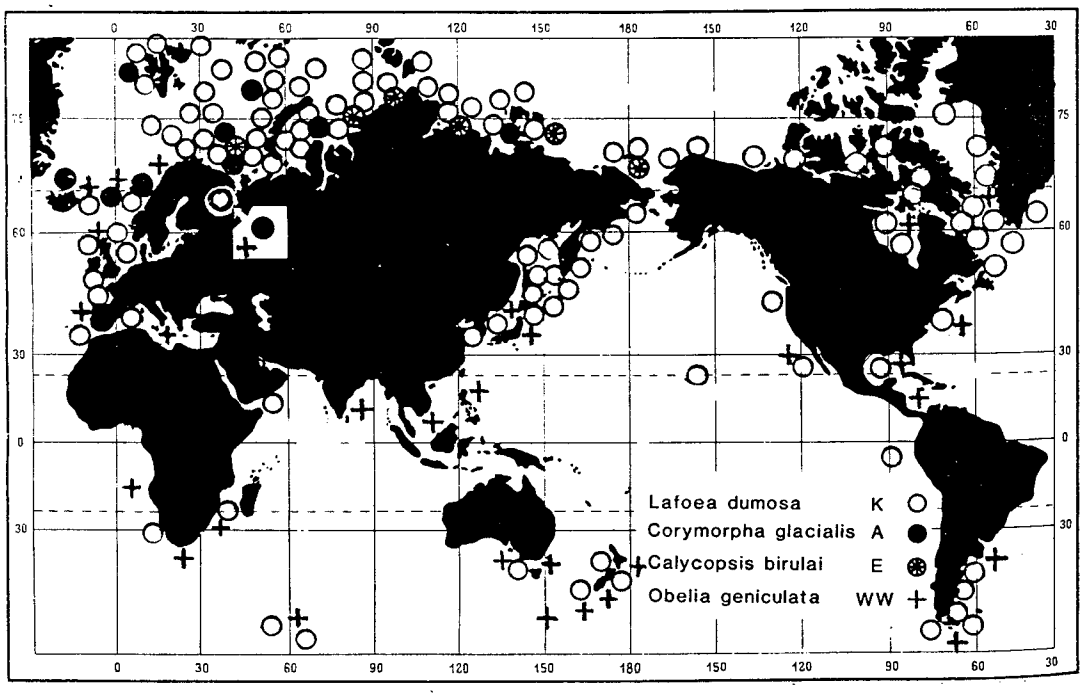


Fig 8

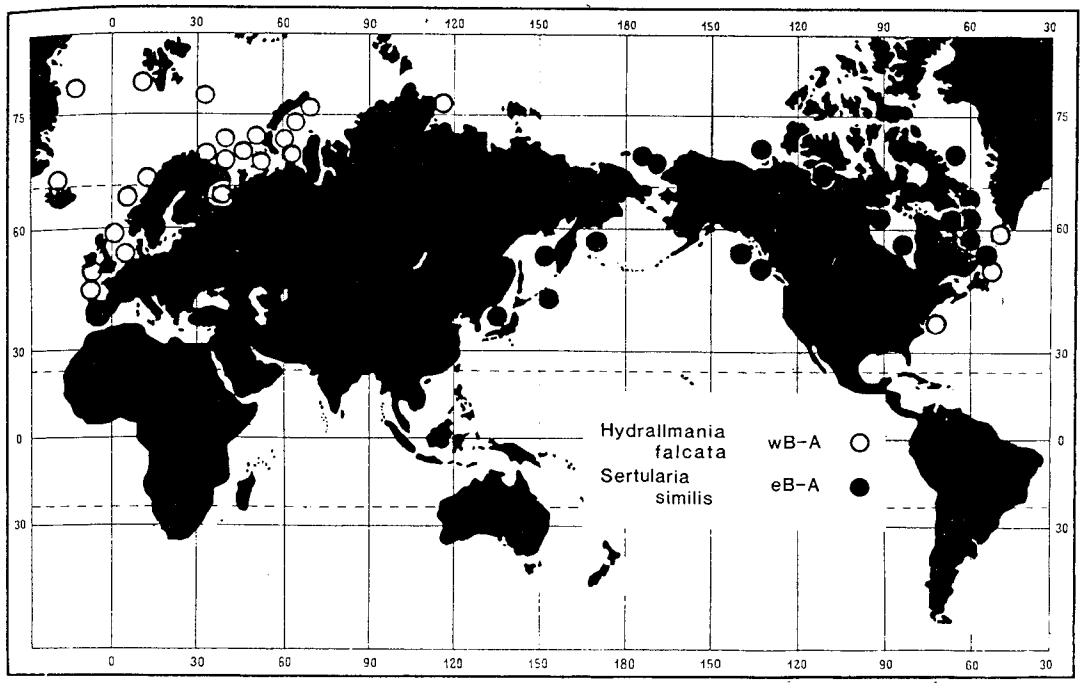
PLATE 16-III



MAP 16-1



MAP 16-2



MAP 16-3

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