CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

Zooplankton
Sheet 134

EUPHAUSIACEA

Adults

(By J. MAUCHLINE)

1971

Order Euphausiacea

There are only 6 species of euphausiids that reside permanently and breed in the North Atlantic, north of 40° N. These are: *Thysanopoda acutifrons* HOLT & TATTERSALL, *Nyctiphanes couchii* (BELL), *Meganyctiphanes norvegica* (M. SARS), *Thysanoëssa inermis* (KRØYER), *T. longicaudata* (KRØYER) and *T. raschii* (M. SARS). A further 8 species occur fairly commonly in southern regions of the North Atlantic and are occasionally caught in more northern areas; these are *Bentheuphausia amblyops* G. O. SARS, *Thysanopoda microphthalma* G. O. SARS, *Euphausia krohnii* (BRANDT), *Thysanoëssa gregaria* G. O. SARS, *Nematoscelis megalops* G. O. SARS, *Nematobrachion boöpis* (CALMAN), *Stylocheiron elongatum* G. O. SARS, *S. longicorne* G. O. SARS, *S. maximum* HANSEN, and *S. abbreviatum* G. O. SARS. These species are all included in the key presented here.

Occasional individuals of other species have been recorded in the sea area lying between southern Ireland and 40° N (see MAUCHLINE & FISHER, 1969) but these species have not been included in the key. If a species is not identified by the key given here then recourse should be made to the fuller key and to the sources of original descriptions of species given in MAUCHLINE & FISHER (1969).

There are two families of the Order Euphausiacea, the first, the Bentheuphausiidae, consisting of only one genus with one species, *Bentheuphausia amblyops* G. O. SARS (Fig. 1).

1. The endopodites of the first and second pairs of pleopods of the male are not modified as copulatory organs and the basipodite of the first pair of pleopods carries 1–6 spines. The endopodite of the maxillule has two joints and the endopodite of the maxilla has three joints. The outer plates of the uropods have a transverse suture. There are no photophores. The eyes are reduced in size and all eight pairs of thoracic legs are well developed ..... Family Bentheuphausiidae COLOSI
2. The endopodites of the first and second pairs of pleopods of the male are modified as copulatory organs and the basipodite of the first pair of pleopods has no spines. The endopodites of the maxillule and maxilla have a single joint. The outer plates of the uropods have no transverse suture. Photophores are present. The eyes are well developed and the last or the penultimate and last pair of thoracic legs are rudimentary ..... Family Euphausiidae HOLT & TATTERSALL

KEY TO GENERA OF EUPHAUSIIDAE

1 a. Thoracic legs nearly uniform in structure 2
1 b. Thoracic legs unequally developed, one or two of the anterior pairs being elongated 5
2 a. Eighth pair of thoracic legs rudimentary 3
2 b. Seventh and eighth pairs of thoracic legs rudimentary. Sixth pair similar in appearance to fifth ..... *Euphausia* DANA
3 a. Seventh pair of thoracic legs of same appearance as sixth, but shorter in length ..... *Thysanopoda* MILNE-EDWARDS
3 b. Seventh pair of thoracic legs has endopodite of not more than two elongate segments 4
4 a. Sixth and seventh pairs of thoracic legs have exopodites in both sexes. There is a reflected leaflet on the first segment of the antennule. One pair of lateral denticles on carapace ..... *Meganyctiphanes* HOLT & TATTERSALL
4 b. Sixth and seventh pairs of thoracic legs have no exopodites in female. There is a reflected leaflet on the first segment of the antennule. No lateral denticles on the carapace ..... *Nyctiphanes* G. O. SARS
4 c. Seventh pair of thoracic legs has fully developed exopodites but there is no endopodite in males and only a short, unjointed or two-jointed endopodite in females ..... *Thysanoëssa* BRANDT (in part)
5 a. Second pair of thoracic legs greatly elongated 6
5 b. Third pair of thoracic legs greatly elongated 7
6 a. Second pair of thoracic legs rather strong, the last two segments armed with spiniform setae on both margins ..... *Thysanoëssa* BRANDT (in part)
6 b. Second pair of thoracic legs very slender, filiform, naked and armed with only a tuft of apical bristles ..... *Nematoscelis* G. O. SARS
7 a. Third pair of thoracic legs slender, naked with a tuft of serrated apical bristles. Photophores on the first four abdominal segments ..... *Nematobrachion* CALMAN
7 b. Third pair of thoracic legs with penultimate segment dilated, and forming, together with the last one, a kind of prehensile hand. A photophore on the first abdominal segment only ..... *Stylocheiron* G. O. SARS

KEY TO SPECIES

1 a. Eight pairs of well-developed thoracic legs. No photophores ..... *Bentheuphausia amblyops* (Fig. 1)
1 b. Six or seven pairs of thoracic legs, nearly uniform in structure, photophores present 2
1 c. Thoracic legs unequally developed, one or two of the anterior pairs being elongated, photophores present 6

2 a. Seventh pair of thoracic legs have same appearance as sixth but shorter in length. No lateral denticles on carapace. Eyes small, almost circular, undivided 3
2 b. Seventh pair of thoracic legs has endopodite of not more than two elongated segments 4
2 c. Seventh and eighth pairs of thoracic legs rudimentary. Lappet on first antennular segment pectinate. Two pairs of lateral denticles on carapace ..... *Euphausia krohnii* (Fig. 8)
3 a. Terminal process of the petasma only half the length of the proximal process, spoon-shaped and tapering towards the end; sternal plate of the thelycum with three rounded ridges ..... *Thysanopoda acutifrons* (Fig. 2)
3 b. Terminal process of the petasma approximately the same length as the proximal process, increasing in breadth towards the end with a transverse row of terminal saw teeth; sternal plate of thelycum forms a horse-shoe shaped ridge. *Thysanopoda microphthalma* (Fig. 3)
4 a. Sixth and seventh pairs of thoracic legs have exopodites in both sexes. There is a reflected lappet on the first segment of the antennule. One pair of lateral denticles on carapace ..... *Meganyctiphanes norvegica* (Fig. 4)
4 b. Sixth and seventh pairs of thoracic legs have no exopodites in female. There is a reflected lappet on the first segment of the antennule. No lateral denticles on the carapace ..... *Nyctiphanes couchii* (Fig. 5)
4 c. Seventh pair of thoracic legs has fully developed exopodites but males have no endopodite and females have only a short, unjointed or two-jointed endopodite 5
5 a. One pair of lateral denticles on the carapace situated anterior to the mid-point of the inferior margin. Second thoracic leg slightly or not at all elongated. Pointed rostrum ..... *Thysanoëssa raschii* (Fig. 6)
5 b. No lateral denticles on carapace. Sixth abdominal segment with strong spine at its distal dorsal end, occasionally a delicate spine at distal dorsal end of fifth segment. Second thoracic limbs either elongated (*neglecta* series) or normal (*inermis* series) ..... *Thysanoëssa inermis* (Fig. 7)
6 a. Second pair of thoracic legs elongated 7
6 b. Third pair of thoracic legs elongated 10
7 a. Second pair of thoracic legs very slender, naked and armed with only a tuft of apical bristles. No lateral denticles on carapace. Eyes divided with lower part slightly larger than upper part ..... *Nematoscelis megalops* (Fig. 11)
7 b. Second pair of thoracic legs rather strong, last two segments armed with spiniform setae on both margins 8
8 a. No lateral denticles on carapace 9
8 b. One pair of lateral denticles on carapace, posterior to mid-point of inferior margin of carapace ..... *Thysanoëssa gregaria* (Fig. 9)
9 a. Sixth abdominal segment much shorter than sum of fourth and fifth, with strong spine at its distal dorsal end, sometimes a delicate spine at distal dorsal end of fifth abdominal segment. Eyes circular ..... *Thysanoëssa inermis* (*neglecta* series) (Fig. 7)
9 b. Length of sixth abdominal segment almost equal to, or equal to, the sum of the lengths of the fourth and fifth segments, usually without a strong spine on its upper distal end. Upper portion of eye narrower than lower portion ..... *Thysanoëssa longicaudata* (Fig. 10)
10 a. Third pair of thoracic legs slender, naked with a tuft of serrated apical bristles. No lateral denticles on carapace. Photophores on first four abdominal segments ..... *Nematobrachion boöpis* (Fig. 12)
10 b. Third pair of thoracic legs slender, terminating in true or false chelae. Photophore on first abdominal segment only 11
11 a. Sixth abdominal segment only slightly longer than fifth 12
11 b. Sixth abdominal segment nearly three times as long as fifth ..... *Stylocheiron elongatum* (Fig. 13)
12 a. Elongated third pair of thoracic legs terminate in true chela 13
12 b. Elongated third pair of thoracic legs terminate in false chelae; divided eyes twice as high as broad .. *Stylocheiron longicorne* (Fig. 14)
13 a. Upper section of eye at most slightly smaller than lower ..... *Stylocheiron maximum* (Fig. 15)
13 b. Upper section of eye much smaller than lower ..... *Stylocheiron abbreviatum* (Fig. 16)

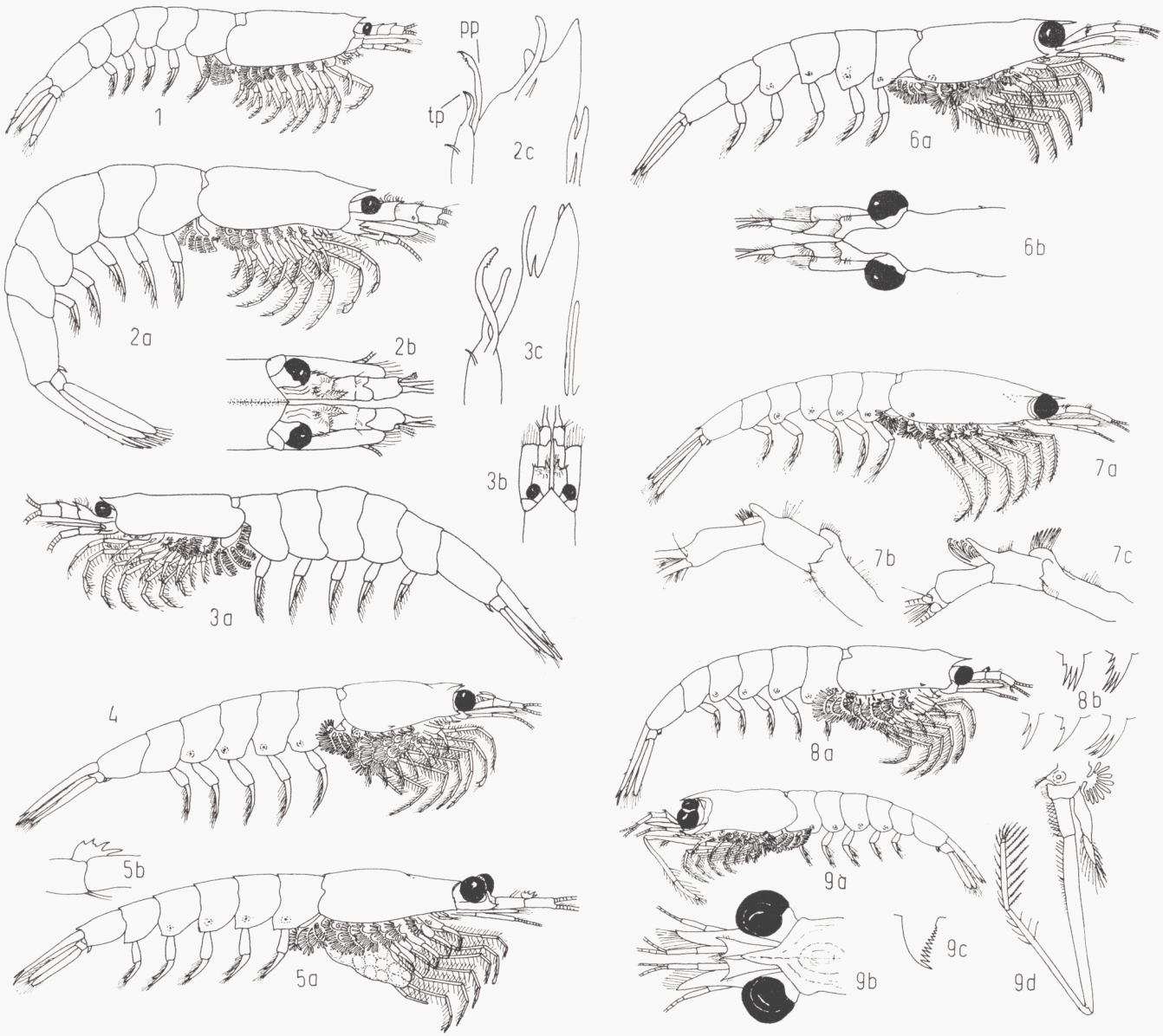
REFERENCES TO DESCRIPTIONS AND FIGURES

1. *Bentheuphausia amblyops: Thysanopoda* (?) *amblyops* G. O. Sars, 1883 b. *Bentheuphausia amblyops*, G. O. Sars, 1885, Fig. 4, pl. 19; Einarsson, 1942, Textfigs.; Boden *et al.*, 1955, Fig. 5.

2. *Thysanopoda acutifrons: T. acutifrons*, Holt & Tattersall, 1905, 1906, pl. 1; Hansen, 1910; Einarsson, 1945, Figs. 4–7, 14; Boden *et al.*, 1955, Fig. 13; Mauchline, 1967, Fig. 6 e. *T. pectinata*, Hansen, 1905 a, Fig. 12; (*not* Ortmann, 1893; *not* Hansen, 1905 b). *T. johnstoni*, Sheard, 1942, Figs. A–Q; 1953 (*fide* Brinton, 1962). *T. dubia*, Banner, 1950, pl. 1, Figs. 20, a–c, pl. 2, Figs. 20, d–h, (*fide* Brinton, 1962).

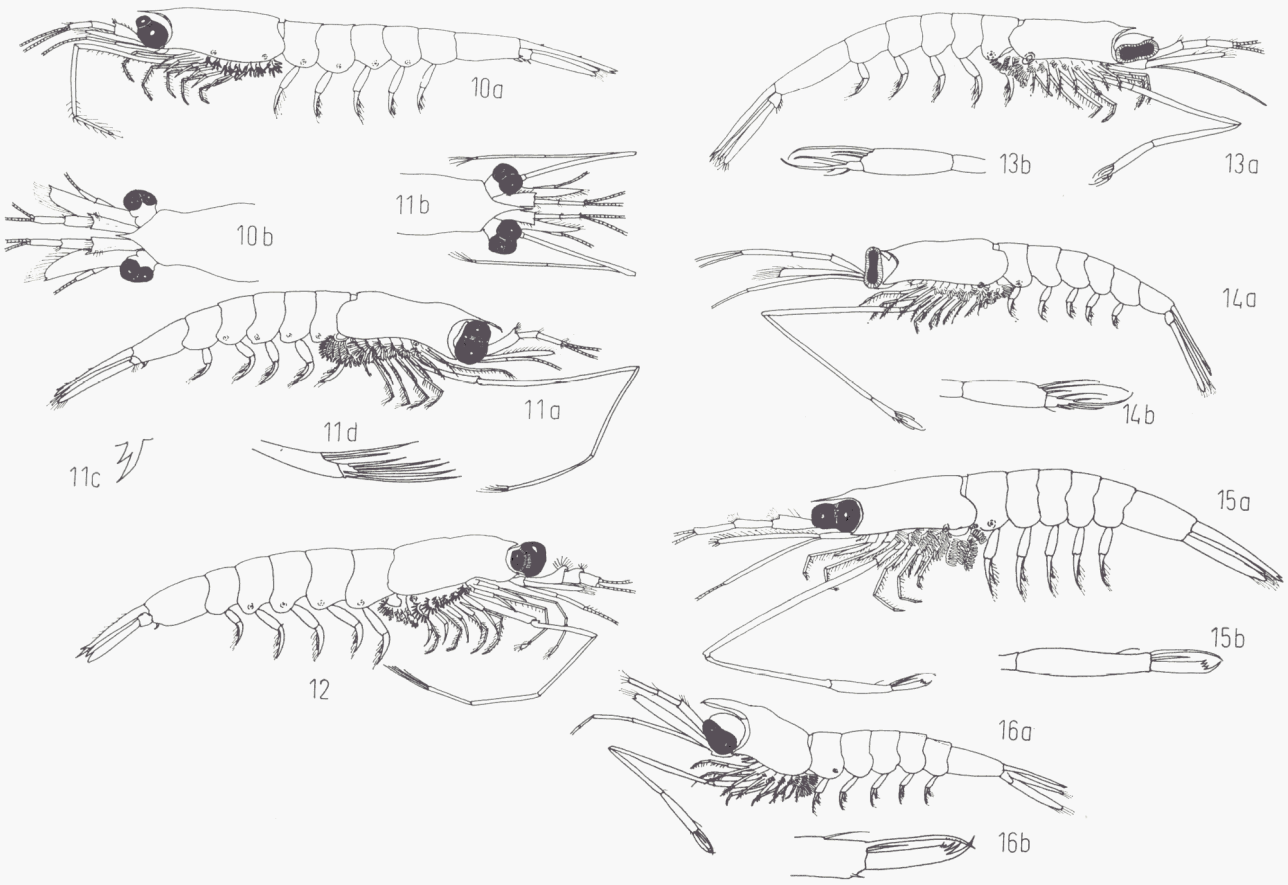
3. *Thysanopoda microphthalma: T. microphthalma*, G. O. Sars, 1885, Fig. 3; (*not* Lo Bianco, 1903). *T. distinguenda*, Hansen 1905 a, Fig. 13 (*fide* Sheard, 1942); Holt & Tattersall, 1906, pl. 2.

Continued on page 5



1, *Bentheuphausia amblyops*. 2 a, *Thysanopoda acutifrons*. 2 b, dorsal view. 2 c, petasma of male. 3 a, *Thysanopoda microphthalma*. 3 b, dorsal view. 3 c, petasma of male. pp. proximal process; tp. terminal process. 4, *Meganyctiphanes norvegica*. 5 a, *Nyctophanes couchii*. 5 b, lappet on antennule. 6 a, *Thysanoëssa raschii*. 6 b, dorsal view. 7 a, *Thysanoëssa inermis*. 7 b, antennule of immature male. 7 c, antennule of mature male. 8 a, *Euphausia krohnii*. 8 b, variation in form of spine on ventral posterior end of sixth abdominal segment. 9 a, *Thysanoëssa gregaria*. 9 b, dorsal view. 9 c, spine on ventral posterior end of sixth abdominal segment. 9 d, elongated second thoracic leg. 10 a, *Thysanoëssa longicaudata*. 10 b, dorsal view. 11 a, *Nematoscelis megalops*. 11 b, dorsal view. 11 c, spine on ventral posterior end of sixth abdominal segment. 11 d, distal end of elongated second thoracic leg. 12, *Nematobrachion boöpis*. 13 a, *Stylocheiron elongatum*. 14 a, *Stylocheiron longicorne*. 15 a, *Stylocheiron maximum*. 13 b, 14 b, 15 b, distal segments of elongated third thoracic leg of respective species. 16 a, *Stylocheiron abbreviatum*. 16 b, distal segment of elongated third thoracic leg.

(Figs. 1, 8 a, 9 a–d, 11 a–d, 13 a, b, 14 a, b, 16 a, after Sars (1885). Figs 2 a, b, 3 a, b, after Holt and Tattersall (1906). Figs. 2 c, 3 c after Einarsson (1945) and Mauchline (unpubl.). Figs. 4, 5 a, b after Holt and Tattersall (1905). Figs. 6 a, b, 7 a, b, 10 a, b, after Einarsson (1945). Fig. 8 b Mauchline (unpubl.). Fig. 12 after Calman (1905). Figs. 15 a, b, 16 b, after Boden, Johnson and Brinton (1955).



References to descriptions and figures (continued from p. 3)

4. *Meganyctiphanes norvegica: Thysanopoda norvegica*, M. SARS, 1857; 1864 a. *T. nana*, M. SARS, 1864 b; *Nyctiphanes norvegica*, G. O. SARS, 1883 b; *Euphausia lanei*, HOLT & TATTERSALL, 1905, pl. 24, Figs. 6–9. *Meganyctiphanes norvegica*, HOLT & TATTERSALL, 1905, pl. 16; EINARSSON, 1945, Fig. 15; MAUCHLINE, 1967, Fig. 7. *Euphausia intermedia*, RIGGIO, 1905, pl. 1, Figs. 3–7. *Meganyctiphanes calmani*, COLOSI, 1918, Figs. 1–3.

5. *Nyctiphanes couchii: Thysanopoda couchii*, BELL, 1853, Figs. a-1. *Nyctiphanes couchii*, NORMAN, 1892; HOLT & BEAUMONT, 1902, pl. 14, Fig. 1, Text fig. I, 1–8; HOLT & TATTERSALL, 1905, pl. 17; HANSEN, 1911; EINARSSON, 1945, Fig. 16; MAUCHLINE, 1967, Figs. 8a, b. ? *N. latifrons* ILLIG, 1908, Fig. 1.

6. *Thysanoëssa raschii: Thysanopoda raschii*, M. SARS, 1864 b; (*not T. raschii* VANHÖFFEN, 1897, pl. 1, Fig. 1). *Rhoda jardineana*, SIM, 1872, pl. 4, Figs. 1–6. *Euphausia raschii*, G. O. SARS, 1883 a. *Boreophausia raschii*, NORMAN, 1886. *Rhoda raschii*, STEBBING, 1893; ZIMMER, 1904, Figs. 10–11. *Thysanoëssa raschii*, HANSEN, 1911; EINARSSON, 1945, Figs. 13, 20; BANNER, 1950, pl. 3, Fig. 22a, b; BODEN, *et al.*, 1955, Fig. 36; MAUCHLINE, 1967, Fig. 16.

7. *Thysanoëssa inermis: Thysanopoda inermis* KRØYER, 1846, pl. 7, Fig. 2; 1859, pl. 5, Fig. 24. *T. neglecta* KRØYER, 1846, pl. 7, Fig. 3; HANSEN, 1887 a. *Thysanoëssa aberdonensis*, SIM, 1872, pl. 5, Figs. 1–8. *Euphausia inermis*, G. O. SARS, 1883 a, pl. 1, Fig. 15. *Thysanoëssa borealis* G. O. SARS, 1883 a, pl. 1, Figs. 16–18. *Boreophausia inermis*, G. O. SARS, 1886; HANSEN, 1887 b, pl. 23, Fig. 3. *Rhoda inermis* SIM, 1872; STEBBING, 1893; ZIMMER, 1904, Figs. 6–9. *Thysanoëssa inermis* HANSEN, 1911; 1915, pl. 2, Figs. 2a–d; EINARSSON, 1945, Figs. 12, 18, 19; BANNER, 1950, pl. 3, Figs. 23a, b; BODEN *et al.*, 1955, Fig. 35; JONES *et al.*, 1967, Fig. 2.

8. *Euphausia krohnii: Thysanopoda krohnii* BRANDT, 1851. *Euphausia mulleri*, CLAUS, 1863, pls. 28, 29, Figs. 29–45. *Thysanopoda bidentata*, G. O. SARS, 1883 a, pl. 1, Figs. 11–14. *Euphausia pellucida*, G. O. SARS, 1885, pls. 11, 12 (*partim*); HOLT & TATTERSALL, 1905. *E. krohnii* HANSEN, 1910; 1911, Fig. 4; DENIS, 1929.

References to descriptions and figures (continued from p. 5)

9. *Thysanoëssa gregaria:* G. O. Sars, 1883 b; 1885, pl. 21, Figs. 8–17, pl. 22. Hansen, 1905 a; 1905 b; 1911, Fig. 15; 1913, pl. 6, Fig. 1 a, b; Boden *et al.*, 1955, Fig. 38. (*not* Hansen, 1915).

10. *Thysanoëssa longicaudata: Thysanopoda longicaudata*, Krøyer, 1846, pl. 8, Fig. 1. *Thysanoëssa tenera*, G. O. Sars, 1883 a, pl. 1, Figs. 19, 20. *T. longicaudata*, Hansen, 1887 a; 1911, Fig. 13; Zimmer, 1904, Figs. 18–21; Holt & Tattersall, 1905, pl. 15. ? *Thysanopoda raschii* Vanhöffen, 1897, pl. 1, Fig. 1.

11. *Nematoscelis megalops:* G. O. Sars, 1883 b; 1885, pl. 23, Figs. 5–10, pl. 24; Denis, 1929.

12. *Nematobrachion boöpis: Nematodactylus boöpis* Calman, 1896. *Nematobrachion boöpis*, Calman, 1905, pl. 26; Hansen, 1912, pl. 10, Figs. 5, a–m; Boden *et al.*, 1955, Fig. 47.

13. *Stylocheiron elongatum:* G. O. Sars, 1883 b; 1885, pl. 27, Figs. 6–10; Boden *et al.*, 1955, Fig. 52; Mauchline, 1967, Fig. 18 h.

14. *Stylocheiron longicorne:* G. O. Sars, 1883 b; 1885, pl. 27, Fig. 5; Hansen, 1910, pl. 16, Figs. 5a, b; 1912, pl. 11, Figs. 4a, b; Banner, 1950, pl. 4, Fig. 25 a; Boden *et al.*, 1955, Fig. 53; Dahl, 1961, Fig. 1; Mauchline, 1967, Fig. 18 g. *S. mastigophorum*, Chun, 1887 (*partim*).

15. *Stylocheiron maximum:* Hansen, 1908; 1910, pl. 16, Figs. 6, a–d; Banner, 1950, pl. 4, Figs. 26, a–j; Boden *et al.*, 1955, Fig. 55.

16. *Stylocheiron abbreviatum:* G. O. Sars, 1883 b; 1885, pl. 27, Figs. 11–13; Hansen, 1912, pl. 11, Figs. 5 a–f; Boden *et al.*, 1955, Fig. 54. *S. chelifer*, Chun, 1896, pl. 1, Figs. 1–8; Holt & Tattersall, 1905.

DISTRIBUTION

1. *Bentheuphausia amblyops:* A bathypelagic species only likely to be found in southern part of North Atlantic near 40° N in water of depth greater than 1000 m. Relatively common in the Pacific Ocean between 55° N and 55° S, in the Indian Ocean between 10° N and 10° S, the Gulf of Oman, and east of Ceylon. Body length, 40–50 mm.

2. *Thysanopoda acutifrons:* Recorded frequently between 70° and 30° N in the North Atlantic, in the Faroe-Shetland Channel, off south and west Iceland, Davis Straits southwards to Gulf of Maine, and in the east to southern Norway, but not in the North Sea, English Channel or Irish Sea; present west of Ireland southwards to the entrance to the Mediterranean, but not in the Mediterranean. Also found between 20° and 40° S off Africa and is present between 27° N and 55° N and between 35° S and 60° S in the Pacific Ocean. Body length, 40–50 mm.

3. *Thysanopoda microphthalma:* Occurs in Atlantic and Indian Oceans but not in Pacific. Has been recorded from west of Ireland but all other records are south of 35° N. Probably deep oceanic species that might be found occasionally.

4. *Meganyctiphanes norvegica:* The distribution of this species in the North Atlantic is given in Mauchline & Fisher (1967). It is confined to the North Atlantic and Mediterranean. It extends northwards from Cape Hatteras along the edge of the Continental Slope to the coasts of Labrador, Baffin Island and West Greenland to about 70° N. Off the coasts of southern and eastern Greenland northwards to about 80° N and eastwards to southern Spitzbergen (75° N), Barents Sea, southwards throughout the Norwegian Sea, North Sea, Skagerrak but not in Kattegat nor the eastern English Channel; present Faroes/Shetland, west coast of Britain southwards to the Azores. Occurs usually close to the sea bottom in depths of 100 to 500 m during the day. Body length up to 50 mm but mature sexually at 25–30 mm.

5. *Nyctiphanes couchii:* Confined to the eastern North Atlantic from about 60° N to 20° N and present throughout Mediterranean. Been recorded from off Möre on the Norwegian Coast but does not breed north of the Skagerrak. Present in Kattegat and is only euphausiid to enter Baltic. Present on continental slope around southern areas of British Isles and southwards through Bay of Biscay towards the Azores. Body length, up to 17 mm.

6. *Thysanoëssa raschii:* This is a neritic species living in coastal areas of the North Atlantic and North Pacific. It is the commonest euphausiid off West Greenland extending northwards to about 70° N for breeding but occasional non-breeding adults are found as far north as 78° N. Present in Gulfs of St Lawrence and Maine but not south of 40° N. Common around Iceland, very rarely off East Greenland, common round Scotland,

Faroes/Shetland to 55° N and along the Norwegian coast north to the Barents, White and Kara Seas; recorded from Spitzbergen, not present south of central North Sea nor south of the Firth of Clyde in Scotland. Body length, up to 30 mm, matures sexually at about 15 mm.

7. *Thysanoëssa inermis:* Present in both the North Atlantic and North Pacific. Present in the Gulf of Maine northwards to about 70° N off West Greenland, to about 80° N off East Greenland. Common throughout the Norwegian Sea, Barents Sea, northern North Sea, Faroes/Shetland and off western Britain but rarely in coastal waters such as Firth of Clyde or Irish Sea. Southern limit in eastern Atlantic at about 50° N. Body length, up to 32 mm, matures sexually at 14–20 mm.

8. *Euphausia krohnii:* Confined to the North Atlantic and Mediterranean between about 66° N and 5–10° N. Does not occur in coastal waters to any great degree. Has been recorded from east of Newfoundland and off Iceland, common off western Britain southwards to African coast. It has been recorded east of the Shetlands and Fair Isle and in the Moray Firth (North-East Scotland).

9. *Thysanoëssa gregaria:* Is a transition zone species in the Atlantic, Pacific and Indian Oceans. Occurs south of about 50° N extending southwards to about 20° N in the western, 10° N in the eastern North Atlantic; also occurs in western Mediterranean. Has been recorded east of Newfoundland, but is much more common south of this latitude. Not present north of Ireland nor in the North Sea. A southern species. Body length, 11–16 mm.

10. *Thysanoëssa longicaudata:* Is restricted to the North Atlantic. Present in the west from the Gulf of Maine northwards to about 70° N off west Greenland, 83° N off east Greenland, and so eastwards to the Barents Sea and southwards throughout the Norwegian Sea but not in the southern North Sea. Present off western Britain southwards to off Portugal. Most common between 55° N and 70° N in offshore areas. Body length, up to 16 mm, matures sexually at 7.5–10 mm.

11. *Nematoscelis megalops:* Occurs in Atlantic, Indian and South Pacific Oceans. Recorded from southern Iceland eastwards to southern Norway and the North Sea, off southern Greenland and east of Newfoundland south to about 30° N off Florida; present west of Britain southwards to Azores. Body length 20–26 mm.

12. *Nematobrachion boöpis:* A mesopelagic species found in the Atlantic, Pacific and Indian Oceans. Been recorded south of Iceland westwards towards southern Greenland and eastwards to Faroes/Shetland and off western Britain, Bay of Biscay and northwest Africa; also in western Atlantic from Gulf of Maine south to Florida. A warm water species rarely caught in North Atlantic. Body length 19–21 mm.

13. *Stylocheiron elongatum:* A mesopelagic species present in Atlantic, Pacific and Indian Oceans. Has been recorded from southern Iceland, north, west and southwest of Britain and in western Atlantic from Gulf of Maine. Warm water species rarely caught in North Atlantic. Body length, 13–16 mm.

14. *Stylocheiron longicorne:* Mesopelagic species occurring in Atlantic, Pacific and Indian Oceans. Recorded between 65° N and 40° S but most common south of 50° N in Atlantic. Been found south of Iceland eastwards to Southern Norway and off western Britain southwards to South Africa. In western Atlantic, present in Gulf of Maine southwards to South America. There are two geographical forms of this species, a "short" and "long" form (see MAUCHLINE & FISHER, 1969). A "short" form has been found in northwest Scotland (MAUCHLINE, 1965). This is the commonest species of the genus *Stylocheiron* in the North Atlantic. Body length, 6–13 mm.

15. *Stylocheiron maximum:* Mesopelagic species present in Atlantic, Pacific and Indian Oceans. Been recorded off southeastern Greenland, southern Iceland and western Britain, but not in Norwegian or North Seas; off southern Ireland, Bay of Biscay and south to South Africa and in western Atlantic from Gulf of Maine to South America. A warm water species, rarely caught in North Atlantic. Body length, 20–30 mm.

16. *Stylocheiron abbreviatum:* This species is found in the Atlantic, Pacific and Indian oceans. It has been recorded west of Ireland and in the Faroe-Shetland Channel but is most common in the Atlantic between 40° N and 40° S, being a rare immigrant species in the North Atlantic.

REFERENCES TO WORK ON BIOLOGY

Special attention should be paid to EINARSSON (1945) and MAUCHLINE & FISHER (1969) where much information is given and literature cited. DUNBAR (1940) 6, 7; FISHER & GOLDIE (1959), 4; JONES (1969) 4, 6, 7, 8, 9, 10; MAUCHLINE (1960) 4; (1966) 6; (1967) 1, 2, 4, 5, 6, 7, 10, 11, 12, 15; MAUCHLINE & FISHER (1967) 4; NEMOTO (1957) 7; RUUD (1936) 4; WIBORG (1966) 4, 7.

REFERENCES

BANNER, A. H., 1950. Trans. R. Can. Inst., **28**, 1–62.

BELL, T., 1853. "*A History of the British Stalkeyed Crustacea*". Van Voorst, London.

BODEN, B. P., JOHNSON, M. W. and BRINTON, E., 1955. Bull. Scripps Instn Oceanogr., **6**, (8), 287–400.

BRANDT, F., 1851. Krebse. In "*Middendorf Reise in den äussersten Norden und Osten Sibiriens während der Jahr 1843 und 1844.*" St Petersburg, **2**, Zool., (1), 79–148.

BRINTON, E., 1962. Bull. Scripps Instn Oceanogr. **8**, 51–270.

CALMAN, W. T., 1896. Trans R. Ir. Acad., **31**, 1–22.

CALMAN, W. T., 1905. Scient. Invest. Fish. Brch Ire., 1902–1903, **4**, (2), 153–155.

CHUN, C., 1887. Zoologica, Stuttg., **1**, 1–66.

CHUN, C., 1896. Zoologica, Stuttg., **7**, 1–262.

CLAUS, C., 1863. Z. wiss. Zool., **13**, 422–454.

COLOSI, G., 1918. Monitore zool. ital., **29**, 178–181.

DAHL, E., 1961. Sarsia, **4**, 39–42.

DENIS, J.-R., 1929. Archs. Zool. exp. gén., Ser II, **69**, 69–74.

DUNBAR, M. J., 1940. J. Anim. Ecol., **9**, 215–226.

EINARSSON, H., 1942. Vidensk. Meddr dansk naturh. Foren., **106**, 263–286.

EINARSSON, H., 1945. Dana Rep., (27), 1–185.

FISHER, L. R. and GOLDIE, E. H., 1959. J. mar. biol. Ass. U.K., **38**, 291–312.

HANSEN H. J., 1887a. Vidensk. Meddr dansk naturh. Foren., 5–226.

HANSEN, H. J., 1887b. "*Dijmphna-Togtets zoologisk-botaniske Udbytte, Kjöbenhavn*", 185–286.

HANSEN, H. J., 1905a. Bull. Mus. océanogr. Monaco, (30), 1–32.

HANSEN, H. J., 1905b. Bull. Mus. océanogr. Monaco, (42), 1–32.

HANSEN, H. J., 1908. Dan. Ingolf Exped., **3**, (2), 1–120.

HANSEN, H. J., 1910. Siboga Exped., **37**, 1–123.

HANSEN, H. J., 1911. Bull. Inst. océanogr. Monaco, (210), 1–54.

HANSEN, H. J., 1912. Mem. Mus. comp. Zool. Harv., **35**, (4), 175–296.

HANSEN, H. J., 1913. Rep. Swed. Antatct. Exped., 1901–1903, 1–56.

HANSEN, H. J., 1915. Proc. U.S. natn Mus., **48**, 59–114.

HOLT, E. W. L. and BEAUMONT, W. I., 1902. Scient. Trans. R. Dubl. Soc., Ser. II, **7**, 221–252.

HOLT, E. W. L. and TATTERSALL, W. M., 1905. Scient. Invest. Fish. Brch Ire., Ann. Rep., 1902–1903, Pt. II, App. IV, 99–152.

HOLT, E. W. L. and TATTERSALL, W. M., 1906. Scient. Invest. Fish. Brch Ire., 1904, App. V, 1–50.

ILLIG, G., 1908. Zool. Anz., **33**, 252–253.

JONES, L. T., 1969. Bull. mar. Ecol., **6**, 275–300.

JONES, L. T., FORSYTH, D. C. T. and COOPER, G. A., 1967. Bull. mar. Ecol., **6**, 181–184.

KRØYER, H., 1846. Atlas des Crustacés. In "*Voyages de la Commission scientifique du Nord en Scandinavie, en Laponie, au Spitzberg et aux Feröe pendant les annees 1838–40, sur la corvette La Recherche Commandée par M. Fabvre. Publiés par ordre du Roi sous la direction de M. Paul Gaimard*".

KRØYER, H., 1859. K. danske Vidensk. Selsk. Skr., Nat. og Mat. Afd. R. V., **4**, (2) 219–303.

Lo BIANCO, S., 1903. Mitt. Zool. Stn. Neapel, **16**, 109–279.

MAUCHLINE, J., 1960. Proc. R. Soc Edinb., B. Biol. **67**: 141–179.

MAUCHLINE, J., 1965. Limnol. Occanogr., **10**, 300.

MAUCHLINE J., 1966. In "*Some Contemporary Studies in Marine Science*", H. Barnes, ed., Georg Allen and Unwin Ltd., London, 493–510.

MAUCHLINE, J., 1967. J. Zool., Lond., **153**, 1–43.

MAUCHLINE, J. and FISHER, L. R., 1967. Ser. Atlas Mar. Environ., Folio 13.

MAUCHLINE, J. and FISHER, L. R., 1969. The Biology of Euphausiids. In "*Advances in Marine Biology*", F. S. RUSSELL and C. M. YONGE, eds., Academic Press, London & New York, **7**, 1–454.

NEMOTO, T., 1957. Scient. Rep. Whales Res. Inst., Tokyo. **14**, 149–290.

NORMAN, A. M., 1886. Rep. Fishery Bd Scotl., 1885, 155–166.

NORMAN A. M., 1892. Ann. Mag. nat. Hist., Ser. 6, **9**, 454–464.

ORTMANN, A. E., 1893. Ergebn. Atlant. Ozean Planktonexped. Humbolt-Stift., **2**, 1–120.

RIGGIO, G., 1905. Naturalista sicil., **17**, 1–56.

RUUD., J. T., 1936. Rep. Dan. oceanogr. Exped. Mediterr., **2**, (Biol.), 1–86.

SARS, G. O., 1883a. Forh. Vidensk Selsk. Krist., 1882, **18**, 1–124.

SARS, G. O., 1883b. Forh. VidenskSelsk. Krist., (7), 1–43.

SARS, G. O., 1885. Rep. scient. Results Voyage H.M.S. Challenger 1873–76, **13** (3), 1–228.

SARS, G. O., 1886. Norw. North Atlantic Exped., 1876–1878, 1–96.

SARS, M., 1857. Forh. skand. Naturf. Møte, 1856, **7**, 160–175.

SARS, M. 1864a. Forh. VidenskSelsk. Krist., 1863, 2–10.

SARS, M. 1864b. Forh. VidenskSelsk. Krist., 1863, 79–84.

SHEARD, K., 1942. Trans. R. Soc. S. Aust., **66**, 60–65.

SHEARD, K., 1953. Rep. B.A.N.Z. antarct. Res. Exped., Ser. B (Zoology and Botany), **8**, 1–72.

SIM, G., 1872. Scott. Nat., **1**, 182–190.

STEBBING, T. R. R., 1893. Int. Science, Ser., **74**, 1–466.

VANHÖFFEN, E., 1897. *Grönlandsexp. der Ges. für Erkunde zu Berlin 1891–1893*, E. von Drygalski, ed. **2**.

WIBORG, K. F., 1966. Fiskets Gang, **41**, 754–761.

ZIMMER, C., 1904. "*Fauna Arctica*", F. Römer and F. Schaudinn, eds., Gustav Fisher, Jena. **3**, 415–492.

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