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Hydromedusae from the Arctic in 2010 during the 4th Chinese National Arctic Research Expedition (CHINARE 4)

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Abstract

Fifty-seven stations (48 grid stations and nine stratified stations) were sampled across the study region (67.000°–88.394°N, 152.500°–178.643°W) during the 4th Chinese National Arctic Research Expedition (CHINARE 4) from July to August 2010 by the icebreaker R/V *Xuelong*. A total of 24 species of Hydromedusae were identified from 130 zooplankton samples, of which seven species belonged to Automedusa, eight species to Anthomedusae, four species to Leptomedudae, and three species to Siphonophora. *Catablema multicirratum* Kishinouye, 1910, *Bougainvillia bitentaculata* Uchida, 1925, and *Euphysa japonica* (Maas, 1909) were recorded for the first time in the Arctic sea. In the present paper, 18 species of Hydromedusae were described and illustrated, of which three species were described for the first time in the Arctic sea, and 15 species were described for the first time in China.

Key words: Arctic, Hydromedusae, taxonomy

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1 Introduction

Hydromedusae diversity is usually ignored compared with zooplankton taxa, leading to the previously one-sided and limited understanding (Boero and Briand, 2001; Raskoff et al., 2003; Mackie, 2002; Mills, 1995, 2001). It is only within the past few decades that the importance of the role of Hydromedusae in marine food webs and biogeochemical cycles of biogenic elements has become widely recognized, and the relations to anthropogenic activities and climate change have been revealed (Mills, 1995, 2001; Dennis, 2003; Purcell and Arai, 2001; Arai, 2001). More and more attention has been directed to the study of Hydromedusae species diversity, abundance, and distribution (Haddock, 2004).

Copepod diversity in the Arctic sea is relatively well known, but in contrast, relatively little is known of the diversity of Hydromedusae in the Arctic sea (Kosobokova and Hopcroft, 2009). Fortunately, Hydromedusae species recorded in the Arctic sea are increasing with the use of advanced collection techniques and observational tools in recent years. By analyzing the literature and relevant databases (Kosobokova and Hopcroft, 2009; Raskoff et al., 2005; Raskoff et al., 2010; Kosobokova et al., 1998; Kramp, 1961, 1968; Melnikov and Kolosova, 2001; Naumov, 1960; Raskoff, 2010; Walkusz et al., 2004; Zhang and Lin, 2000, 2001; WoRMS, 2013), 74 Hydromedusae species have been recorded in the Arctic sea.

The 130 specimens collected in the study region during CHINARE 4 in 2010 were examined. A total of 24 species of Hydromedusae were identified, of which three species, *Catablema multicirratum* Kishinouye, 1910, *Bougainvillia bitentaculata* Uchida, 1925, and *Euphysa japonica* (Maas, 1909), were recorded for the first time in the Arctic sea, and ten species had been reported by CHINARE 1 in 1999 (Zhang and Lin, 2000, 2001). So far, Hydromedusae recorded in the Arctic sea has reached 77 species.

In this study, 24 Hydromedusae species were listed from taxonomic identifications with notes on stations, date, layer depth, and number of specimens for each species collected in the region studied, of which 18 species (including three newly recorded species in the Arctic sea and 15 species previously undescribed in China) were described and illustrated. The present work will provide the reference for marine taxonomy, geographical fauna, and ecology in the Arctic sea.

2 Materials and methods

Fifty-seven stations were sampled by Xiang Peng and Wang Yanguo in the region studied (67.000°–88.394°N, 152.500°–178.643°W) from 20 July to 30 August 2010 during the CHINARE 4 cruise aboard the Chinese icebreaker R/V *Xuelong* (Fig. 1). In total, 130 zooplankton samples from the various depth layers (3 000–2 000, 2 000–1 000, 1 000–500, 500–200, 200–100, and 100–0 m) were obtained from 48 grid stations using a plankton net (50 cm mouth-diameter, 145 cm net length, 0.505 mm mesh)

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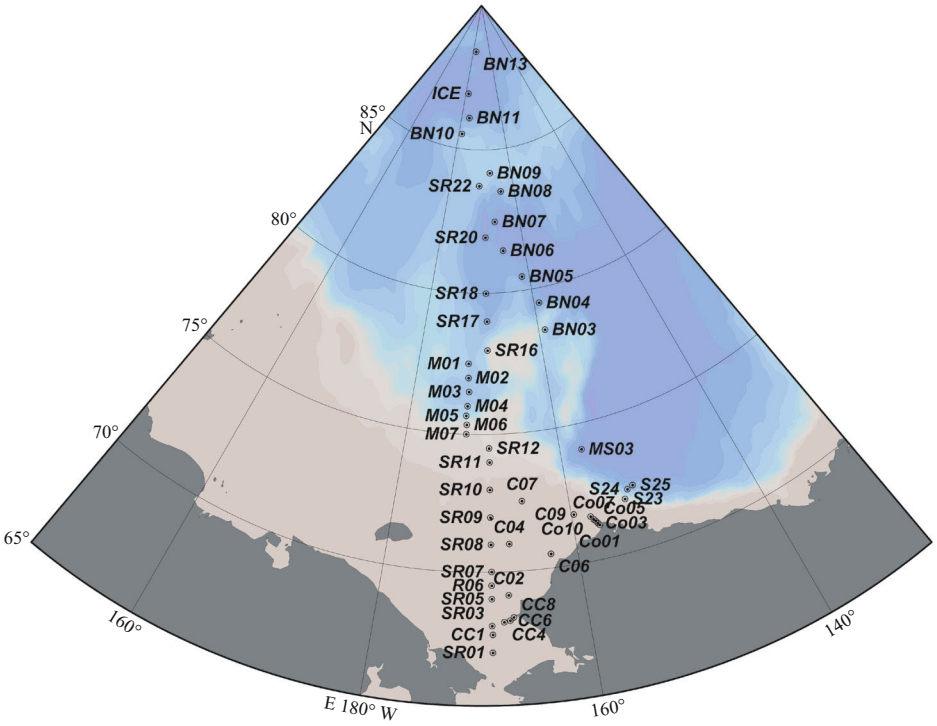

Fig.1. Sampling stations in the Arctic sea area (48 grid stations: BN03, BN04, BN05, BN06, BN08, BN09, BN10, BN11, BN13, C02, C04, C06, C07, C09, CC1, CC4, CC6, CC8, Co01, Co03, Co05, Co07, Co10, ICE, M01, M02, M04, M05, M06, M07, R06, R08, R09, S23, SR01, SR03, SR05, SR07, SR08, SR09, SR10, SR11, SR12, SR16, SR17, SR18, SR20 and SR22. Nine stratified stations: S24, S25, MS03, BN07, BN08, BN11, ICE, BN13 and M03).

and nine stratified stations using multinet tows (0.125 m^2 net opening, 250 cm net length, 0.505 mm mesh). All samples were preserved in 5% formaldehyde and were observed under the microscope for identification and counting in the laboratory. In the CHINARE 4 cruise, the survey range and number of zooplankton samples were greater than the CHINARE 1 (Zhang and Lin, 2000, 2001).

3 List and taxonomic position of the 24 Hydromedusae species

Superclass Hydrozoa Bouillon & Boero, 2000 emend.
- Class Automedusa Lameere, 1920 emend. (Bouillon & Boero, 2000)
  - Subclass Narcomedusae Haeckel, 1879
    - Family Aeginidae Gegenbaur, 1857
      - *Aeginopsis laurentii* Brandt, 1838
      - *Bathykorus bouilloni* Raskoff, 2010
      - *Solmundella bitentaculata* (Quoy & Gaimard, 1833)
  - Subclass Trachymedusae Haeckel, 1866 (1879)
    - Family Halicreatidae Fewkes, 1886
      - *Botrynema brucei* Browne, 1908
      - *Botrynema ellinorae* (Hartlaub, 1909)
    - Family Rhopalonematidae Russell, 1953
      - *Aglantha digitale* (O. F. Müller, 1766)
      - *Smithea actica* Hartlaub, 1909
- Class Hydroidomedusae Claus, 1877 emend.
  - Subclass Anthomedusae Haeckel, 1879
    - Order Filifera Kühn, 1913
      - Suborder Margelina Haeckel, 1879
        - Family Bougainvillidae Lütken, 1850
          - *Bougainvillia bitentaculata* Uchida, 1925
          - *B. principis* (Steenstrup, 1850)
          - *B. superciliaris* (L. Agassiz, 1849)
        - Family Rathkeidae Russell, 1953
          - *Rathkea octopunctata* (M. Sars, 1835)
      - Suborder Pandeida Haeckel, 1879
        - Family Bythotiaridae Maas, 1905 = (Calycopsidae)
          - *Eumedusa birulai* (Linko, 1913)
        - Family Pandeidae Haeckel, 1879
          - *Halitholus pauper* Hartlaub, 1913
          - *Catablema multicirratum* Kishinouye, 1910
    - Order Capitata Kühn, 1913
      - Suborder Tubulariidae
        - Family Euphysidae Haeckel, 1879
          - *Euphysa japonica* (Maas, 1909)
        - Family Tubulariidae Fleming, 1828
          - *Rhabdoon singulare* Keferstein & Ehlers, 1861
          - *Plotocnidae boreals* Wagner, 1885
- Subclass Leptomedusae Haeckel, 1866
  - Order Conica Broch, 1910
    - Family Laodiceidae Agassiz, 1862
      - *Staurophora mertensi*, Brandt, 1838
    - Family Melicertidae Agassiz, 1862
      - *Melicertum octocostatum* (M. Sars, 1835)
  - Order Proboscoida Broch, 1910
    - Family Campanulariidae Johston, 1836

Obelia geniculata (Linnaeus, 1758)
Obelia longissima (Pallas, 1766)
Subclass Siphonophora Eschscholtz, 1829
Order Physonectae Haeckel, 1888
Family Agalmatidae Brandt, 1835
Marrus orthocanna (Kramp, 1942)
Order Calycophorae Leuckart, 1854
Family Diphyidae Quoy & Gaimard, 1827
Subfamily Diphyinae Moser, 1925
Dimophyes arctica (Chun, 1879)
Muggiaea bargnnamae Totton, 1954

4 Species accounts

(1) *Aeginopsis laurentii* Brandt, 1838

Stations, date, layer depth, and number of specimens: collected from 14 of 48 total grid stations for the occurrence rate of 29.2%, 25 July to 27 August 2010; at stratified stations, collected from the 200–0 m and 2 000–1 000 m layers.

(2) *Bathykorus bouilloni* Raskoff, 2010 (Fig. 2)

Description: with bamboo-hat-shaped umbrella, 10 mm wide (maximum 20 mm), 7 mm high (maximum 11 mm), apical jelly thickened, marginal jelly thinned; gaster broad and flat, lenticular, 12 square gastric pouches, mouth simple, circular; 8

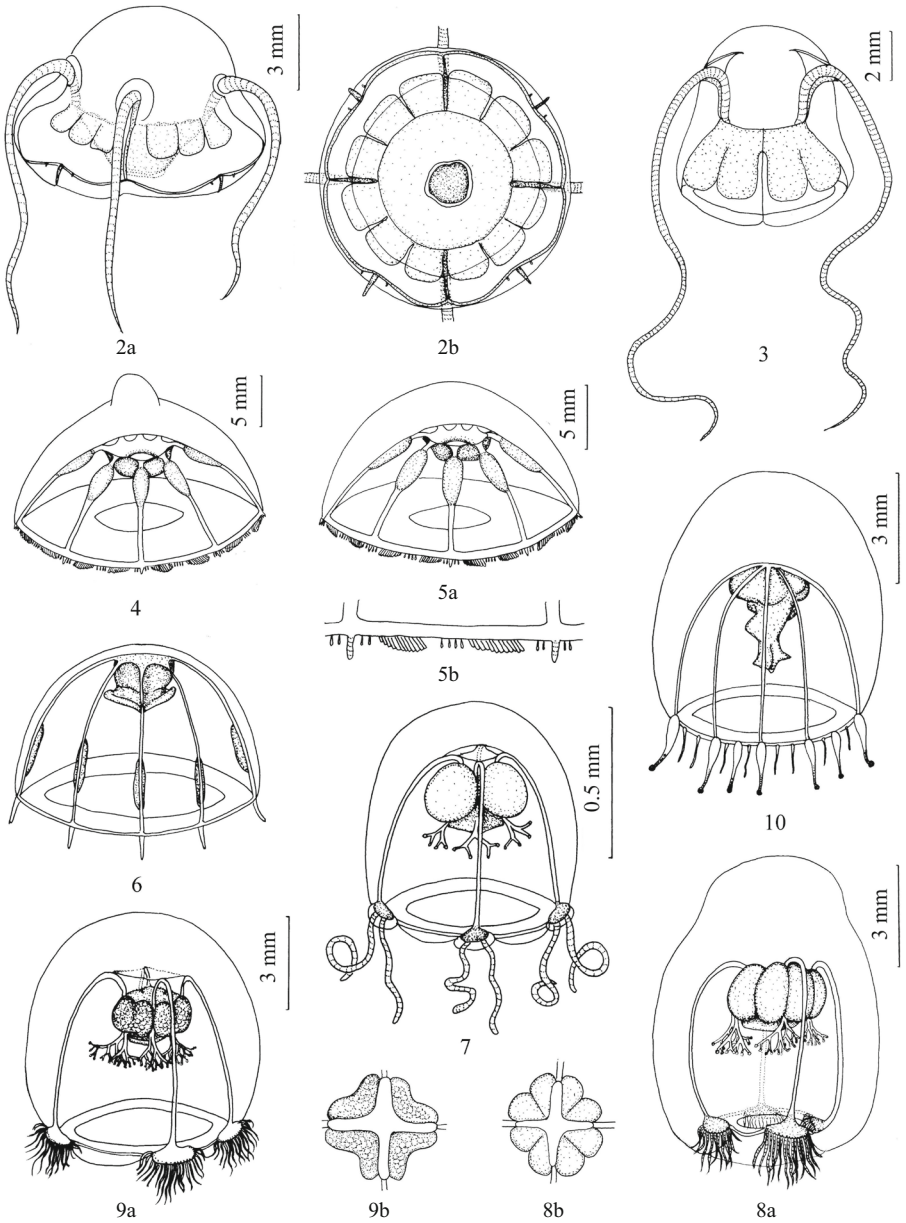

Fig.2–10. *Bathykorus bouilloni* Raskoff, 2010 (Fig. 2; a. lateral view and b. oral view); *Solmundella bitentaculata* (Quoy & Gaimard, 1833) (Fig. 3); *Botrynema brucei* Browne, 1908 (Fig. 4); *Botrynema ellinorae* (Hartlaub, 1909) (Fig. 5; a. lateral view and b. part of umbrella margin); *Sminthea actica* Hartlaub, 1909 (Fig. 6); *Bougainvillia bitentaculata* Uchida, 1925 (Fig. 7); *Bougainvillia principis* (Steenstrup, 1850) (Fig. 8; a. lateral view and b. dorsal view for gonads); *Bougainvillia superciliaris* (L. Agassiz, 1849) (Fig. 9; a. lateral view and b. dorsal view for gonads); and *Eumedusa birulai* (Linko, 1913) (Fig. 10).

marginal lappets; 4 primary, solid, perradial tentacles, issuing from the apical 1/3 of the umbrella, having deep endodermal tentacular roots that anchor into the mesoglea through the exumbrellar surface, 4 adradial, small, secondary tentacles on the margin of the bell; 8 free hanging sensory clubs on each side of the secondary tentacle, 5–7 statoliths in each cluster.

Stations, date, layer depth, and number of specimens: grid station SR07, 30 August 2010, 3 specimens; stratified station S24, 26 July 2010, 100–0 m and 1 000–500 m layers, 2 specimens; Sta. ICE, 15 August 2010, 2 000–1 000 m layer, 1 specimen; Sta. ICE, 18 August 2010, 2 000–1 000 m layer, 1 specimen; Sta. BN13, 20 August 2010, 2 000–1 000 m layer, 1 specimen; Sta. M03, 27 August 2010, 2 000–1 000 m layer, 3 specimens.

Distribution: Arctic Ocean Chukchi Plateau, Canada Basin, and Northwind Ridge (Raskoff, 2010).

(3) *Solmundella bitentaculata* (Quoy & Gaimard, 1833) (Fig. 3)

Description: umbrella hemispherical, usually small, maximum 12 mm wide, mesoglea thick, abundant in the upper half, stomach broad, lenticular; 8 rectangular gastric pouches; 2 opposing tentacles issuing from umbrella near apex, 8–32 statocysts.

Stations, date, layer depth, and number of specimens: grid station SR22, 22 August 2010, 1 specimen; Sta. BN07, 23 August 2010, 2 000–1 000 m layer, 1 specimen.

Distribution: widely distributed in all world oceans; in China, distributed from the Bohai Sea to the South China Sea (Kramp, 1961; Chiu, 1954; Zhang, 1979).

(4) *Botrynema brucei* Browne, 1908 (Fig. 4)

Description: umbrella hemispherical, 24 mm wide, apical mesoglea extremely thick, terminating in a distinct, sharp knob-shaped process; manubrium short, circular; gonads oval, on proximal or central halves of radial canals; 8 radial canals and 1 broad ring canal; 11–12 marginal tentacles in 16 groups; usually 3–4 statocysts in each interradial space and 1–2 on either side of the 8 perradial, solitary tentacles.

Stations, date, layer depth, and number of specimens: Sta. BN07, 23 August 2010, 2 000–1 000 m layer, 1 specimen; Sta. BN11, 6 August 2010, 2 000–1 000 m layer, 2 specimens; Sta. M03, 27 August 2010, 2 000–1 000 m layer, 3 specimens.

Distribution: bathypelagic medusa common in the northern Pacific, Australia, New Zealand, Indian Ocean and Atlantic Ocean (Kramp, 1968).

(5) *Botrynema ellinorae* (Hartlaub, 1909) (Fig. 5)

Description: umbrella 24 mm wide, maximum to 25 mm, hemispherical or slightly higher than the hemispherical shape, apical mesoglea slightly thick, apex dome-shape without knob; others as like *Botrynema brucei*.

Stations, date, layer depth, and number of specimens: grid stations BN06, BN09, BN10, BN11, BN13, SR17, SR18, SR20, and SR28, 2 to 26 August 2010, 39 specimens; stratified stations, collected in all layers.

Distribution: Arctic (Kramp, 1959)

(6) *Aglantha digitale* (O. F. Müller, 1766)

Stations, date, layer depth, and number of specimens: *Aglantha digitale* was the most dominant species in this Hydromedusae investigation. From 20 July to 30 August 2010, *Aglantha digitale* was detected in 45 stations among all 48 grid stations. Occurrence rate was 93.75%. In stratified stations, *Aglantha digitale* was collected in the 100–0 m layer, individually at the 1 500–1 000 m layer. Epipelagic species distributed in the Arctic (Zhang and Lin, 2001).

(7) *Sminthea arctica* Hartlaub, 1909 (Fig. 6)

Description: umbrella 7 mm wide, 5 mm high, higher than the hemispherical shape, mesogloea thin; stomach short, mouth quadrangular; 4 simple lips; 8 radial canal, 1 ring canal; gonads straight or long ovoid, extent from the half of the radial canal without reaching the ring canal; 8 marginal tentacles; velum medium board.

Stations, date, layer depth, and number of specimens: *Sminthea arctica* was the common species in this Hydromedusae investigation. In the 48 total grid stations, it was detected in the 20 stations mainly located in the western, central, and northern parts of the survey area. The occurrence rate was 41.67%. In stratified stations, *Sminthea arctica* was detected in 59 samples among the 73 total samples. Occurrence rate reached 80.82%. It was distributed from the 3 000–2 000 m layer to the surface, with especially large quantities in the 2 000–200 m layer.

Distribution: Arctic (Kosobokova and Hopcroft, 2009; Raskoff et al., 2010; Melnikov and Kolosova, 2001).

(8) *Bougainvillia bitentaculata* Uchida, 1925 (Fig.7)

Description: umbrella width and height about 1 mm, subglobose, thickened at the apex and thinned at the sides; peduncle short, manubrium short, about 1/2 length of subumbrella cavity, mouth quadrangular; gonads interradial, large, ovoid; oral tentacles short, divided twice, a nematocyst cluster at the end; 4 marginal bulbs bearing only 2 large tentacles each; 2 radial canal, 1 ring canal; velum medium board.

Stations, date, layer depth, and number of specimens: Sta. Co10, 25 July 2010, 63 m depth.

Distribution: in China, distributed in the Bohai Sea, Yellow Sea (Jiang and Chen, 1994), Taiwan Strait, and northern South China Sea (Xu and Zhang, 1974); Japan (Kubota and Gravili, 2007); Arctic.

(9) *Bougainvillia principis* (Steenstrup, 1850) (Fig. 8)

Description: umbrella 6–8 mm wide, 5–6 mm high, apex jelly thick, slightly obtuse apical projection; manubrium without gastric peduncle, short and broad, about 2/5 the length of subumbrella cavity; 8 adradial gonads, long oval, with deep interradial furrows; oral tentacles short, divided 4–5 times, almost from base; 4 radial canal wide; 4 marginal bulbs kidney shape, each with 13–15 tentacles, ocelli brown red on adradial surface of the bulb, the length between two marginal bulbs 2 times the bulb length.

Stations, date, layer depth, and number of specimens: Sta. C02 (69.12°N, 167.33°W), 21 July 2010, 48 m depth, 2 specimens.

Distribution: in China, distributed in the Bohai Sea and Yellow Sea (Kubota and Gravili, 2007); Papua New Guinea (Bouillon et al., 1986), north of Alaska, Barents Sea, northwestern Europe, Iceland, West Greenland (Kramp, 1961).

(10) *Bougainvillia superciliaris* (L. Agassiz, 1849) (Fig. 9)

Description: umbrella almost globular, 7 mm wide, 7 mm high, jelly moderately thick; gastric peduncle always well developed, with broad base, manubrium short, about half height of subumbrella cavity, mouth quadrangular, with 4–5 short oral tentacles dichotomously branched 4–5 times; gonads interradial on manubrium walls only; 4 large marginal tentacular bulbs crescent-shaped, each with a group of up to 22 (usually 11–15) tentacles; ocelli black, on base of each tentacle.

Stations, date, layer depth, and number of specimens: grid station Co05, 25 July 2010, 116 m depth, and Sta. S23, 26 July 2010, 360 m depth; 2 specimens.

Distribution: in China, distributed in the Bohai Sea (Chow and Huang, 1958); Japan (Kubota and Gravili, 2007), north Pacific, Atlantic**,** North Sea, Barents Sea, Iceland, Greenland, and Bering Sea (Kramp, 1959).

(11) *Rathkea octopunctata* (M. Sars, 1835)

Stations, date, layer depth, and number of specimens: from 21 July to 29 August 2010, *Rathkea octopunctata* was detected in only 11 stations among all 48 grid stations, and the occurrence rate was 22.92%. However, at Stas Co01, Co05, and Co07, many more specimens were collected: 11, 10, and 10 specimens at the three stations, respectively. The three stations were relatively shallow, with 46 m, 116 m, and 85 m depths, respectively. The result was very different from the summer survey by Zhang in 1999, in which the *Rathkea octopunctata* was the most dominant species (Zhang and Lin, 2000), while in this survey, its numbers were relatively little, especially since there were none in the stratified samples.

(12) *Eumedusa birulai* (Linko, 1913) (Fig. 10)

Description: umbrella 5 mm wide, 6.5 mm high, campaniform, apex jelly thick; manubrium about 1/2 – 2/3 height of subumbrella cavity, mouth simple, with 4 lips; gonads irregularly folded; 4 interradial centripetal canals, joining base of stomach in adult specimen, diverticula in juvenile; 8–16 long tentacles (12 tentacles in this specimen), hollow, wooden club-shaped, with a terminal knob of nematocysts; numerous small, solid tentacles without terminal knob.

Stations, date, layer depth, and number of specimens: Sta. Co05, 25 July 2010, 116 m depth; and Sta. SR11, 29 August 2010, 171 m depth; 2 specimens.

Distribution: Arctic, Barents Sea to Alaska (Kramp, 1968).

(13) *Halitholus pauper* Hartlaub, 1913 (Fig. 11)

Description: umbrella 5 mm wide (up to 9 mm), 7 mm high (up to 10mm), rounded apical projection; manubrium half as long as subumbrella cavity; 4 lips well developed, highly crinkled; gonads interradial, horseshoe-shaped, two bridges connecting the left and right halves of gonads in top and middle position; 4 board radial canals and 1 ring canal; 4 large perradial and 4 small interradial tentacles, 1–3 marginal warts between large and small tentacles, almost 3 marginal warts, the middle wart larger, ocelli brown red on tentacles and marginal warts.

Stations, date, layer depth, and number of specimens: only occurred at grid stations CC4, CC6, CC8, C02, C04, R06, R08, Co01, and Co03, 20 to 25 July, less than 100 m depth, 21 specimens, 8 from Sta. CC8.

Distribution: Nansha of South China Sea (Li and Chen, 1991); Japan (Kubota and Gravili, 2007), Iceland, Greenland, Arctic Canada (Kramp, 1959).

(14) *Catablema multicirratum* Kishinouye, 1910 (Fig. 12)

Description: umbrella 21 mm wide, 21 mm high with apical projection, spherically-shaped, flat rounded apical projection; stomach large with broad base, about half as long as subumbrella cavity; mouth quadrangular with 4 highly folded lips; gonads well developed, interradial, predominantly in vertical folds, faintly reticulate; 4 radial canals very broad, short and denticulated; ring canal fairly broad and not denticulated; 4 short mesenteries; marginal tentacular with laterally depressed bulbs, over 150, without, two kinds of tentacles, the large tentacles on the outer ring canal and the small ones on the inner, all tentacles do not have ocelli on the base.

Remark: this medusa from the Arctic has spherically-shaped apical projection, gonads predominantly in vertical folds, 4 short mesenteries, marginal tentacular with lateral depressed bulbs, over 150. These features place this medusa in the genus *Catablema multicirratum* (Kishinouye, 1910). However, all tentacles do not have ocelli on the base. This may result from the pigment fading in the formaldehyde preserved condition.

Stations, date, layer depth, and number of specimens: grid stations CC6, C04, Co10, R06, R08, Co01, Co03, Co07, S23, SR01, SR03, SR05, and SR10, 20 July to 29 August 2010, 33 specimens were identified in the Chukchi Sea. Most were larvae at Sta. Co01, with the 46 m depth obtaining the maximum of 10 specimens. Most of the stations were less than 100 m. No specimens were collected at stations with depths over 2 000 m.

Distribution: Japan Kuril Islands and Mutsu Bay (Kubota and Gravili, 2007), northern Pacific from Japan to Alaska, west coast of Greenland (Kramp, 1968, 1959).

(15) *Euphysa japonica* (Maas, 1909) (Fig. 13)

Description: umbrella 7 mm wide, 10 mm high, walls fairly thick, bell-shaped, apex obtuse without apical projection; manubrium broad, barrel-shaped, or cylindrical, surrounded by gonad in almost entire length, as long as bell cavity; 4 radial canals very thin, 1 ring canal; 4 perradial tentacles, moniliform, all alike, with abaxial spur.

Stations, date, layer depth, and number of specimens: grid stations CC6, CC8, C02, S23, SR08 and SR10, 20 July to 29 August 2010, 7 specimens. Most of the stations were less than 100 m except Sta. S23 with 230 m depth. No specimens were collected at stations with depths over 2 000 m.

Distribution: northern Japan (Kubota and Gravili, 2007), Arctic Pacific (Barents Sea, Okhotsk Sea), northern Pacific (Kramp, 1959).

(16) *Rhabdoon singulare* Keferstein & Ehlers, 1861 (Fig. 14)

Description: umbrella 0.5 mm wide, 0.8 mm high, bell-shaped; a single tentacle,without marginal bulbs, ending in a large nematocyst knob; mouth circular; manubrium large, longer than the umbrella; the apical manubrium, ring canal and radial cannals, with large vacuolated cells; radial canals fairly broad, with the granules, gonads encircle manubrium.

Remark: This medusa may be a juvenile specimen because its umbrella was only 0.8 mm high, while the adult umbrella is over 1 mm high. The specimen had few nematocysts in the tentacle nematocyst knob, and had a long manubrium beyond the umbrella margin. Its gonads were not obvious.

Stations, date, layer depth, and number of specimens: Sta. M03 (76.50°N, 171.83°W), 27 August 2010, 1 000–500 m layer, 1 specimen.

Distribution: Indian Ocean, Bass Strait (Hamond, 1974), Arctic (WoRMS, 2013).

(17) *Plotocnide borealis* Wagner, 1885

Stations, date, layer depth, and number of specimens: Stas R09 (53 m depth) and Co07 (85 m depth), 24 and 25 July 2010, 8 specimens. No specimens were collected at stations with the depths over 2 000 m. It showed *Plotocnide borealis* was a cool-water surface species.

(18) *Staurophora mertensi* Brandt, 1838 (Fig. 15)

Description: umbrella 14 mm wide (up to 200 mm), more flat than hemispherical; 4 radial canals transformed for a long distance into open grooves, manubrium, mouth and radial canals combined to form a large perradial cross reaching nearly umbrella; gonads on diverticulae of the four radial canals; about 200 marginal tentacles (up to 4 400), short, with elongate conical marginal bulbs; tentacles approximately alternating with

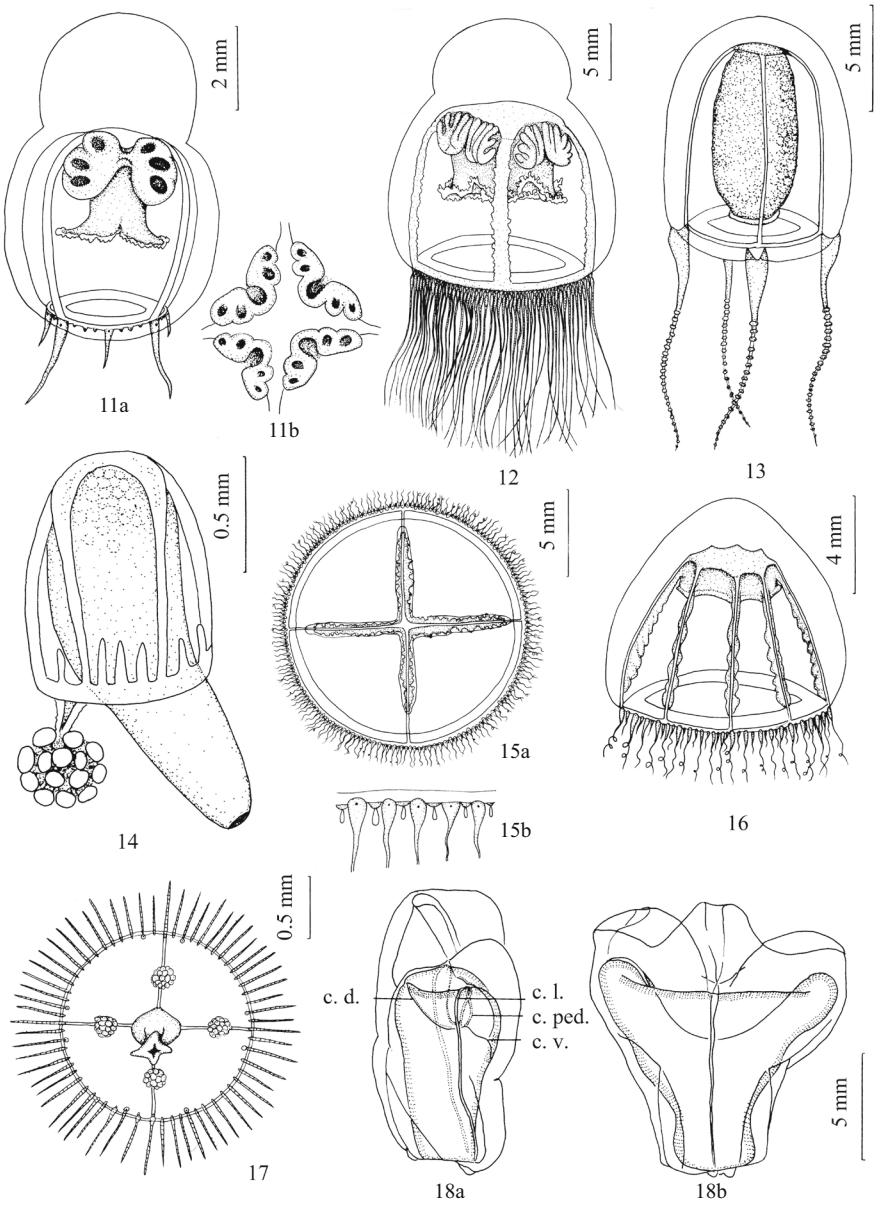

Fig.11–18. *Halitholus pauper* Hartlaub, 1913 (Fig. 11; a. lateral view and b. dorsal view for gonads); *Catablema multicirratum* Kishinouye, 1910 (Fig. 12); *Euphysa japonica* (Maas, 1909) (Fig. 13); *Rhabdoon singulare* Keferstein & Ehlers, 1861 (Fig. 14); *Staurophora mertensi* Brandt, 1838 (Fig. 15; a. oral view and b. part of umbrella margin); *Melicertum octocostatum* (M. Sars, 1835) (Fig. 16); *Obelia geniculata* (Linnaeus, 1758) (Fig. 17); and *Marrus orthocanna* (Kramp, 1942) (Fig. 18; a. lateral view and b. upper view, after Totton, 1954; c. d. means dorsal canal, c. l. lateral canals, c. v. ventral canal, and c. ped. pendicular canal).

cordyli and each with adaxial ocelli, without marginal cirris.

Stations, date, layer depth and number of specimens: Sta. S23 (71.93°N, 153.76°W), 26 July 2010, 200–0 m layer, 1 specimen.

Distribution: northern Pacific from southern Japan to Alaska, Arctic, northern and southern Atlantic (Kramp, 1968; Kubota and Gravili, 2007).

(19) *Melicertum octocostatum* (M. Sars, 1835) (Fig. 16)

Description: umbrella width and height 5–8 mm (up to 14 mm), conical bell-shaped, with jelly thin at sides and thickened in apical region; usually with 3–7 nematocyst tracts on subumbrellar surface in each octant; stomach short, octagonal, with broad base, attached to subumbrella over whole dorsal surface; mouth octagonal, with 8 simple lips; 8 gonads sinuous-sided, extending from stomach base to umbrella margin; about 40–72 large hollow marginal tentacles with laterally compressed bases, and about as many smaller ones alternate in position; no marginal cirri, sense organs and ocelli.

Stations, date, layer depth, and number of specimens: grid stations CC4, CC6, CC8, SR05, SR07, SR08, and SR09 (68.13°–72.00°N, 166.96°–170.00°W), 20 July to 30 August 2010, 11 specimens. All of the stations were located in the southern survey

area and with depths from 34 to 54 m.

Distribution: in China, southern Taiwan Strait (Xu et al., 1991); Japan (Kubota and Gravili, 2007), Papua New Guinea (Bouillon et al., 1986), Arctic.

(20) *Obelia geniculata* (Linnaeus, 1758) (Fig. 17)

Description: umbrella 1.6 mm wide, circular, flat, mesoglea very thin; manubrium short, with farily broad base; mouth quadrangle, with 4 simple lips; 4 radial canals narrow; gonads spherical, hanging in the middle of the radial canals; over 60 marginal tentacles, short, solid with rings of nematocysts; tentacles with short endodermal roots extending into bell mesoglea; 8 statocysts situated on underside of basal bulbs of some marginal tentacles and containing a single concretion.

Stations, date, layer depth, and number of specimens: Sta. Co01 (71.25°N, 157.16°W), 25 July 2010, 48 m depth, 1 specimen; Sta. Co07 (71.25°N, 157.16°W), 25 July 2010, 80 m depth, 30 specimens.

Distribution: in China, distributed from Bohai Sea to northern South China Sea (Gao, 1956; Gao et al., 1958); Japan (Kubota and Gravili, 2007), Philippines, Australia, Pacific east coast, Atlantic, Mediterranean, Arctic (Zhang and Lin, 2000).

(21) *Obelia longissima* (Pallas, 1766)

Stations, date, layer depth, and number of specimens: Sta. Co10 (71.62°N, 157.93°W), 25 July 2010, 63 m depth, 2 specimens; Sta. Co05 (71.25°N, 157.16°W), 25 July 2010, 116 m depth, 230 specimens. No specimens were collected at stations with depths over 2 000 m.

(22) *Marrus orthocanna* (Kramp, 1942) (Fig. 18)

Description: nectophores longer than broad, up to 15 mm in length, with no distinct lateral ridges. The apical ridges divide close to the ostium and delimit two narrow, triangular distal facets. Thrust block well developed and longer than the rounded lateral processes. Nectosac triangular. Bract roughly triangular with a flimsy, tacky appearance.

Stations, date, layer depth, and number of specimens: grid station BN06 (81.46°N, 164.94°W), 2 August 2010, 3 613 m depth, 40 nectophores; stratified station BN11 (86.08°N, 176.10°W), 6 August 2010, 3 881 m depth, 500–200 m layer, 1 nectophore; Sta. ICE (86.92°N, 178.36°W), 6 August 2010, 3 981 m depth, 2 000–1 000 m layer, 4 nectophores; Sta. BN13 (88.39°N, 176.63°W), 6 August 2010, 3 975 m depth, 1 000–500 m and 2 000–1 000 m layers, 5 nectophores.

Distribution: Arctic, Baffin Bay, Faroes (Totton, 1965).

(23) *Dimophyes arctica* (Chun, 1897)

Stations, date, layer depth, and number of specimens: *Dimophyes arctica* was the most dominant Siphonophorae species in the southern Canada Basin (Zhang and Lin, 2001). In the 48 grid stations, it was detected at 22 stations, which were mainly located in the southern Canada Basin of this eastern survey area. The occurrence rate was 45.83%. Collection time was from 26 July to 23 August 2010, and coordinates were 71.93°–88.39°N and 153.76°–176.63°W. Among the 22 grid stations, Sta. SR20 reached the maximun of 20 specimens. In the stratified stations, *Dimophyes arctica* was distributed in the 1 000–100 m layer, especially 500–200 m. For example, at stratified station M03-3, there were no specimens in the 100–0 m layer, 6 in the 200–100 m layer, 12 in the 500–200 m layer, 2 in the 1 000–500 m layer, and none in the 2 000–1 000 m layer.

(24) *Muggiaea bargmannae* Totton, 1954

Stations, date, layer depth, and number of specimens: *Muggiaea bargmannae* was also the common Siphonophorae species (Zhang and Lin, 2001). At the 48 total grid stations, it was detected in the 13 stations, which were mainly located in the eastern and northern parts of the survey area. The occurrence rate was 27.08%. Collection time was from 1 to 30 August, and coordinates were 71.81°–88.39°N, 154.20°–176.63°W. At the stratified stations, *Muggiaea bargmannae* was mainly distributed from 2 000 to 100 m, mainly in the 500–100 m layer.

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