

## **Deep-sea fauna of European seas: An annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe. Asteroidea**

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**ABSTRACT:** An annotated check-list is given of Asteroidea species occurring deeper than 2000 m in the seas bordering Europe. The check-list is based on published data. The check-list includes 66 species. For each species synonymy, data on localities in European seas and general species distribution are provided. Station data are presented separately in the present thematic issue.

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**KEY WORDS:** deep-sea fauna, European seas, Mid-Atlantic, Asteroidea.

## **Глуководная фауна европейских морей: аннотированный список видов донных беспозвоночных, обитающих глубже 2000 м в морях, окружающих Европу. Asteroidea**

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**РЕЗЮМЕ:** Приводится аннотированный список видов Asteroidea, обитающих глубже 2000 м в морях, окружающих Европу. Список основан на опубликованных данных. Список насчитывает 66 видов. Для каждого вида приведены синонимия, данные о нахождении в европейских морях и сведения о распространении. Данные о станциях приводятся в отдельном разделе настоящего тематического выпуска.

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**КЛЮЧЕВЫЕ СЛОВА:** глуководная фауна, европейские моря, Срединная Атлантика, Asteroidea.

**Phylum Echinodermata****Class Asteroidea****Order Paxilloidea****Family Astropectinidae****Genus *Bathybiaster*****Danielssen et Koren, 1882**

COMPOSITION: 2 species (Clark, 1989). Type species: *Astropecten pallidus* Danielssen et Koren, 1877.

DISTRIBUTION: Arctic — 1, Atlantic Ocean — 2, Indian Ocean — 1; 80–3110 m.

***Bathybiaster vexillifer*  
(Thomson, 1873)**

*Archaster vexillifer* Thomson, 1873: 150, fig. 25. *Bathybiaster vexillifer*: Bell, 1891: 228–231; Clark, Downey, 1992: 47–48, pl. 13A, E, F; Dilman, 2008: 132.

LOCALITIES: Norwegian North-Atlantic Expedition (1876–1878), St. 295, St. 303, St. 40 (Danielsen, Koren, 1884); NORATLANTE (1969), P. 6–B. 1 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 10, ES 34, AT 107A, AT 114, AT 138, AT 139, AT 144, AT 151, AT 153, AT 154, AT 161, AT 167, AT 171, AT 175, ES 176, AT 177, AT 181, ES 182, ES 184, AT 186, AT 191, AT 195, ES 197, AT 198, ES 200, SWT 10, SWT 11, SWT 16, (Gage et al., 1983); “Akademik Mstislav Keldysh” (1982), St. 316-5, St. 317-4 (Dilman, 2006); “Challenger” (1984–1985), AT 201, AT 218, AT 228, ES 232, AT 233, ES 244, AT 245, AT 247, AT 267, AT 271, AT 273, AT 288, 3/85/7 OTSB (3) (Harvey et al., 1988); “Discovery” (2000–2001), 13910#1, 14141#1 (Collins, 2000; Bagley Ph., 2001); “G.O. Sars” (2004), MAR-ECO cruise, St. 68/384, St. 72/386 (Dilman, 2008); “James Cook” (2007), St. JC011/017, JC011/023, JC011/075, JC011/101, JC011/106, JC011/111 (Dilman, 2013); “James Cook” (2009) JC037/061, JC037/067, JC037/070 (Dilman, 2013).

DISTRIBUTION: The Arctic region; North Atlantic south to the Cape Hatteras (35°N) in the west and the Bay of Biscay in the east; also Mid-Atlantic from Iceland to the Charlie-Gibbs Fracture Zone. According to Clark, Courtman-Stock (1976) the species also has been recorded southwest off Cape Point, South Africa.

DEPTH RANGE: 225–3110 m.

**Genus *Dytaster* Sladen, 1885**

COMPOSITION: 17 species (Mah, 2014). Type species: *Archaster grandis* Verrill, 1884.

DISTRIBUTION: Atlantic Ocean — 10, Pacific Ocean — 6, Antarctic region — 1; 1000–5005 m.

***Dytaster grandis* (Verrill, 1884)**

*Archaster grandis* Verrill, 1884: 218. *Dytaster grandis*: Verrill, 1894: 248; Clark, Downey, 1992: 53–54, fig. 13a–c, pls. 15A, B, 16C, D; Dilman, 2008: 132; Dilman, 2013: 566.

REMARKS: Downey *in* Clark, Downey (1992) distinguishes 2 subspecies: *D. g. grandis* and *D. g. nobilis* (Sladen, 1889) (Western South Atlantic). *D. g. grandis* differs from *D. g. nobilis* in the number of adambulacral furrow spines (7–8 instead of 5).

LOCALITIES: “Challenger” (1873–1876), St. 79 (Sladen, 1889); “Talisman” (1883), St. 134, 138 (Perrier, 1885; 1894); “Princesse-Alice” (1896), St. 749, 753, 757 (Koehler, 1909); NORATLANTE (1969), P. 115–B. 17, P. 116–B. 18 (Cherbonnier, Sibuet, 1972); “Shackleton” (1977), St. 121 (Gage et al., 1983); “Discovery” (1977), 9640/1; “Challenger” (1979–1982), 50514/1, 50711/1, 50811/1, 50910/1, 51214/1, 51216/4, 51309/1, 51414/1, 51610/1 (Tyler et al., 1990); “Discovery” (2000–2001), 13925/1, 14137/1, 14158/1 (Collins, 2000; Bagley Ph., 2001); “G.O. Sars” (2004), St. 40/367, 46/372, 52/374 (Dilman, 2008); “James Cook” (2007), St. JC011/017, JC011/023 (Dilman, 2013); “James Cook” (2007), St. JC037/015, JC037/027 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean, from the US coast south to ca. 36°S in the west, and from Porcupine Abyssal Plain to south-west Africa in the east, Mid-Atlantic from the Charlie-Gibbs Fracture Zone area to the Azores.

DEPTH RANGE: 1000–4930 m.

***Dytaster insignis* (Perrier, 1884)**

*Archaster insignis* Perrier, 1884: 256, pl. 9. *Dytaster insignis*: Perrier, 1894: 299; Clark, Downey, 1992: 54, pl. 16G, H.

LOCALITIES: NORATLANTE (1969), P. 62–C. 3, P. 65–B. 10, P. 67–B. 11 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 53, ES 55, ES 56, ES 129, AT 131, AT 153, AT 181, ES 182, SWT 13, SWT 27 (Gage et al., 1983); “Shackleton” (1977), ES 120, AT 121 (Gage et al., 1983); “James Cook” (2009), St. JC037/027 (Dilman, 2013).

DISTRIBUTION: Gulf of Mexico, the West Indies, also off Tristan da Cunha and the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 2515–3670 m.

***Dytaster mollis* (Perrier, 1885)**

*Crenaster mollis* Perrier, 1885a: 71; 1894: 310, pl. 18. 3. *Dytaster mollis*: Clark, Downey, 1992: 55, pl. 16E, F.

LOCALITIES: “Talisman” (1883), St. 131 (Perrier, 1894); “Atlantis” (1948), St. 20 (Clark, 1949).

DISTRIBUTION: the Azores.

DEPTH RANGE: 2560–3000 m.

***Dytaster semispinosus* (Perrier, 1894)**

*Crenaster semispinosus* Perrier, 1894: 307. *Dytaster semispinosus* Clark, Downey, 1992: 55.

LOCALITIES: “Talisman” (1883), St. 137 (Perrier, 1894).

DISTRIBUTION: Bay of Biscay, the Azores.

DEPTH RANGE: 4200–5005 m.

**Genus *Persephonaster*****Wood-Mason et Alcock, 1891**

COMPOSITION: 24 species (Mah, 2014). Type species: *Persephonaster croceus* Wood-Mason et Alcock, 1891.

DISTRIBUTION: Atlantic Ocean — 8, Pacific Ocean — 11, Indian Ocean — 8; 160–3430 m. Centre of diversity — Indo-West Pacific.

***Persephonaster patagiatus* (Sladen, 1889)**

*Psilaster patagiatus* Sladen, 1889: 232–234, pl. 7 (11, 12), pl. 41 (3, 4); Downey, 1973: 32, pl. 8 A, B. *Persephonaster patagiatus*: Mortensen, 1927: 65–66, fig. 37; Clark, Downey, 1992: 63–64, figs 14d, 15f, g, pl. 19A, C; Howell et al., 2002: 1906.

LOCALITIES: “Princesse-Alice” (1901), St. 1116 (Koehler, 1909); “Challenger” (1984–1985), AT 107A, AT 186, SWT 27 (Harvey et al., 1988).

DISTRIBUTION: West Atlantic: Gulf of Mexico and Caribbean basin, warm-water part of Denmark Strait, East Atlantic: from the Rockall Trough to northwestern Africa, also Reykjanes Ridge and off the Azores.

DEPTH RANGE: 730–2970 m.

**Genus *Plutonaster* Sladen, 1885**

COMPOSITION: 13 species (Mah, 2014). Type species: *Archaster bifrons* Thomson, 1873.

DISTRIBUTION: Atlantic Ocean — 6, Indian Ocean — 1, Pacific Ocean — 6; 12–3110 m.

***Plutonaster agassizi* (Verrill, 1880)**

*Archaster agassizi* Verrill, 1880: 403. *Plutonaster agassizi*: Grieg, 1921 [1932]: 14–15, pl. 4, figs 2–4; Sibuet, 1977: 552; Clark, Downey, 1992: 69–71, pl. 17A–E; Benavides-Serrato et al., 2005: 177; Dilman, 2008: 134–135; Dilman, 2013: 566–567.

REMARKS: Downey *in* Clark, Downey (1992) distinguishes 2 subspecies: *P. a. agassizi* (Verrill, 1880) and *P. a. notatus* Sladen, 1889. According to Clark *in* Clark, Downey (1992), *P. a. notatus* differs from *P. a. agassizi* in having a more delicate appearance; narrower tips to the arms; marginals relatively slightly smaller and more numerous; superomarginals form a less conspicuous border; macroscopic superomarginal armament lacking altogether and inferomarginal spines inconspicuous, restricted to interradii or lacking.

LOCALITIES: “Travailleur” (1881), St. 36 (Perrier, 1894); “Princesse-Alice” (1896), St. 632 (Koehler, 1909); “Atlantis” (1948), St. 28 (Clark, 1949); “Discovery” (1971), 7711/78 (Clark *in* Clark, Downey, 1992); “G.O. Sars” (2004), St. 42/368, 50/373, 52/374, 54/377, 56/378, 62/380 (Dilman, 2008); “James Cook” (2009), St. JC037/027 (Dilman, 2013).

DISTRIBUTION: South of Newfoundland (*ca.* 43°N, 51°W) to the Florida Strait and Gulf of Me-

xico (also Guiana Basin, according to the website “World Asteroidea Database”) in the western Atlantic, from south of Ireland (*ca.* 53°N, 20°W) to South Africa in the eastern Atlantic, also Mid-Atlantic, from the Charlie-Gibbs Fracture Zone to Ascension Island.

DEPTH RANGE: 70–4252 m.

***Plutonaster bifrons*****(Thomson, 1873)**

*Archaster bifrons* Thomson, 1873: 122–123, figs 17, 74. *Plutonaster bifrons*: Sladen, 1889: 84–88, pl. 11: 1–4, pl. 13: 9, 10; Sibuet, 1977: 552; Clark, Downey, 1992: 71–72, figs 15m, 16a, b, pl. 18A–C; Dilman, 2008: 135; Dilman, 2013: 567.

LOCALITIES: “Porcupine” (1869), St. 19 (Sladen, 1889); “Travailleur” (1881), St. 4 (Perrier, 1894); NORATLANTE (1969), P. 6 – B. 1, P. 124 – B. 19 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 6, AT 107A, AT 144, AT 151, AT 153, AT 154, AT 161, AT 167, AT 171, AT 175, ES 176, AT 177, AT 181, ES 182, ES 184, AT 186, ES 190, AT 191, AT 195, ES 197, AT 198, ES 200, SWT 10, SWT 11, SWT 27, SWT 32 (Gage et al., 1983); “Challenger” (1984–1985), AT 201, ES 202, ES 218, AT 228, ES 232, AT 233, ES 244, AT 245, AT 247, ES 264, AT 267, AT 271, AT 273, ES 285, AT 286, AT 288, ES 289 (Harvey et al., 1988); St. 50304 (Clark, Downey (1992) noted only the area — the Porcupine Seabight, depth 2600 m); “Discovery” (2001), St. 14143/1 (Bagley, 2001); “James Cook” (2009), St. JC037/027.

DISTRIBUTION: East Atlantic from Faroe Channel to off South Africa, also Charlie-Gibbs Fracture Zone in the Mid-Atlantic.

DEPTH RANGE: 630–4252 m.

**Genus *Psilaster* Sladen, 1885**

COMPOSITION: 13 species (Mah, 2014). Type species: *Astropecten andromeda* Müller et Troschel, 1842.

DISTRIBUTION: Atlantic Ocean — 5, Pacific Ocean — 7, Indian Ocean — 1, Antarctic region — 2; 35–2970 m.

***Psilaster andromeda*****(Müller et Troschel, 1842)**

*Astropecten andromeda* Müller, Troschel, 1842: 129; Düben, Koren, 1846: 250–251, pl. 7 (18, 19). *Psilaster andromeda*: Sladen, 1885: 61; Perrier, 1894: 195–196; Koehler, 1909: 60–61, pl. 2 (3), pl. 16 (8, 9); Clark, Downey, 1992: 77–79, figs 14a, c, 15a–e, k, l, pls 21D–G, 22A, B.

REMARKS: Clark *in* Clark, Downey (1992) distinguished 2 subspecies: *P. a. andromeda* (Müller, Troschel, 1842) and *P. a. florum* (Verrill, 1878) (Grand Banks, south of Newfoundland, to south-east

of Cape May). *P. a. andromeda* differs from *P. a. flora* by absence (in most cases) of a spine on supermarginal plates beyond the first five or six and by narrow supermarginals on the upper side.

LOCALITIES: “Challenger” (1973–1982), AT 107A; AT 186, SWT 27 (Gage et al., 1983).

DISTRIBUTION: Arctic Ocean: Murman coast, Barents Sea and Norwegian Sea. Atlantic Ocean: from Grand Banks to New Jersey (c. 38.5°N) in the west, and from Arctic south to the Bay of Biscay in the east.

DEPTH RANGE: 35–2965 m.

### Family Porcellanasteridae

#### Genus *Caulaster* Perrier, 1882

COMPOSITION: 5 species (Belyaev, Mironov, 1996). Type species: *Caulaster pedunculatus* Perrier, 1882

DISTRIBUTION: Atlantic Ocean — 2, Pacific Ocean — 3, Indian Ocean — 1, Antarctic region — 1; 1505–6035 m.

#### *Caulaster pedunculatus* Perrier, 1882

*Caulaster pedunculatus* Perrier, 1882: 1379–1381; Perrier, 1894: 204–208, pl. XV (fig. 1a–e); Belyaev, Mironov, 1996: 892–896, fig. 3; Dilman, 2008: 135–136; Dilman, 2013: 567. *Porcellanaster coeruleus*: Lieberkind, 1935 (part): fig. 1B–D, fig. 3 (1, 2, 4), pl. II (2–6), pl. III (12), pl. V (17). *Porcellanaster caeruleus*: Madsen, 1961 (part): 127–129. *Porcellanaster ceruleus*: Gage et al., 1983 (?part): 275–276; Clark, Downey, 1992 (part): 100–101.

REMARKS: Validity of the genera *Caulaster* and *Porcellanaster* has not been agreed up to date. Some authors recognise *Caulaster* as a separate genus, others believe that representatives of *Caulaster* are juveniles of *Porcellanaster*. The most recent publication devoted to the status of *Caulaster* and *Porcellanaster* is Belyaev, Mironov (1996). These authors examined rich collection of original material from the Atlantic Ocean and Antarctic and re-established the genus *Caulaster*. According to Belyaev, Mironov (1996), the juveniles of *Porcellanaster ceruleus* are well distinguishable from adult *Caulaster pedunculatus* of the same size by complete plate cover of the ventrolateral areas, well developed inferomarginals; lack of pedicellariae and spear-like furrow spines.

LOCALITIES: “Travailleur” (1881), St. 4 (Perrier, 1894); “Talisman” (1883), St. 131 (Perrier, 1894); “Ingolf” (1895–1896), St. 11 (Lieberkind 1935, cit. Madsen 1961); NORATLANTE (1969), P. 11–B. 2, P. 12–E. 2 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 2, ES 6, ES 8, ES 10, ES 11, ES 27, ES 34, SBC 49, ES 52, ES 55, ES 56, ES 57, SBC 58, ES 59, ES 111, ES 129, ES 135, ES 137, ES 140, AT 141, ES 143, ES 147, ES 152, ES 164, AT 169, ES 172, SBC 174, ES 176, ES 180, ES

184, ES 185, ES 190, AT 191, ES 197, SWT 13 (Gage et al., 1983); “Shackleton” (1977), ES 118, AT 121 (Gage et al., 1983); “Akademik Mstislav Keldysh” (1982), St. 268-1, 316-5, 317-4, 352, 390-3, 499 (Belyaev, Mironov, 1996); “Challenger” (1984–1985) ES 204, ES 207, ES 218, ES 231, ES 266, AT 267, AT 282, ES 283, AT 284, ES 285, AT 286 (Harvey et al., 1988); “G.O. Sars” (2004), St. 66/383 (Dilman, 2008); “James Cook” (2007), St. JC011/017, JC011/075, JC011/106, JC011/111 (Dilman, 2013); “James Cook” (2009) JC037/015, JC037/061, JC037/067, JC037/070, JC037/079 (Dilman, 2013).

DISTRIBUTION: Davis Strait, the northern Mid-Atlantic Ridge (Reykjanes Ridge, Charlie-Gibbs Fracture Zone area), and from the Rockall Trough to the Bay of Biscay.

DEPTH RANGE: 1505–3076 m.

#### Genus *Eremicaster* Fisher, 1905

COMPOSITION: 3 species (Clark, 1989). Type species: *Porcellanaster (Eremicaster) tenebrarius* Fisher, 1905, a synonym of *Eremicaster crassus* (Sladen, 1883).

DISTRIBUTION: Atlantic Ocean — 2, Pacific Ocean — 3, Indian Ocean — 2, Sub-antarctic region — 3; 1570–7250 m.

#### *Eremicaster vicinus* (Ludwig, 1907)

*Porcellanaster vicinus* Ludwig, 1907: 318. *Eremicaster vicinus*: Clark, 1920: 77; Clark, Downey, 1992: 97, fig. 18e. *Eremicaster pacificus*: Madsen, 1951: 76–78, fig. 1. [Non *E. pacificus* Ludwig, 1907]

LOCALITIES: “James Cook” (2007), St. JC011/075 (Dilman, 2013).

DISTRIBUTION: Pacific Ocean; Indian and Southern Oceans; in Atlantic, Cape Verde Basin and the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 2605–7250 m.

#### Genus *Hyphalaster* Sladen, 1883

COMPOSITION: 3 species (Mah, 2014). Type species: *Hyphalaster hyalinus* Sladen, 1883.

DISTRIBUTION: Pacific Ocean — 2, Atlantic Ocean — 1, Antarctic — 1; 1444–5430 m.

#### *Hyphalaster inermis* Sladen, 1883

*Hyphalaster inermis* Sladen, 1883: 239–242; Sladen, 1889: 162–164, pl. 25 (4–6), pl. 28 (5–8); Madsen, 1961 (part): 58–72, figs 6–7, pl. 1–3, pl. 13 (3, 4) (synonymy before 1961); Clark, Downey, 1992: 98–99, figs 18g–i, 19a, b, j, pl. 26A–C; Howell et al., 2002: 1906; Dilman, 2008: 136–137; Dilman, 2013: 568.

LOCALITIES: “Talisman” (1883), St. 131, St. 138 (Perrier, 1885b, 1894); “Princesse-Alice” (1895–1910), St. 753, 1787, (Koehler, 1907, 1909, cit. Madsen, 1961); “Hirondelle II” (1912), St. 3223 (Koehler, 1921, cit. Madsen 1961); “Atlantis” (1948),

St. 15 (Clark, 1948, cit. Madsen, 1961); NORATLANTE (1969), P. 11 – B. 2, P. 12 – E. 2, P. 115 – B. 17 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 147, SWT 13 (Gage et al., 1983); “Challenger” (1979–1981), 50603/1, 50604/1, 51216/4 (Clark, Downey, 1992); “Challenger” (1994–1999), 53201, 54301, 54901 (Ramirez-Llodra et al., 2002); “Discovery” (1985–1998), St. 11261, 12930, 13078, 13200, 13368, 13627 (Ramirez-Llodra et al., 2002); “Discovery” (2000), 13906/1, 13925/1 (Collins, 2000); “G.O. Sars” (2004), MAR-ECO cruise, St. 54/377, 64/381, 66/383, (Dilman, 2008); “James Cook” (2007), St. JC011/017, JC011/023, JC011/075, JC011/075 (Dilman, 2013); “James Cook” (2009), St. JC037/015, JC037/019, JC037/027, JC037/067, JC037/070 (Dilman, 2013).

DISTRIBUTION: West Atlantic: Labrador Basin and Guyana Basin, East Atlantic from Rockall Trough to Guinea Basin, also the Charlie-Gibbs Fracture Zone area and eastwardly [c. 54°N, 27.5°W according to Clark, Downey (1992)]; Indian Ocean; Pacific Ocean: off Japan, off Marquesas, Kermadec Trench; Antarctica.

DEPTH RANGE: 1444–5430 m.

### Genus *Porcellanaster*

#### Thomson, 1877

COMPOSITION: 2 species (Clark, 1989). Type species: *Porcellanaster ceruleus* Thomson, 1877.

REMARKS: Madsen (1961) concluded that 13 nominal species of Porcellanasteridae are the junior synonyms of *P. ceruleus*. The two species, *Caulaster pedunculatus* Perrier, 1882 and *Porcellanaster eremicus* Sladen, 1889 were re-established by Belyaev, Mironov (1986) as valid species of the genus *Caulaster*. According to these authors, *Porcellanaster caulifer* Sladen, 1883, *P. tuberosus* Sladen, 1883 and *P. granulosus* Perrier, 1885 may be valid species of the genus *Porcellanaster*.

DISTRIBUTION: Atlantic Ocean — 1–2, Pacific Ocean — 1–3, Indian Ocean — 1; 1158–8720 m.

### *Porcellanaster ceruleus*

#### Thomson, 1877

*Porcellanaster ceruleus* Thomson, 1877: 378–380, figs 97–98; Belyaev, Mironov, 1996: 887–892, figs 1–2; Clark, Downey, 1992 (part): 100–101, fig. 18 a, c, pl. 27A–C; Dilman, 2006: 179–180; Dilman, 2008: 137. *Porcellanaster caeruleus*: Sladen, 1883: 218–222; Sladen, 1889 (part): 134–138, pls 20 (1–7), 20A (1–10); Madsen, 1961 (part): 126–130, 136–138, fig. 22 (synonymy before 1961). *Porcellanaster coeruleus*: Lieberkind, 1935 (part): 5–19, fig. 1A, pl. II (1, 7, 8).

LOCALITIES: “Talisman” (1883), St. 131 (Perrier, 1885b; 1894); NORATLANTE (1969), St. P.11, St. P.12 (Cherbonnier, Sibuet, 1972); “G.O. Sars” (2004), St. 54/377, St. 64/381, St. 66/383, St. 68/

384, St. 72/386 (Dilman, 2008); “James Cook” (2007), St. JC011/017, JC011/075, JC011/101, JC011/106, JC011/111 (Dilman, 2013); “James Cook” (2009), St. JC037/015, JC037/019, JC037/027, JC037/061, JC037/067, JC037/070 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean: from Davis Strait to Maryland in the west, and from Iceland southward to South Africa in the east, including the Azores and the Charlie-Gibbs Fracture Zone. Also Indo-West Pacific (according to Madsen, 1961).

DEPTH RANGE: 2270–3600 m. According to Howell et al. (2002), this species was found in the north-eastern Atlantic at depth 1327–4846 m. Sibuet (1975) reported the species at depths 2840–4335 m in the SE Atlantic. Clark (1989) gave depth range 1160–6040 m for this species. However, some of the records of *Porcellanaster ceruleus* are doubtful owing to confusion of the genera *Porcellanaster* and *Caulaster*.

### Genus *Styracaster* Sladen, 1883

COMPOSITION: 12 species (Mah, 2014). Type species: *Styracaster horridus* Sladen, 1883.

DISTRIBUTION: Pacific Ocean — 8, Indian Ocean — 6, Atlantic Ocean — 5, Antarctic region — 1; 2000–6600 m.

### *Styracaster armatus* Sladen, 1883

*Styracaster armatus* Sladen, 1883: 232–234; Sladen, 1889: 153–154, pl. 24 (1–4), pl. 28 (1–4); Madsen, 1961: 119–121, fig. 21 (synonymy before 1961); Madsen, 1981: 318–319, fig. 8; Belyaev, Moskalev, 1986b: 875–876, figs 2 (6), 3 (9–10), 4 (6), 5 (2); Belyaev, Moskalev, 1986c: 1017, fig. 1; Clark, Downey, 1992: 102–103, pl. 27G, H; Howell et al., 2002: 1906; Dilman, 2008: 137; Dilman, 2013: 569.

LOCALITIES: “Talisman” (1883), St. 131 (Perrier 1885); “Princesse-Alice” (1895–1896), St. 527, 745, 753 (Koehler 1909); “Challenger” (1981), 51216/4 (Clark, Downey, 1992); G.O. Sars (2004), St. 54/377, 64/381 (Dilman, 2008); “James Cook” (2009), St. JC037/019, St. JC037/027 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean: Guyana Basin in the west, and from Ireland south to Cape Verde Islands in the east, also the Charlie-Gibbs Fracture Zone and the Azores; Indian Ocean: Bay of Bengal; West Pacific.

DEPTH RANGE: 2700–5422 m.

### *Styracaster chuni* Ludwig, 1907

*Styracaster chuni* Ludwig, 1907: 491; Lieberkind, 1932: 276–281, figs 5–7, pl. 1 (figs 3–4), pl. 4 (figs 2–6), pl. 6 (figs 12–15), Lieberkind, 1935: pl. V (5, 8); Madsen, 1961: 113–118, figs 3, 20, pl. 10, figs 3–5 (synonymy before 1961); Belyaev, 1969a: 110; Belyaev, Moskalev, 1986b: 876, figs 2 (7), 3 (11), 5 (3); Belyaev, Moskalev, 1986c: 1016, fig. 1; Clark, Downey, 1992: 103, fig. 19e; Howell et al., 2002: 1906; Dilman, 2008: 137–138. *Styra-*

*caster chuni* var. *groenlandica* Lieberkind, 1935: 26–29, figs 9, 10, pl. 1, figs 1–3 and 6, Pl. 3 (13–16), pl. IV (10–13), pl. V (6, 7).

LOCALITIES: NORATLANTE (1969), P. 12 – E. 2, P. 115 – B. 17, P. 116 – B. 18 (Cherbonnier, Sibuet, 1972); “Challenger” (1994–1999), St. 53201, 13078, 54301, 54901 (Ramirez-Llodra et al., 2002); “Challenger” (1979–1981), 50603/1, 50711/1, 51216/4 (Clark, Downey, 1992); “Discovery” (1985–1998), St. 11261, 12930, 13200, 13368, 13627 (Ramirez-Llodra et al., 2002); “Discovery” (2000), 13925#1 (Collins, 2000); “G.O. Sars” (2004), St. 54/377, 64/381 (Dilman, 2008).

DISTRIBUTION: Atlantic Ocean: southern part of the Davis Strait in the west, and from the Porcupine Abyssal Plain and the Bay of Biscay to ~8°S in the east, also the Charlie-Gibbs Fracture Zone and eastwardly (c. 54°N 27°W according to Clark *in* Clark, Downey (1992)); Pacific Ocean, off New Zealand.

DEPTH RANGE: 2492–4877 m.

### ***Styracaster elongatus* Koehler, 1907**

*Styracaster elongatus* Koehler, 1907: 11–13; Koehler, 1909a: 33–38, pl. 19 (5–6), pl. 20 (2–4), pl. 21 (3–5); Koehler, 1921a: 2; Madsen, 1961: 110–113, fig. 19, pl. 10 (figs 1–2); Madsen, 1981: 310–317, figs 1–7; Belyaev, Moskalev, 1986a: 776, 778, fig. 4 D; Belyaev, Moskalev, 1986a: 1016, fig. 1; Belyaev, Moskalev, 1986c: 1016, fig. 1; Clark, Downey, 1992: 103–104, fig. 19k, pl. 27 I; Howell et al., 2002: 1906. *Styracaster* sp.: Belyaev, 1985: 545–546.

LOCALITIES: “Princesse-Alice” (1896), St. 753 (Koehler, 1909); BIOGAS (1972–1974), St. 4 (Sibuet, 1977).

DISTRIBUTION: Atlantic Ocean: Caribbean Basin in the west, and from the Porcupine Abyssal Plain to Angola in the east; also Indian Ocean (according to Madsen, 1961).

DEPTH RANGE: 3310–6600 m.

### ***Styracaster horridus* Sladen, 1883**

*Styracaster horridus* Sladen, 1883: 229–232; Sladen, 1889: 150–152, pl. 23 (5–7), pl. 27 (17–20); Koehler, 1909: 38–39; Koehler, 1921a: 2; Madsen, 1961: 93–107, figs 12–17, pls. 7–8; Belyaev, 1969a: 110; Clark, Downey, 1992: 104–105, fig. 19c, g, l; Howell et al., 2002: 1906.

LOCALITIES: “Princesse-Alice” (1896–1904), St. 757, 1789 (Koehler, 1909); NORATLANTE (1969), P. 116 – B. 18 (Cherbonnier, Sibuet, 1972); “Challenger” (1994–1997), St. 53201, 12930, 13078 (Ramirez-Llodra et al., 2002); “Discovery” (1997–1998), St. 13200, 13368 (Ramirez-Llodra et al., 2002).

DISTRIBUTION: East Atlantic: from Porcupine Abyssal Plain to Namibia; Indian Ocean; Pacific Ocean: off New Zealand.

DEPTH RANGE: 4040–5600 m.

### **Genus *Thoracaster* Sladen, 1883**

COMPOSITION: 1 species (Clark, 1989). Type species: *Thoracaster cylindratus* Sladen, 1883.

DISTRIBUTION: Atlantic Ocean — 1; Indian Ocean — 1; Pacific Ocean — 1; 2540–5990 m.

### ***Thoracaster cylindratus* Sladen, 1883**

*Thoracaster cylindratus* Sladen, 1883: 245–247; Sladen, 1889: 168–170, pl. 29 (1–6); Koehler, 1909: 40–41, pl. 18 (1); Lieberkind, 1932: 285–288, fig. 10, pl. 2 (figs 1–2), pl. 3 (figs 12–14), pl. 4 (fig. 1), pl. 6 (figs 5–8); Madsen, 1961: 82–92, figs 10–11, pls 5–6; Clark, Downey, 1992: 105–106, fig. 18f, pl. 26D–G; Howell et al., 2002: 1906.

LOCALITIES: “Talisman” (1883), St. 134 (Perrier, 1885b; 1894); “Princesse-Alice” (1896), St. 753 (Koehler, 1909); “Challenger” (1980), St. 50812 (Clark, Downey, 1992).

DISTRIBUTION: Atlantic Ocean: off Canary Islands, off Azores, southwest of Ireland; Indian Ocean; North and East Pacific.

DEPTH RANGE: 2540–5990 m.

## **Order Notomyotida**

### **Family Benthopectinidae**

#### **Genus *Benthopecten* Verrill, 1884**

COMPOSITION: 23 species (Clark, 1989). Type species: *Benthopecten spinosus* Verrill, 1884.

DISTRIBUTION: Atlantic Ocean — 4, Pacific Ocean — 14, Indian Ocean — 5; 420–3700 m. Centre of diversity — West and Southwest Pacific.

#### ***Benthopecten simplex* (Perrier, 1881)**

*Archaster simplex* Perrier, 1881: 28; 1884: 264, pl. 1 (8). *Benthopecten simplex*: Ludwig, 1910: 451, 464, 465, 466; Downey, 1973: 40, pl. 12 (figs C, D); Howell et al., 2002: 1906; Clark, Downey, 1992: 121–123, fig. 23l, pl. 30A.

REMARKS: Clark, Downey (1992) distinguish 2 subspecies: *B. s. simplex* (Perrier, 1881) and *B. s. chardyi* Sibuet, 1975 (Gulf of Guinea). *B. s. simplex* differs in the presence of central disc spines, also in the number of adambulacral plates corresponding to the first ten inferomarginals (16–23 instead of 24–25).

LOCALITIES: NORATLANTE (1969), P. 124 – B. 19 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 4, ES 10, ES 34, AT 107A, AT 114, AT 138, AT 139, AT 144, AT 151, AT 153, AT 154, AT 161, AT 167, AT 171, AT 175, ES 176, AT 177, AT 181, ES 182, ES 184, AT 186, AT 191, AT 195, ES 197, AT 198, ES 200, SWT 13, SWT 16, SWT 17, SWT 32 (Gage et al., 1983); “Challenger” (1984–1985), AT 201, ES 202, AT 218, AT 228, ES 232, AT 233, ES 244, AT 245, AT 247, ES 264, AT 271, AT 273, AT 288, ES 289, 3/85/7 OTSB (2) (Harvey et al., 1988); “Discovery” (2001), 14143#1 (Bagley, 2001).

DISTRIBUTION: West Atlantic from Cape Cod to Guyana Basin, East Atlantic from Rockall Trough to the Gulf of Guinea, also south of Iceland (personal comments of F.J. Madsen, published in the book by Clark, Downey, 1992) and Reykjanes Ridge.

DEPTH RANGE: 1175–3757 m.

#### ***Benthopecten spinosus* Verrill, 1884**

*Benthopecten spinosus* Verrill, 1884: 218; Clark, Downey, 1992: 124–125, fig. 21d, pl. 30B, C; Dilman, 2008: 138.

LOCALITIES: “G.O. Sars” (2004), St.54/377, 72/386 (Dilman, 2008).

DISTRIBUTION: West Atlantic from ~43° N to Guyana in the south (not found in the Gulf of Mexico and the Caribbean), also Mid-Atlantic: the Reykjanes Ridge and the Charlie-Gibbs Fracture Zone.

DEPTH RANGE: 1300–3700 m.

#### **Genus *Cheiraster* (*Cheiraster*) Studer, 1883**

COMPOSITION: 13 species (Clark, 1989). Type species: *Cheiraster gazella* Studer, 1883.

DISTRIBUTION: Atlantic Ocean — 2, Pacific Ocean — 10, Indian Ocean — 4; 170–3700 m. Centre of diversity — West and Southwest Pacific region.

#### ***Cheiraster* (*Cheiraster*) *sepius* (Verrill, 1885)**

*Archaster sepius* Verrill, 1885a: 151. *Cheiraster* (*Cheiraster*) *sepius*: Clark, 1981: 117–118, figs 4i–r, 5c; Clark, Downey, 1992: 129–130, figs 22d, e, 23b, pl. 31D–H; Howell et al., 2002: 1906; Dilman, 2008: 138.

LOCALITIES: “Challenger” (1873–1876), St. 79 (Sladen, 1889); “G.O. Sars” (2004), St.54/377 (Dilman, 2008).

DISTRIBUTION: Atlantic Ocean: Nova Scotia south to Venezuela in the west, from Rockall Trough to the Cape Verde in the east, also west of Iceland and the Charlie-Gibbs Fracture Zone.

DEPTH RANGE: 485–3700 m.

#### **Genus *Pectinaster* Perrier, 1885**

COMPOSITION: 3 species (Clark, 1989). Type species: *Pectinaster filholi* Perrier, 1885.

DISTRIBUTION: Pacific Ocean — 2, Indian Ocean — 3, Atlantic Ocean — 1; 690–4850 m.

#### ***Pectinaster filholi* Perrier, 1885**

*Pectinaster filholi* Perrier, 1885a: 71; Perrier, 1894: 280–285, pl. 18 (2), pl. 20 (3); Clark, Downey, 1992: 139–140, figs 21b, 22l, m, pl. 34A, C; Howell et al., 2002: Dilman, 2008: 139; Dilman, 2013: 569.

LOCALITIES: “Challenger” (1973–1982), ES 10, ES 34, AT 114, AT 138, AT 139, AT 141, AT 144, AT 153, AT 154, AT 161, AT 167, AT 171, AT 175, ES 176, AT 177, AT 181, ES 182, ES 184, ES 185, AT 186, ES 197, AT 198, SWT 16 (Gage et al.,

1983); “Akademik Mstislav Keldysh” (1982), St. 316–5, 317–4, 499 (Dilman, 2006); “Challenger” (1984–1985), AT 201, AT 233, AT 267, AT 288, 3/85/7 OTSB (Harvey et al., 1988); “Discovery” (2001), St. 14143#1 (Bagley, 2001); “G.O. Sars” (2004), St.68/384, 72/386 (Dilman, 2008); “James Cook” (2009), St. JC037/015, JC037/027 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean: south of Nova Scotia to Delaware, USA and off the River Plate in the west, and from the Rockall Trough to South Africa in the east, also Mid-Atlantic Ridge from south of Iceland to the Azores.

DEPTH RANGE: 1260–4850 m.

#### **Genus *Pontaster* Sladen, 1885**

COMPOSITION: 1 species (Clark, 1989). Type species: *Astropecten tenuispinus* Düben et Koren, 1846.

DISTRIBUTION: Circum-Arctic and Atlantic Ocean; 16–2620 m.

#### ***Pontaster tenuispinus***

#### **(Düben et Koren, 1846)**

*Astropecten tenuispinus* Düben, Koren, 1846: 251–253, pl. 8 (20–22). *Pontaster tenuispinus*: Sladen, 1889: 28–29; Koehler, 1909: 10–13, pl. 10 (1–4), pl. 12 (6); Koehler, 1924: 185–186, pl. 2 (15); Grainger, 1966: 5, 26–27, fig. 6; Clark, Downey, 1992: 140–142, figs 22n, o, 23m, n, pl. 34D–G; Howell et al., 2002.

LOCALITIES: “F. Litke” (1955), St. 32 (Koltun, 1964); “Challenger” (1973–1982), AT 107A, (Gage et al., 1983); “Challenger” (1984–1985), AT 271, AT 273 (Harvey et al., 1988).

DISTRIBUTION: Arctic Ocean: from the Canadian Arctic Islands to the East Siberian Sea, also Norwegian Sea; Atlantic Ocean: from Arctic waters to Cape Cod in the west and to the Bay of Biscay in the east, also Iceland and the Reykjanes Ridge.

DEPTH RANGE: 16–2620 m.

### **Order Valvatida**

#### **Family Odontasteridae**

#### **Genus *Hoplaster* Perrier, 1882**

COMPOSITION: 2 species (Clark, 1993). Type species: *Hoplaster spinosus* Perrier in Milne Edwards, 1882.

DISTRIBUTION: Atlantic Ocean — 1, Pacific Ocean — 1; 1795–3310 m.

#### ***Hoplaster spinosus* Perrier, 1882**

*Hoplaster spinosus* Perrier in Milne Edwards, 1882: 48; Perrier, 1894: 324–325, pl. 14: 2; Clark, Downey, 1992: 151–152, pl. 36E, F.

LOCALITIES: “Travailleur” (1881–1883), St. 3, 131 (Perrier, 1894); “Challenger” (1973–1982), AT 167 (Gage et al., 1983); “Shackleton” (1977), AT 121 (Gage et al., 1983); “Challenger” (1984–

1985), ES 266, AT 267 (Harvey et al., 1988). “Challenger”, St. 50304, 51110; “Discovery” (1979), St. 10112 (Clark, Downey, 1992).

DISTRIBUTION: East Atlantic from Rockall Trough to Cape Town, including the Azores.

DEPTH RANGE: 1795–3310 m.

### Family Poraniidae

#### Genus *Chondraster* Verrill, 1895

COMPOSITION: 2 species (Clark, 1993). Type species: *Porania grandis* Verrill, 1878.

DISTRIBUTION: Atlantic Ocean — 2; 300–2490 m.

#### *Chondraster grandis* (Verrill, 1878)

*Porania grandis* Verrill, 1878: 371–372; Verrill, 1885b: 542, pl. 15 (44), pl. 16 (44a). *Chondraster grandis*: Clark, 1984: 27–33, fig. 4A, B, 5A, 6A, B, 7d; Clark, Downey, 1992: 203–204, fig. 35: e, pl. 49: A–F.

LOCALITIES: “Porcupine” (1869), St. 31 (Sladen, 1889); “Challenger” (1984–1985), AT 247 (Harvey et al., 1988).

DISTRIBUTION: Atlantic Ocean: off Cape Cod south to c. 38°N off New Jersey, southwest of the Faroe Islands to the Bay of Biscay.

DEPTH RANGE: 300–2490 m.

#### Genus *Tylaster* Danielssen et Koren, 1881

COMPOSITION: 1 species (Clark, 1993). Type species: *Tylaster willei* Danielssen et Koren, 1881.

DISTRIBUTION: Arctic; 520–2920 m.

#### *Tylaster willei* Danielssen et Koren, 1881

*Tylaster willei* Danielssen, Koren, 1881: 186; Daniels- sen, Koren, 1884b: 64; Ludwig, 1900: 459; Djakonov, 1933: 44.

LOCALITIES: “Ob” (1956), St. 6, 45 (Koltun, 1964).

DISTRIBUTION: Norwegian Sea and westward to the west Greenland and eastward to the Kara Sea.

DEPTH RANGE: 520–2920 m.

### Family Goniasteridae

#### Genus *Ceramaster* Verrill, 1899

COMPOSITION: 17 species (Mah, 2014). Type species: *Asterias granularis* Retzius, 1783.

DISTRIBUTION: Pacific Ocean — 13, Indian Ocean — 2, Atlantic Ocean — 3; 0–2500 m. Centre of diversity — North and Northwest Pacific.

#### *Ceramaster granularis* (Retzius, 1783)

*Asterias granularis* Retzius, 1783: 238. *Ceramaster granularis*: Mortensen, 1914: 245, 250, fig. 1, pl. 4 (fig. 4); Clark, Downey, 1992: 233–234, fig. 39a, b, pl. 55A, B.

REMARKS: Downey *in* Clark, Downey (1992) distinguished 2 subspecies: *C. g. granularis* (Retzius, 1783) and *C. g. trispinosus* Clark, 1923 (south-

west of Vasco da Gama Peak, South Africa). According to these authors, the two subspecies have slight differences in the form of adambulacral and interradial supermarginal plates, but geographical isolation suggests that *trispinosus* is the subspecies of *Ceramaster granularis*.

LOCALITIES: “Challenger” (1984–1985), AT 273 (Harvey et al., 1988).

DISTRIBUTION: Atlantic Ocean: from southern Greenland and Newfoundland south to 41°N (Long Island) in the west, Barents Sea and southward to South Africa, including Iceland waters and Reykjanes Ridge; North Pacific according to Clark (1993).

DEPTH RANGE: 40–2185 m.

#### *Ceramaster grenadensis* (Perrier, 1881)

*Pentagonaster grenadensis* Perrier, 1881: 19; Perrier, 1884: 168, 181, 186, 232–233, pl. 8 (2); Sladen, 1889: 265, 266, 744. *Ceramaster grenadensis*: Verrill, 1915: 222; Halpern, 1970: 213, figs 8–9; Downey, 1973: 49, pl. 17C, D; Clark, Downey, 1992: 234–237, fig. 39c–f, pl. 55C–F.

REMARKS: Downey *in* Clark, Downey (1992) distinguished 3 subspecies in the Atlantic Ocean: *C. g. grenadensis* (Perrier, 1881), *C. g. euryplax* (Clark, 1923) (W and SW of Cape Province, South Africa) and *C. g. patagonicus* (Sladen, 1889) (Falkland Plateau, Burdwood Bank in the Atlantic, also from Gulf of California and southern Alaska to Bering Sea in the Pacific). According to Downey, the subspecies differ in the number of granules of abactinal plates, the shape of superomarginal plates, number of pairs of superomarginals in contact. In addition, *C. g. grenadensis* occurs deeper than others subspecies: 200–2500 m compared to 156–462 m for *C. g. euryplax* and 106–192 m for *C. g. patagonicus*. According to Downey, there are two more subspecies in the Pacific Ocean: *C. g. fisheri* Bernasconi, 1963 and *C. g. productus* Djakonov, 1950.

LOCALITIES: “Talisman” (1883), St. 38 (Perrier 1894); “Princesse-Alice” (1901), St. 1116 (Koehler, 1909).

DISTRIBUTION: Atlantic Ocean: from Florida to northern Brazil in the west, from Ireland to the Gulf of Guinea in the east, also off the Azores and Mediterranean.

DEPTH RANGE: 200–2500 m.

#### Genus *Litonotaster* Verrill, 1899

COMPOSITION: 4 species (Clark, 1993). Type species: *Litonotaster intermedius* (Perrier, 1884).

DISTRIBUTION: Atlantic Ocean — 3, Pacific Ocean — 1; 1050–5200 m.

***Litonotaster intermedius* (Perrier, 1884)**

*Pentagonaster intermedius* Perrier, 1884: 243, pl. 5, figs. 5–6. *Litonotaster intermedius*: Verrill, 1899: 172, pl. 28, figs. 5–5b; Clark, Downey, 1992: 250–251, pl. 59C, D.

LOCALITIES: “James Cook” (2010), St. JC048/53 Dive 178 (Dilman, 2013).

DISTRIBUTION: Gulf of Mexico, Cuba to Guyana, Straits of Florida, West Indies. Also northern Mid-Atlantic, the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 1960–3530 m.

**Genus *Mediaster* Stimpson, 1857**

COMPOSITION: 17 species (Clark, 1993). Type species: *Mediaster aequalis* Stimpson, 1857.

DISTRIBUTION: Atlantic Ocean — 3, Pacific Ocean — 13, Indian Ocean — 3; 16–3509 m. Centre of diversity — West and Southwest Pacific.

***Mediaster bairdi* (Verrill, 1882)**

*Archaster bairdi* Verrill, 1882: 139. *Mediaster bairdi*: Verrill, 1899: 181, pl. 24 (figs 1–9), pl. 26 (figs 8–8a); Halpern, 1970: 53, fig. 4; Clark, Downey, 1992: 251–253, pl. 60A–C.

REMARKS: According to Downey in Clark, Downey (1992), two subspecies occur in the Atlantic Ocean: *M. b. bairdi* (Verrill, 1882) and *M. b. capensis* (Clark, 1923) (False Bay area, South Africa). *M. b. bairdi* differs from *M. b. capensis* in the number of central granules on the abactinal plates (8–10 opposed to 3–8 at similar R=53 mm). Moreover, *M. b. bairdi* occurs deeper (642–3509 m opposed to 38–170 m in *M. b. capensis*).

LOCALITIES: “G.O. Sars” (2004), St. 54/377 (Dilman, 2008).

DISTRIBUTION: Atlantic Ocean: from Newfoundland to Guyana in the west, and from the Rockall Trough to South Africa in the east, also Charlie-Gibbs Fracture Zone.

DEPTH RANGE: 38–3509 m.

**Genus *Paragonaster* Sladen, 1885**

COMPOSITION: 7 species (Clark, 1993). Type species: *Paragonaster ctenipes* Sladen, 1889.

REMARKS: According to Mah, Foltz (2011) and Mah (2014) the genus *Paragonaster* is referred to the family Pseudarchasteridae, order Paxillosida, based on molecular phylogenetic analysis.

DISTRIBUTION: Atlantic Ocean — 2, Pacific Ocean — 4, Indian Ocean — 2; 50–4825 m.

***Paragonaster subtilis* (Perrier, 1881)**

*Goniopecten subtilis* Perrier, 1881: 26; Perrier, 1884: 168, 183, 242–254, pl. 5: 3–4. *Paragonaster subtilis*: Perrier, 1894: 358, pl. 23: 5, pl. 24: 3; Koehler, 1909: 86, pl. 4: 2; Sibuet, 1977: 552; Clark, Downey, 1992: 256–257, pl. 62: C, D; Howell et al., 2002: 1906.

LOCALITIES: “Talisman” (1883), St. 131, 134 (Perrier, 1894); “Princesse-Alice” (1896), St. 652

(Koehler, 1909); “Challenger” (1973–1982), ES 6, ES 27, ES 28, ES 34, ES 53, ES 56, ES 111, ES 129, AT 131, AT 138, AT 139, ES 140, AT 141, ES 147, ES 164, AT 171, AT 177, ES 180, AT 186, SWT 16, OTSB 51001 (Gage et al., 1983); “Shackleton” (1977), AT 121 (Gage et al., 1983); “Challenger” (1977), ES 204, AT 267, AT 282, ES 283, AT 284, ES 285, AT 286, 51301 OTSB, 3/85/5 OTSB, 3/85/7 OTSB (Harvey et al., 1988); “Discovery” (2001), St. 14137#1 (Bagley, 2001).

DISTRIBUTION: Atlantic Ocean: from New York area to Gulf of Mexico, from Rockall Trough south to the Gulf of Guinea and the Azores.

DEPTH RANGE: 1845–4825 m.

**Genus *Plintaster* Verrill, 1899**

COMPOSITION: 5 species (Mah, 2014). Type species: *Pentagonaster perrieri* Sladen, 1889.

DISTRIBUTION: Atlantic Ocean — 1, Indian Ocean — 3, Pacific Ocean — 1; 229–2910 m.

***Plinthaster dentatus* (Perrier, 1884)**

*Pentagonaster dentatus* Perrier, 1884: 168, 242, pl. 3: 8. *Plinthaster dentatus*: Fisher, 1910: 172; Sibuet, 1977: 552; Clark, Downey, 1992: 260, pl. 61: D, E.

LOCALITIES: According to Sibuet (1977), the species was found on the depths 1845–2430 m.

DISTRIBUTION: North Carolina sea area and Gulf of Mexico to northern Brazil sea area, Rockall Trough to Gulf of Guinea, also Azores, Canary and Cape Verde Islands sea areas.

DEPTH RANGE: 229–2910 m. Max depth of the early juvenile stage distribution is 4069 m (Sumida et al., 2001).

**Genus *Pseudarchaster* Sladen, 1885**

COMPOSITION: 21 species (Clark, 1993). Type species: *Pseudarchaster discus* Sladen, 1889.

REMARKS: According to Mah, Foltz (2011) and Mah (2014) the genus *Pseudarchaster* is referred to the family Pseudarchasteridae, order Paxillosida, based on molecular phylogenetic analysis.

DISTRIBUTION: Atlantic Ocean — 3, Pacific Ocean — 15, Indian Ocean — 4; 56–3540 m. Centre of diversity — West and Southwest Pacific.

***Pseudarchaster gracilis* (Sladen, 1889)**

*Aphroditaster gracilis* Sladen, 1889: 117, pl. 17 (1–2), pl. 18 (7–8). *Pseudarchaster gracilis*: Mortensen, 1927: 86; Halpern, 1972: 360, figs 1–2; Downey, 1973: 59, pl. 23C, D; Clark, Downey, 1992: 262–263, pl. 62E–H.

REMARKS: Downey in Clark, Downey (1992) distinguished 2 subspecies in the Atlantic Ocean: *P. g. gracilis* (Sladen, 1889) and *P. g. tessellatus* Sladen, 1889 (from Gulf of Guinea to False Bay, South Africa). *P. g. gracilis* differs from *P. g. tessellatus* in the presence of only one row of abactinals reaching the terminal plate and in the greater number of oral

spines (8–10 instead of 6–9). Furthermore, *P. g. gracilis* is deeper (320–2940 m instead of 168–732 m in *P. g. tessellatus*).

LOCALITIES: “Challenger” (1984–1985), AT 233, AT 288, ES 289, 3/85/7 OTSB (Harvey et al., 1988); “G.O. Sars” (2004), St. 56/378 (Dilman, 2008); “James Cook” (2009), St. JC037/015 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean: from Cape Cod south to the Equator and from Rockall Trough to the False Bay, South Africa, also the Charlie-Gibbs Fracture Zone.

DEPTH RANGE: 168–2940 m.

***Pseudarchaster parelii*  
(Düben et Koren, 1846)**

*Astropecten parelii* Düben, Koren, 1846: 247, pl. 7 (14–16); Verrill, 1885: 543, pl. 13 (37). *Pseudarchaster parelii*: Fisher, 1911a (pt): 202; Sibuet, 1977: 552; Clark, Downey, 1992: 264, pl. 63A, B.

LOCALITIES: “Porcupine” (1869), St. 31 (Sladen, 1889); “Talisman” (1883), St. 129 (Perrier, 1894); NORATLANTE (1969), P. 6 – B. 1, P. 124 – B. 19 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 55, ES 56, AT 114, AT 138, AT 139, AT 144, AT 151, AT 154, AT 167, AT 175, ES 176, AT 177, AT 181, ES 184, AT 191, AT 195, AT 198, ES 200, SWT 10, SWT 11, SWT 16, SWT 27 (Gage et al., 1983); “Challenger” (1984–1985), AT 201, ES 202, AT 267, AT 288 (Harvey et al., 1988).

DISTRIBUTION: Barents Sea, Norwegian Sea and North Atlantic: south to the Bay of Biscay in the east and Florida in the west, also Iceland.

DEPTH RANGE: 75–3540 m.

**Order Velatida**

**Family Solasteridae Viguier, 1878**

**Genus *Lophaster* Verrill, 1878**

COMPOSITION: 10 species (Mah, 2014). Type species: *Solaster fuscifer* Düben et Koren, by original designation.

DISTRIBUTION: Atlantic Ocean — 4, Pacific Ocean — 3, Indian Ocean — 1, Antarctic region — 4, Arctic Ocean — 1; 6–4200 m. Centre of diversity — Southern Ocean.

***Lophaster fuscifer* (Düben et Koren, 1846)**

*Solaster fuscifer* Düben, Koren, 1846: 243; Grieg, 1907: 8, pl. 1 (figs 3–5), pl. 3 (fig. 9). *Lophaster fuscifer*: Verrill, 1878: 214; Duncan, Sladen, 1881: 43, pl. 3, figs 9–12; Smirnov, 1990: 440; Clark, Downey, 1992: 299–300, fig. 47a, b, pl. 73C, D; Clark, 1996: 188; Dilman, 2008: 140–141.

LOCALITIES: “G.O. Sars” (2004), St. 72/386 (Dilman, 2008).

DISTRIBUTION: Arctic Ocean: from the Canadian Arctic Islands to the East-Siberian Sea. Atlantic

Ocean: from Arctic Ocean to the Bermudas in the west, and to Faroe Channel in the east, also the Reykjanes Ridge and Charlie-Gibbs Fracture Zone.

DEPTH RANGE: 6–2555 m.

**Family Pterasteridae**

**Genus *Calyptroaster* Sladen, 1882**

COMPOSITION: 5 species (Clark, 1996). Type species: *Calyptroaster coa* Sladen, 1882.

DISTRIBUTION: Atlantic Ocean — 4, Indian Ocean — 1; 145–6560 m.

***Calyptroaster personatus* (Perrier, 1885)**

*Cryptaster personatus* Perrier, 1885a: 69. *Calyptroaster personatus*: Madsen, 1947: 3–7, figs 1–2; Downey, 1973: 80, pl. 35C–D; Clark, Downey, 1992: 309–310, pl. 75C, D; Clark, 1996: 197.

LOCALITIES: “Talisman” (1883), St. 131 (Perrier, 1894); NORATLANTE (1969), P. 65 – B. 10 (Cherbonnier, Sibuet, 1972).

DISTRIBUTION: West Atlantic: from Florida and Bahamas south to Colombia.

DEPTH RANGE: 2150–6560 m.

**Genus *Hymenaster* Thomson, 1873**

COMPOSITION: 52 species (Dilman, 2013; Mah, 2014). Type species: *Hymenaster pellucidus* Thomson, 1873.

DISTRIBUTION: Pacific Ocean — 28, Atlantic Ocean — 16, Indian Ocean — 2, Southern Ocean — 9, Arctic Ocean — 1; 13–9990 m.

***Hymenaster coccinatus* Sladen, 1882**

*Hymenaster coccinatus* Sladen, 1882: 238; Sladen, 1889: 522–524, pl. XC, figs. 3, 4, pl. XCI, figs. 10–12; AM Clark, 1996: 200; Dilman, 2008: 141–142; Dilman, 2013: 569–571, fig. 1 A, B.

LOCALITIES: “Challenger” (1873–1876), St. 146 (Sladen, 1889); “G.O. Sars” (2004), St. 68/384 (Dilman, 2008); “James Cook” (2007), St. JC011/106, JC011/101, JC011/111 (Dilman, 2013); “James Cook” (2009) St. JC037/15, JC037/19, JC037/27 (Dilman, 2013).

DISTRIBUTION: Mid-Atlantic Ridge, the Charlie-Gibbs Fracture Zone area. Also Sub-antarctic between Marion and the Crozet Islands.

DEPTH RANGE: 2350–2750 m.

***Hymenaster ecomari* Dilman, 2013**

*Hymenaster ecomari* Dilman, 2013: 573–574, figs 2A, B, 3C, D

LOCALITIES: “James Cook” (2010), St. 48/40, Dive 173 (Dilman, 2013).

DISTRIBUTION: Mid-Atlantic, the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 2623–2428 m.

***Hymenaster giboryi* Perrier, 1885**

*Hymenaster giboryi* Perrier, 1885a: 69; Perrier, 1894: 189, pl. 14: 1; Cherbonnier, Sibuet, 1972: 1349–1350; Koehler, 1909: 93, pl. 1 (2, 3); Clark, Downey, 1992: 316–317, fig. 51f–h; Clark, 1996: 201.

LOCALITIES: “Talisman” (1883), St. 134 (Perrier, 1894); “Princesse-Alice” (1896), St. 652 (Koehler, 1909); NORATLANTE (1969), P. 6 – B. 1 (Cherbonnier, Sibuet, 1972).

DISTRIBUTION: Off Newfoundland and off Jamaica, west of Ireland and between the Azores, Madeira Islands and Portugal.

DEPTH RANGE: 2215–4261 m.

***Hymenaster latebrosus* Sladen, 1882**

*Hymenaster latebrosus* Sladen, 1882: 230; Sladen, 1889: 514, pl. 92, figs. 4–5, pl. 93, figs. 7–9; Clark, 1923: 300; Clark, Courtman-Stock, 1976: 83; Clark, Downey, 1992: 317–318, pl. 76 G, H; Clark, 1996: 202. *Hymenaster* sp. (part): Dilman, 2008: 142–143; Dilman, 2013: 574, fig. 3E.F.

LOCALITIES: “Challenger” (1873–1876), St. 157 (Sladen, 1889); “G.O. Sars” (2004), St. 54/377; “James Cook” (2009), St. JC037/27 (Dilman, 2013).

DISTRIBUTION: Rockall Trough, west of South Africa and the Mid-Atlantic Ridge, the Charlie-Gibbs Fracture Zone area; Antarctic and Subantarctic waters (according to the Antarctic Invertebrates database, see “References” section).

DEPTH RANGE: 1460–3570 m; 722–5045 m according to the Antarctic Invertebrates database.

***Hymenaster membranaceus* Thomson, 1877**

*Hymenaster membranaceus* Thomson, 1877: 108; Mortensen, 1927: 106; Sibuet, 1976: 315; Sibuet, 1977: 552; Gage et al., 1983: 282; Clark, 1996: 202. *Hymenaster pellucidus*: Dilman, 2006: 182; Dilman, 2008: 142; Dilman, 2013: 574–575. [Non *H. pellucidus* Thomson, 1877].

LOCALITIES: POLYGAS, CV 08, CV 09, CV 10, CV 11, CV 12; POLYGAS A, DS 18, DS 26; BIOGAS III (1973), CV 23, CV 24; BIOGAS IV (1974), CP 02, CP 03, DS 51; BIOGAS VI (1974), CP 09, CP 10 (Sibuet, 1976; Laubier, Monniot, 1985); “Challenger” (1973–1982), ES 12, AT 141, AT 144, AT 151, AT 153, AT 154, AT 161, AT 167, AT 171, AT 175, ES 176, AT 177, AT 181, ES 182, ES 184, ES 185, AT 186, AT 191, AT 195, ES 197, AT 198, ES 200, SWT 32 (Gage et al., 1983); “Challenger” (1984–1985), AT 201, ES 202, ES 218, ES 232, AT 233, ES 244, AT 245, AT 271, AT 273, AT 288, ES 289, 3/85/5 OTSB (Harvey et al., 1988); CYAPORK (1986), dive 32 (Tyler, Zibrowius, 1992); “Discovery” (2000–2001) 13910#1, 13914#1 (Collins, 2000; Bagley, 2001); “G.O. Sars” (2004), St. 46/372, 54/377, 72/386 (Dilman 2008); “James Cook” (2007), St. JC011/101, JC011/106, JC011/111 (Dilman, 2013); “James Cook” (2009), St. JC037/15, JC037/19, JC037/27 (Dilman, 2013).

REMARKS: According to Clark, Downey (1992) and Mah (2014), *H. membranaceus* is considered to

be a junior synonym of *H. pellucidus*. A.M. Clark (1996) and Dilman (2013) assigned *H. membranaceus* to a distinct species.

DISTRIBUTION: From Rockall Trough to Portugal, and the northern mid-Atlantic, Reykjanes Ridge to the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 981–3540 m.

***Hymenaster pellucidus* Thomson, 1873**

*Hymenaster pellucidus* Thomson, 1873: 120, fig. 16; Danielsen, Koren, 1884: 72–80, pl. 13 (1–17), pl. 15 (7–8); Sladen, 1889: 508, pl. 80 (1–5); Smirnov, 1990: 439; Clark, Downey, 1992: 319–320 (part), pl. 77C, D; Clark, 1996: 203. *Hymenaster perissonotus* Fisher, 1910: 170; Fisher, 1911a: 376, pl. 109 (1, 2), pl. 115 (1, 1a–e), pl. 117 (3, 3a); D'yakonov, 1950: 83, 84.

LOCALITIES: “Vöringen” (1876–1878), St. 40, 53, 205, 295, 303, 353 (Danielsen, Koren, 1884); “Ob” (1956), St. 22 (Koltun, 1964).

REMARKS: According to Downey in Clark, Downey (1992), this species includes three synonyms: *H. membranaceus*, *H. giganteus* Sladen, 1891 and *H. perissonotus*. Clark (1996) considers only *H. perissonotus* as a junior synonym.

DISTRIBUTION: Arctic Ocean; Atlantic Ocean: south to c.07°N in the west and to Portugal and north of the Azores in the east; also Sea of Okhotsk and eastern Pacific south to South California for *H. perissonotus*.

DEPTH RANGE: 13–3240 m.

***Hymenaster regalis* Verrill, 1895**

*Hymenaster regalis* Verrill, 1895: 203; Clark, Downey, 1992: 320–321, pl. 78C, D; Clark, 1996: 204; Dilman, 2013: 575. *Hymenaster kieri* Downey, 1979: 801, fig. 1.

LOCALITIES: “Challenger” (1973–1982), “Shackleton” (1977), AT 195; “Challenger” (1984–1985), AT 288 (Harvey et al., 1988); “James Cook” (2009), St. JC037/27 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean: northeast of USA in the west and from Rockall Trough to South Africa in the east, also Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 1460–2700 m.

***Hymenaster reticulatus* Sibuet, 1976**

*Hymenaster reticulatus* Sibuet, 1976: 307, figs 1–2; Sibuet, 1977: 552; Clark, Downey, 1992: 321; Clark, 1996: 204.

LOCALITIES: BIACORES, St. 251 (Sibuet, 1976); BIOGAS VI (1974), CP 11 (Sibuet, 1976).

DISTRIBUTION: Bay of Biscay, Gulf of Cadiz.  
DEPTH RANGE: 1894–3540 m.

***Hymenaster rex* Perrier, 1885**

*Hymenaster rex* Perrier, 1885a: 69; Perrier, 1894: 186, pl. 13: 2; Clark, Downey, 1992: 322, pl. 78A, B; Clark, 1996: 204.

LOCALITIES: “Talisman” (1883), St. 140 (Perrier, 1894); BIOGAS IV (1974), CP 01 (Sibuet,

1976); “Challenger” (1973–1982) AT 144, AT 154, AT 171, AT 181, AT 195, SWT 11 (Gage et al., 1983); “Shackleton” (1977), AT 121 (Gage et al., 1983); “Challenger” (1977), AT 233 (Harvey et al., 1988).

DISTRIBUTION: Eastern Atlantic: from Rockall Trough to South Africa.

DEPTH RANGE: 1140–2910 m.

### ***Hymenaster roseus* Koehler, 1907**

*Hymenaster roseus* Koehler, 1907: 21; Koehler, 1909: 94, pl. 20 (1, 11); Sibuet, 1976: 314–315, fig. 5A; Clark, Downey, 1992: 322–323, pl. 78E, F; Clark, 1996: 204.

LOCALITIES: BIACORES, St. 163 (Sibuet, 1976).

DISTRIBUTION: the Azores.

DEPTH RANGE: 1846–2370 m.

### ***Hymenaster rotundus* Dilman, 2013**

*Hymenaster rotundus* Dilman, 2013: 577–578, figs. 2E, F, 4C, D.

LOCALITIES: “James Cook” (2010), St. JC048/53, Dive 178 (Dilman, 2013).

DISTRIBUTION: Mid-Atlantic, the Charlie–Gibbs Fracture Zone area.

DEPTH RANGE: 2442–2630 m.

### ***Hymenaster tenuispinus* Sibuet, 1976**

*Hymenaster tenuispinus* Sibuet, 1976: 309, fig. 3; Sibuet, 1977: 552; Clark, 1996: 204–205.

LOCALITIES: BIACORES, St. 131 (Sibuet, 1976); POLYGAS, CV 11 (Sibuet, 1976); BIOGAS IV (1974), CP01 (Sibuet, 1976); BIOGAS VI (1974), CP 08 (Sibuet, 1976).

REMARKS: According to Dilman (2013), *H. tenuispinus* is probably a junior synonym of *H. coccinatus*.

DISTRIBUTION: Western European Basin, Bay of Biscay.

DEPTH RANGE: 2120–2360 m.

### **Genus *Hymenasterides* Fisher, 1911**

COMPOSITION: 2 species (Dilman, 2008). Type species: *Hymenasterides zenognathus* Fisher, 1911.

DISTRIBUTION: Pacific Ocean — 1, Atlantic Ocean — 1; 472–2567 m.

### ***Hymenasterides mironovi* Dilman, 2008**

*Hymenasterides mironovi* Dilman, 2008: 143–146, fig. 1A–D, figs 2–4; Dilman, 2013: 579–582, figs. 5C, D, 6A, B.

REMARKS: The genus *Hymenasterides* consists of two species. The most significant differences between *H. zenognathus* from West Pacific and *H. mironovi* from Atlantic are the following: 1) only five to seven spines per paxilla (instead of 9–25) and 2) adambulacral plates with one and three spines (instead of one and two). Additionally *H. mironovi*

occurs much deeper (1630–2567 m opposed to 472–503 m).

LOCALITIES: “G.O. Sars” (2004), St. 72/386 (Dilman, 2008); “James Cook” (2010), JC048/16 Dive 162 (Dilman, 2013).

DISTRIBUTION: Mid-Atlantic, Charlie–Gibbs Fracture Zone area.

DEPTH RANGE: 1630–2567 m.

### **Genus *Pteraster* Müller et Troschel, 1842**

COMPOSITION: 46 species (Mah, 2014). Type species: *Asterias militaris* O.F. Müller, 1776.

DISTRIBUTION: Pacific Ocean — 27, Atlantic Ocean — 20, Indian Ocean — 4, Antarctic region — 5, Arctic Ocean — 3; 5–7230 m. Centres of diversity — N and NW Pacific, also W Atlantic: Caribbean basin and off Florida.

### ***Pteraster alveolatus* Perrier, 1894**

*Pteraster alveolatus* Perrier, 1894: 183, pl. 13 (1); Clark, Downey, 1992: 327, fig. 51a–e.

LOCALITIES: “Talisman” (1883), St. 134 (Perrier, 1894).

DISTRIBUTION: Azores.

DEPTH RANGE: 4060 m.

### ***Pteraster militaris* (O.F. Müller, 1776)**

*Asterias militaris* O.F. Müller, 1776: 234. *Pteraster militaris*: Müller, Troschel, 1842: 128, pl. 6 (figs 1a–b); Koehler, 1911: 346, pl. 98 (1, 2); Mortensen, 1912: 260, pl. 16 (2), pl. 17 (1, 2); Clark, Downey, 1992: 332–333.

LOCALITIES: “Akademik Mstislav Keldysh” (1982), St. 317-4 (Dilman, 2006).

DISTRIBUTION: Arctic Ocean; Atlantic Ocean: south to Cape Cod in the west and to the Rockall area in the east, also off Iceland and Reykjanes Ridge; Pacific Ocean: south to Washington and Japan.

DEPTH RANGE: 10–2152 m.

### ***Pteraster personatus* Sladen, 1891**

*Pteraster personatus* Sladen, 1891: 694, pl. 27 (1–5), Downey, 1973: 76, pl. 32C–D, Clark, Downey, 1992: 334, pl. 82A, B; Benavides-Serrato et al., 2005. *Pteraster reductus*: Koehler, 1907: 25; Koehler, 1909: 96, pl. 3: 8–9, pl. 20: 10; Sibuet, 1977: 552.

LOCALITIES: NORATLANTE (1969), P. 6 – B. 1 (Cherbonnier, Sibuet, 1972).

DISTRIBUTION: Atlantic Ocean: Labrador, Gulf of Mexico, and from Rockall Trough south to Mauritania, including the Azores.

DEPTH RANGE: 480–2430 m.

### ***Pteraster pulvillus* M. Sars, 1861**

*Pteraster pulvillus* M. Sars, 1861: 62, pl. 6 (14–18), pls 7–8, pl. 9 (1–6); Fisher, 1911: 358, pl. 102 (2, 4); Mortensen, 1912: 261, pl. 14 (3), pl. 16 (3); Clark, Downey, 1992: 334–335, pl. 81D, E.

LOCALITIES: “Akademik Mstislav Keldysh” (1982), St. 317-4 (Dilman, 2006).

DISTRIBUTION: Arctic Ocean (from Canadian Arctic eastward to the East-Siberian Sea, also Norwegian Sea); Atlantic Ocean: south to Cape Code, c.42° in the west and to British Islands and Iceland in the east, also the Reykjanes Ridge; Pacific Ocean from Bering Sea to northern Japan Sea.

DEPTH RANGE: 36–3700 m.

***Pteraster (Apterodon) hystrix* Harvey, 1989**

*Pteraster (Apterodon) hystrix* Harvey, 1989: 1051–1057, figs 1, 2.

LOCALITIES: “Challenger” (1984–1985), AT 247, ES 264 (Harvey et al., 1988).

DISTRIBUTION: Rockall Trough.

DEPTH RANGE: 2084–2144 m.

**Family Myxasteridae**

**Genus *Pythonaster***

**Sladen in Thomson et Murray, 1885**

COMPOSITION: 3 species (Clark, 1996). Type species: *Pythonaster murrayi* Sladen, 1885.

DISTRIBUTION: Pacific Ocean — 1, Atlantic Ocean — 2; 3200–4877 m.

***Pythonaster atlantidis* A.H. Clark, 1948**

*Pythonaster atlantidis* Clark, 1948: 76; Alton, 1966: 688; Clark, Downey, 1992: 339.

LOCALITIES: “Atlantis” (1947), St. 15, 35° 37'N, 30°51'W (Clark, 1948). In addition, according to Howell et al. (2002), the species was recorded in the Porcupine Abyssal Plain at the depth 4802–4877 m (no station data in the work).

DISTRIBUTION: Porcupine Abyssal Plain and south of the Azores.

DEPTH RANGE: 3200–4877 m.

**Order Spinulosida**

**Family Echinasteridae**

**Genus *Henricia* Gray, 1840**

COMPOSITION: 91 species (Mah, 2014). Type species: *Henricia oculata* (Pennant, 1777).

DISTRIBUTION: Centres of diversity — northern Pacific Ocean; 0–2620 m.

***Henricia cylindrella* (Sladen, 1883b)**

*Cribrella oculata* var. *cylindrella* Sladen, 1883b: 160, pl. 26, fig. 8. *Henricia cylindrella*: Madsen, 1987: 231–235, figs 2g, 21–23; Clark, Downey, 1992: 390, figs. 60a(?), f, g, pls. 93B, 94G. *Henricia abyssicola*: Howell et al., 2002: 1096, tabl. I; Dilman, 2013: 583.

LOCALITIES: “James Cook” (2010), St. JC048/43 Dive 174 (Dilman, 2013).

DISTRIBUTION: Rockall Trough south to the Porcupine Seabight, south-west of Ireland, probably to Morocco and Azores. Also the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 1015 (?530 m, Madsen, 1987)–2620 m.

**Order Forcipulatida**

**Family Zoroasteridae**

**Genus *Zoroaster* Thomson, 1873**

COMPOSITION: 20 species (Mah, 2014). Type species: *Zoroaster fulgens* Thomson, 1873.

DISTRIBUTION: Pacific Ocean — 13, Indian Ocean — 6, Atlantic Ocean — 2; 150–4810 m. Centres of diversity — northern Indian Ocean and Pacific.

***Zoroaster fulgens* Thomson, 1873**

*Zoroaster fulgens* Thomson, 1873: 153; Clark, Downey, 1992: 403–404, figs 61c–d, 67a, pl. 96G–H; Clark, Mah, 2001: 234; Howell et al., 2002: 1906; Mah, 2007: 196, fig. 6C–H; Dilman, 2008: 147.

LOCALITIES: “Talisman” (1883), St. 131, 136 (Perrier, 1894); “Princesse-Alice” (1896), St. 745 (Koehler, 1909); NORATLANTE (1969), P. 6 – B. 1 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), ES 10, ES 34, AT 107A, AT 114, AT 138, AT 139, AT 171, AT 175, AT 177, AT 181, ES 182, AT 186, AT 191, AT 195, AT 198, SWT 10, SWT 11, SWT 12, SWT 13, SWT 15, SWT 16, SWT 27 (Gage et al., 1983); “Challenger” (1984–1985), AT 201, ES 232, AT 233, AT 245, ES 264, AT 267, AT 273, AT 288, 3/85/7 OTSB (Harvey et al., 1988); “Discovery” (2000), 13906#1 (Collins, 2000); “G.O. Sars” (2004), St. 40/367, 46/372 (Dilman, 2008).

DISTRIBUTION: Atlantic Ocean.

DEPTH RANGE: 220–4810 m.

**Family Pedicellasteridae**

**Genus *Hydrasterias* Sladen, 1889**

COMPOSITION: 5 species (Mah, 2014). Type species: *Asterias (Hydrasterias) ophidian* Sladen, 1889.

DISTRIBUTION: Pacific Ocean — 3, Atlantic Ocean — 2; 600–4405 m.

***Hydrasterias sexradiata* (Perrier, 1882)**

*Pedicellaster sexradiatus* Perrier in Milne-Edwards, 1882: 46; Perrier, 1894: 100, pl. 9 (2). *Hydrasterias sexradiata*: Fisher, 1928: 69; Clark, Downey, 1992: 410, fig. 62c, d; Clark, Mah, 2001: 239; Dilman, 2008: 147–148; Dilman, 2013: 583.

LOCALITIES: “Travailleur” (1881–1883), St. 3, 5, 136 (Perrier, 1894); “Princesse-Alice” (1896), St. 673, 745 (Koehler, 1909); “Atlantis” (1948), St. 20 (Clark, 1949); BIOGAS (1972–1974), St. 1, 3, 6 (Sibuet, 1977); “Challenger” (1973–1982), AT 138, AT 139, AT 154, AT 167, ES 176 (Gage et al., 1983); “Akademik Mstislav Keldysh” (1982), St. 499 (Dilman, 2006); “G.O. Sars” (2004), St. 50/373 (Dilman, 2008); “James Cook” (2007), St. JC011/017 (Dilman, 2013); “James Cook” (2009), St. JC037/015, JC037/019, JC037/027, JC037/061, JC037/067, JC037/070 (Dilman, 2013); “James Cook” (2010), St. JC048/16 Dive 162 (Dilman, 2013).

DISTRIBUTION: East and middle parts of the Atlantic: from the Rockall Trough to the Cape Verde Islands, and from Reykjanes Ridge to Azores.

DEPTH RANGE: 600–4269 m.

**Order Brisingida**  
**Family Brisingidae**

**Genus *Brisinga* Asbjørnsen, 1856**

COMPOSITION: 20 species (Clark, Mah, 2001).  
Type species: *Brisinga endecacnemos* Asbjørnsen, 1856.

DISTRIBUTION: Atlantic Ocean — 4, Pacific Ocean — 12, Indian Ocean — 6; 183–5200 m. Centre of diversity — West and Southwest Pacific.

***Brisinga endecacnemos* Asbjørnsen, 1856**

*Brisinga endecacnemos* Asbjørnsen, 1856: 95, pl. 9; Clark, Downey, 1992: 466–467, fig. 70a; Clark, Mah, 2001: 314; Howell et al., 2002: 1906.

LOCALITIES: “Porcupine” (1870), St. 17 (Sladen, 1889); “Challenger” (1973–1982), AT 107, AT 151, AT 181, AT 186, ES 200, SWT 32 (Gage et al., 1983); “Challenger” (1984–1985), AT 201, AT 233, AT 245, AT 254, ES 264 (Harvey et al., 1988).

DISTRIBUTION: From southern Norway to Portugal, also the Reykjanes Ridge.

DEPTH RANGE: 183–2000 m.

***Brisinga hirsuta* Perrier, 1894**

*Brisinga hirsuta* Perrier, 1894: 66; Downey, 1986: 11, fig. 5; Clark, Downey, 1992: 467, pl. 108A–E; Clark, Mah, 2001: 314; Dilman, 2013: 583–584.

LOCALITIES: “Travailleur” (1881), St. 13 (Perrier, 1894); “James Cook” (2010), St. JC048/16 Dive 162 (Dilman, 2013).

DISTRIBUTION: Iberian Basin, Gulf of Guinea and the Charlie-Gibbs Fracture Zone area.

DEPTH RANGE: 640–2525 m.

**Genus *Brisingenes* Fisher, 1917**

COMPOSITION: 4 species (Clark, Mah, 2001).  
Type species: *Brisinga mimica* Fisher, 1917.

DISTRIBUTION: Indo-Malaysian region — 3, Atlantic Ocean — 1; 694–3186 m. Centre of diversity — Indo-Malaysian region.

***Brisingenes multicosata* (Verrill, 1894)**

*Brisinga multicosata* Verrill, 1894: 280. *Brisingenes multicosata*: Downey, 1986: 17, fig. 8; Clark, Downey, 1992: 470–471, fig. 69a, pl. 109E–G; Tyler, Zibrowius, 1992: 222; Clark, Mah, 2001: 315–316.

LOCALITIES: CYAPORK (1986), dive 34, 37 (Tyler, Zibrowius, 1992).

DISTRIBUTION: Georges Bank to the Strait of Florida.

DEPTH RANGE: 805–3186 m.

**Genus *Hymenodiscus* Perrier, 1884**

COMPOSITION: 16 species (Clark, Mah, 2001).  
Type species: *Hymenodiscus agassizi* Perrier, 1882.

DISTRIBUTION: Atlantic Ocean — 3, Pacific Ocean — 10, Antarctic — 3; 100–3750 m. Centres of diversity — North and Northwest Pacific.

***Hymenodiscus coronata* (G.O. Sars, 1872)**

*Brisinga coronata* G.O. Sars, 1872: 5; Sladen, 1889: 598, 601–604, 832; Perrier, 1894: 50, 51, 54, 68–70, pl. 1. *Brisingella coronata*: Grieg, 1927: 127; Clark, Downey, 1992: 468–469, figs 67b, 70b, pl. 108F; Howell et al., 2002: 1906. *Hymenodiscus coronata*: Clark, Mah, 2001: 326.

LOCALITIES: “Travailleur” (1881), St. 17 (Perrier, 1894); “Princesse-Alice” (1896), St. 673 (Koehler, 1909); “Challenger” (1973–1982), AT 138, AT 167, ES 176, AT 177 (Gage et al., 1983); “Akademik Mstislav Keldysh” (1982), St. 317–4 (Dilman, 2006); “Challenger” (1984–1985), ES 289 (Harvey et al., 1988).

DISTRIBUTION: Norwegian Sea and eastern part of the Atlantic to Cape Verde Islands, including the Azores and the Reykjanes Ridge, also Mediterranean.

DEPTH RANGE: 100–2600 m.

**Family Freyellidae**

**Genus *Freyastera* Downey, 1986**

COMPOSITION: 6 species (Mah, 2014).  
Type species: *Freyella sexradiata* Perrier, 1885.

DISTRIBUTION: Pacific Ocean — 4, Indian Oceans — 2, Atlantic Ocean — 4; 2683–6160 m.

***Freyastera benthophila* (Sladen, 1889)**

*Freyella benthophila* Sladen, 1889: 641–643, pl. 11: 5–8. *Freyastera benthophila*: Downey, 1986: 36, fig. 18; Clark, Downey, 1992: 480, fig. 74a, b, pl. 112C, D; Clark, Mah, 2001: 318.

LOCALITIES: NORATLANTE (1969), P. 115–B. 17 (Cherbonnier, Sibuet, 1972).

DISTRIBUTION: Atlantic Ocean: Bay of Biscay and between the Azores and Spain; South Pacific and East Pacific off California up to Oregon; Indian Ocean: Bay of Bengal.

DEPTH RANGE: 4250–5000 m.

***Freyastera sexradiata* (Perrier, 1885)**

*Freyella sexradiata* Perrier, 1885a: 6; Perrier, 1894: 89–90, pl. 3 (2); Koehler, 1909: 129–130, pl. 23 (9). *Freyastera sexradiata*: Downey, 1986: 40, fig. 20; Clark, Downey, 1992: 481–482, fig. 74 (c, d); Clark, Mah, 2001: 318–319.

LOCALITIES: “Talisman” (1883), St. 134 (Perrier, 1894); “Princesse-Alice” (1896), 753 (Koehler, 1909); NORATLANTE (1969), P. 96–B. 14 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), SWT 15 (Gage et al., 1983).

DISTRIBUTION: Off North America (38–45°N), off Ireland to Gibraltar and the Azores.

DEPTH RANGE: 4020–5110 m.

### Genus *Freyella* Perrier, 1885

COMPOSITION: 30 species (Clark, Mah, 2001).  
Type species: *Freyella spinosa* Perrier, 1885.

DISTRIBUTION: Atlantic Ocean — 4, Pacific Ocean — 17, Indian Ocean — 4, Indo — West Pacific — 2, Antarctic region — 4; 515–6860 m. Centres of diversity — West and Northwest Pacific.

### *Freyella elegans* (Verrill, 1884)

*Freyella elegans* Verrill, 1884: 382, Downey, 1986: 43, fig. 22; Clark, Downey, 1992: 484–485, fig. 69f, pl. 113A, B; Clark, Mah, 2001: 320; Howell et al., 2002: 1906; Dilman, 2006: 182; Dilman, 2008: 148; Dilman, 2013: 584.

LOCALITIES: “Talisman” (1883), St. 134 (Perrier, 1894); NORATLANTE (1969), P. 65 – B. 10 (Cherbonnier, Sibuet, 1972); “Challenger” (1973–1982), SWT 15 (Gage et al., 1983); “Akademik Mstislav Keldysh” (1982), St. 316-5, St. 317-4, St. 499 (Dilman, 2006); “Challenger” (1979–1982), St. 50514, 51216, St. 51414 (Tyler et al., 1984); CYAPORK (1986), dive 33, 37 (Tyler, Zibrowius, 1992); “Discovery” (2000–2001), St. 13906#1, St. 14137#1, 14158#1 (Collins, 2000; Bagley, 2001); “G.O. Sars” (2004), St. 40/367, 42/368, 46/372, 50/373, 52/374, 72/386 (Dilman, 2008); “James Cook” (2007), St. JC011/017, JC011/075, JC011/101, JC011/106, JC011/111 (Dilman, 2013); “James Cook” (2009), St. JC037/015, JC037/019, JC037/027, JC037/061, JC037/067, JC037/070 (Dilman, 2013).

DISTRIBUTION: Atlantic Ocean: from Greenland south to North Carolina in the west and from the West European Basin to Angola in the east, also central Atlantic from the Reykjanes Ridge to north of the Azores.

DEPTH RANGE: 1600–4849 m.

### *Freyella recta* Koehler, 1907

*Freyella recta* Koehler, 1907: 3; Koehler, 1909: 127, pl. 21 (7), pl. 22 (4), pl. 23 (3–5); Clark, Downey, 1992: 485–486, fig. 73; Clark, Mah, 2001: 323.

LOCALITIES: “Princesse-Alice” (1905), St. 2111 (Koehler, 1909).

DISTRIBUTION: Mid-Atlantic Ridge, 31°45'N, 42°42'W.

DEPTH RANGE: 3465 m.

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