

APPENDICULARIA

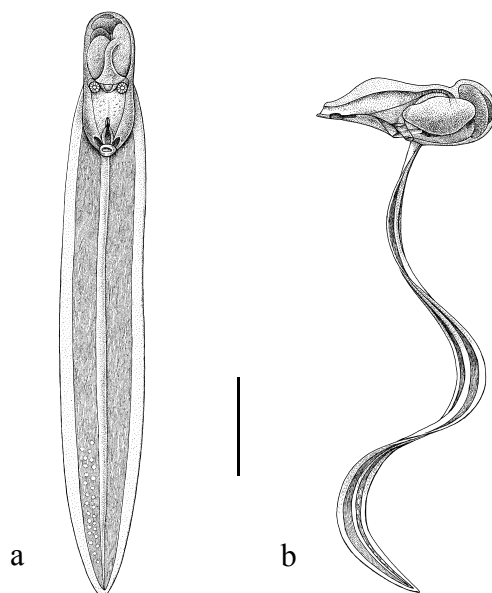


Fig. 26. *Oikopleura albicans* (Leuckart, 1854), a commonly occurring appendicularian species: **a**, dorsal view; **b**, lateral view. (Scale bar = 0.1 mm).

[after T. Prentiss, reproduced with permission, from Alldredge 1976]

Appendicularians are small free swimming planktonic tunicates, their bodies consisting of a short trunk and a tail (containing the notochord cells) which is present through the life of the individual. Glandular (oikoplast) epithelium on the trunk secretes the mucous house which encloses the whole or part of the body and contains the complex filters which strain food from the water driven through them (Deibel 1998; Flood & Deibel 1998). Unlike other tunicates, there is no peribranchial cavity and a pair of pharyngeal perforations (spiracles) surrounded by a ring of cilia open directly to the exterior from the floor of the pharynx.

The early studies of these organisms, begun with Chamisso's description of *Appendicularia flagellum* Chamisso, 1821, were confounded by questions of its phylogenetic affinity. Chamisso classified his species with medusoids, Mertens (1830) with molluscs, and Quoy & Gaimard (1833) with zoophytes. Only in 1851 were appendicularians correctly assigned to the Tunicata by Huxley. At the time of this placement, the existence of more than one taxon was only just beginning to be recognised, and despite Huxley's work, they were not universally regarded as adult organisms—some authors still insisting that they were ascidian larvae or a free swimming generation of the sessile ascidians (Fenaux 1993). Subsequently, these questions were resolved by the work of Fol (1872) on material from the Straits of Messina, which forms the basis of later studies on the large collections of the great expeditions of the 19th century that revealed their true diversity in the oceanic plankton.

Appendiculariadae Brown, 1862 (at family level) and Appendicularia (as a tribe) were the first collective names given to this group of organisms. Fol (1872) applied the family name Appendiculaires to the group. Appendicularia predates Copelata Haeckel, 1866, Larvacea Herdman, 1882 and other names at ordinal or class level (see Fenaux 1993). It is, accordingly, the name given to the class in the present work.

APPENDICULARIA

Lohmann (1892–1931) and Lohmann & Bückmann (1926) made important contributions to the study of the group, as did Aida (1907–1908) and Tokioka (1940 *et seq.*) in Japanese waters, and Ritter (1905) and Essenberg (1926) off California. Fenaux *et al.* (1990) published a bibliography and Fenaux (1993) completely revised the group and reviewed its history. The taxonomy and biology are reviewed in Bone (1998).

The classification within the class is generally that originally proposed by Lohmann (1896a) and followed, with minor modifications, by later workers. The families are Oikopleuridae Lohmann, 1896a, Fritillariidae Seeliger, 1895 and Kowalevskiidae Lahille, 1888. They are distinguished from one another by characteristics of body shape, endostyle, pharyngeal perforations, stomach wall, oikoplast epithelium and tail.

In Australia, the appendicularians of the eastern coast collected by the CSIRO research vessel FRV *Warreen* between the Tropic of Capricorn and South Australia were studied and recorded by Thompson (1945). A few species were recorded from Shark Bay and off Fremantle by Lohmann (1909), but there is no systematic study on this group in western Australian waters or in the tropical or the southern coastal waters of the Australian continent. So far, no indigenous species are known.

As with the thaliaceans, the geographic ranges of most species are great, being defined by the course of the relevant ocean currents rather than by geographic regions. Tokioka (1960) reviewed the geographic distribution of species in the class.

The search for the location of type specimens of the class has been unsuccessful. In particular, the collections of the Humboldt Plankton Expedition (Lohmann) and the Deutsch Tiefsee Expedition (Lohmann 1892–1931) have not been found. At this stage, no relevant larvacean type specimens have been located in the Natural History Museum (London), U.S. National Museum of Natural History (Washington, D.C.), the American Museum of Natural History (New York), the Muséum d'Histoire Naturelle, (Geneva), the Natural History Museum (Vienna), the Muséum National d'Histoire Naturelle (Paris), the Naturhistoriske Riksmuseum (Stockholm), Museum für Naturkunde (Berlin) or the Japanese collections. Hopefully, the publication of this section of the *Catalogue* will advertise the need for information on the location of the type specimens in this taxon of the Tunicata, although it is probable that many were lost during World War II (Fenaux 1993).

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FRITILLARIIDAE

The members of the family Fritillariidae Seeliger, 1895 (as amended by Lohmann, 1915) have dorsoventrally compressed or spindle-shaped trunks. The endostyle is curved upwards. The pharyngeal perforations (spiracles) are in the anterior part of the pharynx and each (with its ring of cilia) opens directly to the exterior, rather than through a tubular passage. The stomach wall consists of few large cells. The oikoplast epithelium lacks a row of conspicuous oikoplast cells (Fol's fibroblasts) dorsally, and ventrally is a small anterior area only.

The family is represented in Australian waters by seven species of *Fritillaria* and one of *Tectillaria*. It has been reviewed by Lohmann (1933) and Fenaux (1993) and its occurrence in Australian waters is documented by Thompson (1945).

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Fritillaria Fol, 1872

Fritillaria Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* **21**(2): 445–499 pls i–xi [473].

Type species: *Eurycercus pellucidus* Busch, 1851 by original designation.

Extralimital distribution: worldwide. See: Lohmann, H. (1933). Appendicularia. pp. 3–192 in Kükenthal, W. & Krumbach, T. (eds) *Handbuch der Zoologie*. Berlin : Walter de Gruyter Vol. 5(2); Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls [191].

Fritillaria borealis Lohmann, 1896

Taxonomic decision for subspecific arrangement: Lohmann, H. (1905). Die Appendicularien des arktischen und antarctischen Gebiets, ihr Beziehungen zueinander und zu den arten des Gebietes der warmen Ströme. *Zool. Jahrb. (Suppl.)* **8**: 353–382 [361]; Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443.

Distribution: NSW (Central E coast, Lower E coast), QLD (Great Barrier Reef), VIC (Bass Strait).

Fritillaria borealis allongata Lohmann, 1899

Fritillaria borealis allongata Lohmann, H. (1899). Untersuchungen über den Auftrieb des Strasse von Messina mit besonderer Berücksichtigung der Appendicularien und Challengerien. *Sber. K. Preuss. Akad. Wiss. Berl. Math. Naturwiss* **20**(587): 384–400 [386] [as *Fritillaria borealis* var. *allongata*].

Type data: type status and whereabouts unknown.

Type locality: Straits of Messina.

Fritillaria borealis intermedia Lohmann, H. (1905). Die Appendicularien des arktischen und antarktischen Gebiets, ihr Beziehungen zueinander und zu den arten des Gebietes der warmen Ströme. *Zool. Jahrb. (Suppl.)* **8**: 353–382 [361].

Type data: type status and whereabouts unknown.

Type locality: North Sea.

Fritillaria tenebra Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [419].

Type data: type status and whereabouts unknown.

Type locality: San Diego region, winter months, surface, 14.5°C.

Fritillaria pulchrituda Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [437].

Type data: type status and whereabouts unknown.

Type locality: San Diego region, surface, 14.23°C.

Fritillaria artus Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [447].

Type data: type status and whereabouts unknown.

Type locality: San Diego.

Fritillaria juncea Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [452].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 13.76°C.

Fritillaria nitida Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [458].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 13.6°C.

Fritillaria gigas Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [464].

Type data: type status and whereabouts unknown.

Type locality: San Diego 13.2–13.8°C.

Fritillaria brevicollis Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [477].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 15.0–15.6°C.

Fritillaria claudaria Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [478].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 13.4°C.

Fritillaria borealis mediterranea Vernieres, P. (1933). Essai sur l'histoire naturelle des Appendiculaires de Banyuls et de Sète. *Bull. Inst. Océanogr. Monaco* **30**(617): 1–60 [41] [as

Fritillaria borealis acuta formae *mediterranea*].

Type data: type status and whereabouts unknown.

Type locality: Banyuls-sur-Mer.

Taxonomic decision for synonymy: Tokioka, T. (1940). Some additional notes on the Japanese appendicularian fauna. *Rec. Oceanogr. Works, Japan* **11**(1): 1–26 [15]; Tokioka, T. & Caabro, J.A.S. (1956). Appendicularias de los mares cubanos. *Mem. Soc. Cuba. Hist. Nat. 'Felipe Poey'* **23**(1): 37–95 [71]; Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443 [360–362]; Fenaux, R. (1993). The classification of the Appendicularia (Tunicata): History and current state. *Mém. Inst. Océanogr. Monaco*. **17**: i–vii, 1–123 [62] (as *Fritillaria borealis intermedia*).

Distribution: QLD (Great Barrier Reef); North Sea, Baltic Sea, Mediterranean Sea.

Ecology: marine, planktonic; warm and mixed waters.

Fritillaria borealis sargassi Lohmann, 1896

Fritillaria sargassi Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **2**(E.C.): 1–148 pls i–xxiv [51].

Type data: type status and whereabouts unknown.

Type locality: equatorial stream to Cape Verde.

Fritillaria ritteri Aida, T. (1907). Appendicularia of Japanese waters. *J. Coll. Sci. Imp. Univ. Tokyo* **23**(5): 1–25 pls i–iv [4].

Type data: type status and whereabouts unknown.

Type locality: near western coast of Kinshu, Japan.

Fritillaria trigonis Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [432].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 13.7°C.

Fritillaria angularis Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [437].

Type data: type status unknown.

Type locality: San Diego, surface, 14.9°C.

Fritillaria diafana Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [440].

Type data: type status and whereabouts unknown.

Type locality: San Diego region, surface, 13.4–14.5°C.

Fritillaria plana Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [453].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 12–15.6°C.

Fritillaria clava Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [459].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 14.5°C.

Fritillaria velocita Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [467].

Type data: type status and whereabouts unknown.

Type locality: San Diego, surface, 14.4°C.

- Fritillaria borealis crassa*** Vernieres, P. (1933). Essai sur l'histoire naturelle des Appendiculaires de Banyuls et de Sète. *Bull. Inst. Océanogr. Monaco* **30**(617): 1–60 [41] [as *Fritillaria borealis truncata crassa*].
Type data: type status and whereabouts unknown.
Type locality: Banyuls-sur-Mer.
Taxonomic decision for synonymy: Tokioka, T. (1940). Some additional notes on the Japanese appendicularian fauna. *Rec. Oceanogr. Works, Japan* **11**(1): 1–26 [15, 16]; Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443 [361–363].
Distribution: NSW (Central E coast, Lower E coast), VIC (Bass Strait); Atlantic Ocean, Pacific Ocean and Indian Ocean.
Ecology: marine, planktonic; warm waters.
Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls [61].
- Fritillaria formica*** Fol, 1872
Fritillaria formica Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* **21**(2): 445–499 pls i–xi [479].
Type data: type status unknown GMNH (depository uncertain, not found).
Type locality: Straits of Messina, Mediterranean Sea.
Distribution: NSW (Central E coast), QLD (Central E coast); equatorial regions in north and south Atlantic Equatorial Streams, west Pacific Ocean.
Ecology: marine, planktonic; not deeper than 200 m, water temperature 24.1–26.5°C, salinity 34.8–36.8 parts per thousand.
Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.
- Fritillaria fraudax*** Lohmann, 1896
Fritillaria fraudax Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **2**(E.C.): 1–148 pls i–xxiv [35].
Type data: syntypes (probable) ZMH* (depository uncertain).
Type locality: Sargasso Sea, Atlantic Ocean.
Distribution: NSW (Central E coast), QLD (Central E coast); north Atlantic Stream circuit, Sargasso Sea, and Guinea, S Equatorial and Benguela Streams.
Ecology: marine, planktonic; to 200 m and more, water temperature 21–27°C, salinity 36.2–37.4 parts per thousand.
Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.
- Fritillaria haplostoma*** Fol, 1872
Fritillaria haplostoma Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* **21**(2): 445–499 pls i–xi [478].
Type data: type status unknown GMNH (depository uncertain, not found).
Type locality: Straits of Messina, Mediterranean Sea.
- Type data: type status unknown GMNH (depository uncertain, not found).
Type locality: Straits of Messina, Mediterranean Sea.
- Fritillaria abjornseni*** Lohmann, H. (1909). Copelata und Thaliacea. pp. 143–149 in Michaelsen, W. & Hartmeyer, R. (eds) *Die Fauna Südwest-Australiens*. 2(10) Jena : Fischer [147].
Type data: holotype ZMB* (depository uncertain).
Type locality: Swan River, North Fremantle, WA.
- Fritillaria lohmanni*** Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [424].
Type data: type status and whereabouts unknown.
Type locality: San Diego region, 13.68–14.82°C.
- Fritillaria amygala*** Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [426].
Type data: type status and whereabouts unknown.
Type locality: San Diego region, 14.98–15.15°C.
- Fritillaria campila*** Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [445].
Type data: type status and whereabouts unknown.
Type locality: San Diego region, 13–17.3°C.
- Fritillaria tacita*** Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [465].
Type data: type status and whereabouts unknown.
Type locality: San Diego region, 14.75°C.
- Fritillaria tereta*** Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [473].
Type data: type status unknown.
Type locality: San Diego region, 14.7°C.
- Taxonomic decision for synonymy: Tokioka, T. (1956). *Fritillaria arafaera* n.sp. a form of the sibling species: *Fritillaria haplostoma*-complex (Appendicularia: Chordata). *Pac. Sci.* **10**(4): 403–406 [405].
Distribution: Japan, California, NSW (Central E coast, Lower E coast), QLD (Central E coast), TAS (Tas. coast); Mediterranean Sea, Atlantic Ocean, South Equatorial Stream, south California, rare in west Pacific Ocean.
Ecology: marine, planktonic; water temperature 23.3–29.5°C, salinity 34.8–37 parts per thousand.
References: Fol, H. (1874). Note sur un nouveau genre d'Appendiculaires. *Arch. Zool. Exp. Gén.* **3**(Notes et revue): XLIX–LIII, pl. 18 (figs 1–5); Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.
- Fritillaria megachile*** Fol, 1872
Fritillaria megachile Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* **21**(2): 445–499 pls i–xi [477].
Type data: type status unknown GMNH (depository uncertain, not found).
Type locality: Straits of Messina, Mediterranean Sea.

Fritillaria dispar Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [472].

Type data: type status and whereabouts unknown.
Type locality: San Diego region.

Fritillaria macrotrachela Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [438].

Type data: type status and whereabouts unknown.
Type locality: San Diego region, surface, 14.2°C.

Taxonomic decision for synonymy: Tokioka, T. (1940). Some additional notes on the Japanese appendicularian fauna. *Rec. Oceanogr. Works, Japan* **11**(1): 1–26 [16]; Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443 [361].

Distribution: NSW (Central E coast); Mediterranean Sea, Atlantic Ocean, South Equatorial Stream, tropical west Pacific Ocean.

Ecology: marine, planktonic; warm water, surface temperature 22.1–23.3°C.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Fritillaria pellucida (Busch, 1851)

Eurycercus pellucidus Busch, W. (1851). *Beobachtungen über Anatomie und Entwicklung einiger wirbelloser Seethiere*. Berlin pp. 118–120 pls i–xvi. [118].

Type data: holotype (probable) ZMB* (depository uncertain).

Type locality: Gibraltar.

Distribution: NSW (Lower E coast); also in warm waters of all oceans.

Ecology: marine, planktonic; not deeper than 200 m, water temperature 15.3–27.2°C, salinity 34.8–37.4 parts per thousand.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Fritillaria venusta Lohmann, 1896

Fritillaria venusta Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **2**(E.C.): 1–148 pls i–xxiv [46].

Type data: type status and whereabouts unknown.

Type locality: Cape Verde, equatorial and Guinea currents.

Fritillaria bicornis Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **2**(E.C.): 1–148 pls i–xxiv [47].

Type data: type status and whereabouts unknown.

Type locality: equatorial regions, north and south Atlantic streams.

Fritillaria inverta Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [423].

Type data: type status and whereabouts unknown.

Type locality: San Diego, 0–200 m, surface temperature, 20.2°C.

Taxonomic decision for synonymy: Tokioka, T. (1951). Pelagic tunicates and chaetognaths collected during the cruises to the new Yamoto Bank in the Sea of Japan. *Publ. Seto Mar. Biol. Lab.* **2**(1): 1–25 [14].

Distribution: NSW (Central E coast), QLD (Central E coast); rare, also equatorial regions in north and south Atlantic Streams, tropical west Pacific Ocean and Mediterranean Sea.

Ecology: marine, planktonic; not deeper than 200 m, temperature 24.10–26.5°C, salinity 34.8–36.8 parts per thousand.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Tectillaria Lohmann & Bückmann, 1926

Tectillaria Lohmann, H. & Bückmann, A. (1926). Die Appendicularien der Deutschen Südpolar-Expedition 1901 bis 1903. *Ergebn. Deutsch. Südp.-Exped.* **18**(Zool. 10): 63–231 [159].

Type species: *Fritillaria fertilis* Lohmann, 1896 by monotypy.

Extralimital distribution: warm oceanic waters of the tropical Atlantic Ocean, Pacific Ocean and Indian Ocean. See: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Tectillaria fertilis (Lohmann, 1896)

Fritillaria fertilis Lohmann, H. (1896). Die Appendicularien der Expedition. *Zool. Ergebn. Ges. Erdk. Berlin Gronland-Exped. Bi* **20**(2): 25–44 [29].

Type data: syntypes (probable) ZMH* (depository uncertain).

Type locality: north and south Atlantic equatorial currents.

Distribution: NSW (Central E coast); the Atlantic Ocean, Florida Stream, E Sargasso Sea, North Equatorial Stream, west Pacific Ocean and Indian Ocean.

Ecology: marine, planktonic; not deeper than 200 m, water temperature 24.5–26.6°C, salinity 35.6–37.0 parts per thousand.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

KOWALEVSKIIDAE

The family Kowalevskiidae Lahille, 1888 is characterised by a short trunk, and lacks both endostyle and heart. The ciliated ring around the internal opening of each spiracle is compressed into a long narrow slit with upper and lower rims. The stomach wall consists of few, large, conspicuous cells; a spectacular, large, button-shaped cell is on the upper part of the oikoplast epithelium. The outline of the tail is fusiform or spindle-shaped.

One of the two known species is recorded from Australia—being taken only once off southeastern Queensland and once off central New South Wales (Thompson 1945).

References

Lahille, F. (1888). Etude systématique des tuniciers. *Compt. Rend. Ass. Fr. Avanc. Sci.* **1887**(2): 667–677

Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls

Kowalevskia Fol, 1872

Kowalevskia Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* **21**(2): 445–499 pls i–xi [481].

Type species: *Kowalevskia tenuis* Fol, 1872 by monotypy.

Extralimital distribution: north east Atlantic Ocean, Mediterranean Sea, west and east Pacific Ocean. See: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Kowalevskia tenuis Fol, 1872

Kowalevskia tenuis Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* **21**(2): 445–499 pls i–xi [481].

Type data: type status unknown GMNH (depository uncertain, not found).

Type locality: Straits of Messina, Mediterranean Sea.

Distribution: Portugal, Japan, California, NSW (Central E coast), QLD (Central E coast); warm waters from Portugal to equator, Mediterranean Sea, Benguela stream, south California.

Ecology: marine, planktonic; in surface waters, temperature 13–14°C.

References: Fol, H. (1874). Note sur un nouveau genre d'Appendiculaires. *Arch. Zool. Exp. Gén.* **3**(Notes et revue): XLIX–LIII, pl. 18 (figs 1–5); Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

OIKOPLEURIDAE

Oikopleuridae have ovoid bodies, straight endostyles, and the spiracles have tubular passages from the internal pharyngeal openings to the external ones in the vicinity of the rectum. Stomach walls have numerous small cells and a row of only a few large cells. A row of large (Fol's) fibroblasts is on both parts of the antero-dorsal oikoplast epithelium.

Appendicularia flagellum Chamisso, 1821, the first recorded organism of the class, although barely recognisable at family level, has a species description and accompanying figures that make the general affinity of the organism clear enough (see Fenaux 1993). Mertens (1830) believed that he had the same species from the Bering Strait but renamed it *Oikopleura chamissonis*. Fenaux (1993) believes that either *Oikopleura labradoriensis* Lohmann, 1892 or *Oikopleura vanhoeffeni* Lohmann, 1896 could be conspecific with either *Appendicularia flagellum* or *Oikopleura chamissonis* Mertens, 1830, type species of the genus *Oikopleura* Mertens, 1830, or with both. Whichever species are found to be synonyms, the genus name *Appendicularia* Chamisso has priority over *Oikopleura* Mertens and this is emphasised in discussions on a case put to the International Commission on Zoological Nomenclature (Case 23, 1922). At the time the decision was to table the question until more information was presented. However, the much used names *Oikopleura* and Oikopleuridae are used here pending an application to the Commission for Zoological Nomenclature to validate them. Further, the description of a neotype from (Bering Strait) is required to establish the identity of *O. chamissonis*, as the type specimen is not available.

The family is the most diverse in the class. It is represented in Australian waters by nine species of *Oikopleura* Mertens, 1830, and one each of *Megalocercus* Chun, 1887, *Stegosoma* Chun, 1887, *Althoffia* Lohmann, 1892 (all in the subfamily Oikopleurinae); and one of *Bathochordaeus* Chun, 1900 (in the subfamily Bathochordaeinae; Fenaux & Youngbluth 1990). The commonly occurring species are *Oikopleura rufescens* Fol, 1872, *Oikopleura dioica* Fol, 1872 and *Oikopleura longicauda* (Vogt, 1854). The family has been reviewed by Lohmann (1933) and Fenaux (1993), and Thompson (1945) has documented its occurrence in eastern Australian waters.

References

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OIKOPLEURIDAE

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- Mertens, C.H. (1830). Beschreibung der *Oikopleura*, einer neuen Mollusken-Gattung. *Mém. Acad. Imp. Sci. St Pétersburg* **6**(1)**2**: 205–220 2 pls
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BATHOCHORDAEINAE

Bathochordaeus Chun, 1900

Bathochordaeus Chun, C. (1900). pp. 136, 149, 210, 289, 518, 519 in, *Aus den Tiefen des Weltmeeres. Schilderungen von der deutschen Tiefsee-Expedition*. Jena : Gustav Fischer 550 pp. 390 figs 46 pls [519].

Type species: *Bathochordaeus charon* Chun, 1900 by monotypy.

Extralimital distribution: southwest Atlantic Ocean, South-Equatorial Stream. See: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls; Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* 8(2): 351–443.

Bathochordaeus charon Chun, 1900

Bathochordaeus charon Chun, C. (1900). pp. 136, 149, 210, 289, 518, 519 in, *Aus den Tiefen des Weltmeeres. Schilderungen von der deutschen Tiefsee-Expedition*. Jena : Gustav Fischer 550 pp. 390 figs 46 pls [519].

Type data: syntypes (probable) ZMB* (depository uncertain).

Type locality: Benguela Stream, southwest Atlantic Ocean.

Distribution: NSW (SE coastal); SW Atlantic Ocean. Ecology: marine, planktonic; rare, in vertical hauls from 2000 m and 200 m.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

OIKOPLEURINAE

Althoffia Lohmann, 1892

Althoffia Lohmann, H. (1892). Vorberichte über die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **1**(A): 139–149 [146].

Type species: *Althoffia tumida* Lohmann, 1892 by monotypy.

Extralimital distribution: Atlantic Ocean, Pacific Ocean and Indian Ocean. See: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne: Council for Scientific and Industrial Research 196 pp. 75 pls; Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443.

Althoffia tumida Lohmann, 1892

Althoffia tumida Lohmann, H. (1892). Vorberichte über die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **1**(A): 139–149 [147].

Type data: type status and whereabouts unknown.

Type locality: Sargasso Sea, Atlantic Ocean.

Distribution: NSW (Central E coast), QLD (Central E coast); Sargasso Sea, Florida Stream, South Equatorial Stream and in Indian Ocean and Pacific Ocean.

Ecology: marine, planktonic; not taken at surface or deeper than 20 m, present where surface temperature between 15.8–27°C and salinity 35.5–37.4 parts per thousand.

References: Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* **2**(E.C.): 1–148 pls i–xxiv; Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne: Council for Scientific and Industrial Research 196 pp. 75 pls.

Megalocercus Chun, 1887

Megalocercus Chun, C. (1887). Die pelagische Thierwelt in grösseren Meerestiefen und ihre Beziehungen zu der Oberflächenfauna. *Bibl. Zool., Stuttgart* **1**(1): 1–66 pls i–v [40]. Type species: *Megalocercus abyssorum* Chun, 1887 by monotypy.

Extralimital distribution: Indian Ocean, west Pacific Ocean, Atlantic Ocean, Mediterranean Sea. See: Lohmann, H. (1933). Appendicularia. pp. 3–192 in Kükenthal, W. & Krumbach, T. (eds) *Handbuch der Zoologie*. Berlin: Walter de Gruyter Vol. 5(2); Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443.

Megalocercus huxleyi (Ritter, 1905)

Oikopleura huxleyi Ritter, W.E. In, Ritter, W.E. & Byxbee, E.S. (1905). The pelagic Tunicata. Rep. Sci. Res. Expl. Trop. Pac. St. 'Albatross' VIII. *Mus. Comp. Zool., Harvard Coll.*

26(8): 195–214 pls i–ii [206].

Type data: type status and whereabouts unknown.

Type locality: north of New Guinea [2°38'N 137°22'E].

Oikopleura megastoma Aida, T. (1907). Appendicularia of Japanese waters. *J. Coll. Sci. Imp. Univ. Tokyo* **23**(5): 1–25 pls i–iv [11].

Type data: type status and whereabouts unknown.

Type locality: Japan.

Taxonomic decision for synonymy: Ihle, J.E.W. (1908).

Oikopleura megastoma Aida, identisch mit *Megalocercus huxleyi* (Ritter). *Zool. Anz.* **32**: 775–776 [775].

Distribution: Japan, NSW (Central E coast, Lower E coast), QLD (Central E coast), VIC (Bass Strait*); Indian Ocean, Indo-west Pacific Ocean.

Ecology: marine, planktonic; warm water up to 29.3°C.

Oikopleura Mertens, 1830

Oikopleura Mertens, C.H. (1830). Beschreibung der *Oikopleura*, einer neuen Mollusken-Gattung. *Mém. Acad. Imp. Sci. St Pétersburg* **6**(1)2: 205–220 2 pls [205].

Type species: *Oikopleura chamissonis* Mertens, 1830 (= ?*Oikopleura labradoriensis* Lohmann, 1896, or ?*Oikopleura vanhoeffeni* Lohmann, 1896, see Fenaux, R. (1993). The classification of the Appendicularia (Tunicata): History and current state. *Mém. Inst. Océanogr. Monaco*. **17**: i–vii, 1–123) by original designation.

Vexillaria Mueller, J. (1846). Bericht über einige neue Theirformen der Nordsee. *Müllers Arch. Anat. Phys. Wiss. Med.* **1846**: 106 [106].

Type species: *Vexillaria flabellum* Mueller, 1846 by monotypy.

Oikomikron Swainson, G. (1890). Appendicularia, with its 'haus'. *Int. J. Microsc. Nat. Sci.* (3)4: 10–19 [18].

Type species: *Oikomikron mitrateton* Swainson, 1890 by monotypy.

Haplopleura Berrill, N.J. (1950). The Tunicata. *Ray Soc. Pubs* **133**: 1–354 [309].

Type species: *Appendicularia longicauda* Vogt, 1854 by monotypy.

Taxonomic decision for synonymy: Fenaux, R. (1993). The classification of the Appendicularia (Tunicata): History and current state. *Mém. Inst. Océanogr. Monaco*. **17**: i–vii, 1–123 [58].

Extralimital distribution: worldwide. See: Lohmann, H. (1933). Appendicularia. pp. 3–192 in Kükenthal, W. & Krumbach, T. (eds) *Handbuch der Zoologie*. Berlin: Walter de Gruyter Vol. 5(2); Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* **8**(2): 351–443.

Oikopleura albicans (Leuckart, 1854)

Appendicularia albicans Leuckart, (1854). Zur Anatomie und Entwicklungsgeschichte der tunicaten Beschreibung einer Schwaermencker Ascidienlarve (*Appendicularia albicans*). *Zool. Unters Gressen* 2: 77–93 [81].

Type data: type status unknown.
Type locality: Mediterranean Sea.

Distribution: Japan, California, NSW (Lower E coast); Indian Ocean, Atlantic Ocean, Mediterranean, Californian coast.

Ecology: marine, planktonic; water temperatures to 27.2°C, a warm water species usually found with *Oikopleura longicaudata* (Vogt, 1854) and *O. rufescens* Fol, 1872, but less numerous.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Oikopleura cophocerca Gegenbaur, 1855

Oikopleura (Vexillaria) cophocerca Gegenbaur, C. (1855). Bemerkungen über die organisation der appendicularian. *Zeit. Wiss. Zool.* 6(4): 406–427 [408].

Type data: type status unknown.
Type locality: Messina, Mediterranean Sea.

Distribution: Japan, Indonesia, NSW (Central E coast, Lower E coast), QLD (Central E coast), VIC (Bass Strait), WA (Central W coast); warmer sections of Indian and Atlantic Oceans (including West Indies), and western and eastern Pacific Ocean, including Indonesia and Japan.

Ecology: marine, planktonic; warm water species, not taken at depths greater than 200 m in waters 13–28°C and salinity to 34.4‰.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Oikopleura cornutogastra Aida, 1907

Oikopleura cornutogastra Aida, T. (1907). Appendicularia of Japanese waters. *J. Coll. Sci. Imp. Univ. Tokyo* 23(5): 1–25 pls i–iv [15].

Type data: type status and whereabouts unknown.
Type locality: off Japan.

Distribution: NSW (Lower E coast); off Agulhas, Benguela and South Equatorial Streams.

Ecology: marine, planktonic; water temperature 19°C or higher.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Oikopleura dioica Fol, 1872

Vexillaria flabellum Mueller, J. (1846). Bericht über einige neue Theiformen der Nordsee. *Müllers Arch. Anat. Phys. Wiss. Med.* 1846: 106 [106] [this is a little used name, and for stability in nomenclature, *Oikopleura dioica* Fol, 1872 is maintained here as the valid name, pending an application to

the International Commission on Zoological Nomenclature].

Type data: type status and whereabouts unknown.

Type locality: North Sea.

Oikopleura dioica Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* 21(2): 445–499 pls i–xi [472] [for stability in nomenclature this name is maintained here as the valid name, pending an application to the International Commission on Zoological Nomenclature to have it conserved].

Type data: type status unknown GMNH (depository uncertain, not found).

Type locality: Straits of Messina, Mediterranean Sea.

Vexillaria speciosa Eisen, A.G. (1874). *Vexillaria speciosa* n. sp. ett bidrag till Appendiculariornas Anatom. K. Sven. Vetensk.-Akad. Handl. (ser. 4) 12(9): 1–15 pls i–iii [1].

Type data: type status and whereabouts unknown.
Type locality: Fiskelbäckskil, Gullmarfjorden, Sweden.

Oikopleura malmii Hartmann, R. (1878). Einige Mittheilungen über Appendicularien. *Sitzungs-Ber. Ges. naturforsch. Freunde Ber.* 1878: 97–100 [100].

Type data: type status and whereabouts unknown.
Type locality: Kattegat.

Oikomicron mitrateton Swainson, G. (1890). Appendicularia, with its 'haus'. *Int. J. Microsc. Nat. Sci.* (3) 4: 10–19 [18].

Type data: type status and whereabouts unknown.

Type locality: Irish Sea.

Taxonomic decision for synonymy: Lohmann, H. (1895). Ueber die Verbreitung der Appendicularien im Atlantischen Ozeane. *Verh. Ges. Dtsch. Naturforsch. Aerzte* 67(2, 1): 113–120 [116]; Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* 2(E.C.): 1–148 pls i–xxiv [76].

Distribution: NSW (Lower E coast), SA (Great Australian Bight, S Gulfs coast), TAS (Bass Strait*, Tas. coast*), VIC (Bass Strait*), WA (Central W coast, Lower W coast); Tas. coast, VIC; also in warmer parts of all oceans 3.2–29.5°C, rare in open sea.

Ecology: marine, planktonic; never deeper than 200 m, water temperature 3.2–29.5°C, salinity 11.4–36.7 parts per thousand.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Oikopleura fusiformis Fol, 1872

Oikopleura fusiformis Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* 21(2): 445–499 pls i–xi [473].

Type data: type status unknown GMNH (depository uncertain, not found).

Type locality: Straits of Messina, Mediterranean Sea.

Distribution: Japan, NSW (Central E coast, Lower E coast), QLD (Central E coast, Great Barrier Reef), VIC (Bass Strait*), WA (Central W coast); Great Barrier Reef, central E coast, lower E coast, QLD, NSW, VIC, ; also Indian Ocean, Indo-Pacific Ocean.

Ecology: marine, planktonic; warm water to 29.3°C.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Oikopleura intermedia Lohmann, 1896

Oikopleura intermedia Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* 2(E.C.): 1–148 pls i–xxiv [62].

Type data: syntypes (probable) ZMB* (depository uncertain).

Type locality: ?Atlantic Ocean.

Oikopleura microstoma Aida, T. (1907). Appendicularia of Japanese waters. *J. Coll. Sci. Imp. Univ. Tokyo* 23(5): 1–25 pls i–iv [14].

Type data: type status and whereabouts unknown.

Type locality: Japan.

Oikopleura tortugensis Kellner, K. (1908). On *Oikopleura tortugensis*, a new appendicularian from the Tortugas, Florida, with notes on its embryology. pp. 89–94 in Brooks, W.K. The pelagic Tunicata of the Gulf Stream. *Publ. Carnegie Inst. (Washington)* 102: 89–94 [90].

Type data: type status and whereabouts unknown.

Type locality: Tortugas, Florida, USA.

Taxonomic decision for synonymy: Lohmann, H. (1913). Die Appendicularien (Ausbeute von Kükenthal und Hartmeyer in Westindien). *Zool. Jahrb. Suppl.* 11(3): 343–350 [343]; Tokioka, T. (1940). Some additional notes on the Japanese appendicularian fauna. *Rec. Oceanogr. Works, Japan* 11(1): 1–26 [3].

Distribution: Japan, NSW (Lower E coast), VIC (Bass Strait*); to 35°11'S in Benguela Stream, Atlantic Ocean.

Ecology: marine, planktonic; water temperature to 27°C, salinity to 37.3 parts per thousand.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Oikopleura longicauda (Vogt, 1854)

Appendicularia longicauda Vogt, C. (1854). Recherches sur les animaux inférieurs de la Méditerranée. *Sci. Mém. sur les Tuniciers nageants de la mer de Nice. Mém. Inst. Génèvois* 2(3): 1–102 pls v–x [74].

Type data: type status unknown GMNH (depository uncertain, not found).

Type locality: off Nice, Mediterranean Sea.

Oikopleura spissa Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* 21(2): 445–499 pls i–xi [470].

Type data: type status unknown GMNH (depository uncertain, not found).

Type locality: Straits of Messina, Mediterranean Sea.

Oikopleura velifera Langerhans, P. (1880). Über Madeira's Appendicularien. *Zeit. Wiss. Zool.* 34: 144–146 pl. vi [145].

Type data: type status and whereabouts unknown.

Type locality: Madeira, NE Atlantic Ocean.

Taxonomic decision for synonymy: Lohmann, H. (1896). Die Appendicularien der Plankton-Expedition. *Ergebn. Plankt.-Exped.* 2(E.C.): 1–148 pls i–xxiv [59].

Distribution: Peru, California, NSW (Central E coast, Lower E coast), QLD (Central E coast, Great Barrier Reef), SA (S Gulfs coast), VIC (Bass Strait), WA (Central W coast); Mediterranean Sea, and most warmer oceanic waters, including areas where mixing with cold waters off Peru and S California.

Ecology: marine, planktonic; water temperature 11.2–29.7°C, salinity 12.8–37.3 parts per thousand.

Oikopleura rufescens Fol, 1872

Oikopleura rufescens Fol, H. (1872). Etudes sur les Appendiculaires du détroit de Messine. *Mém. Soc. Phys. Hist. Nat. Genève* 21(2): 445–499 pls i–xi [471].

Type data: type status unknown GMNH (depository uncertain, not found).

Type locality: Straits of Messina, Mediterranean Sea.

Distribution: California, NSW (Central E coast, Lower E coast), QLD (Central E coast, Great Barrier Reef), SA (Great Australian Bight, S Gulfs coast), VIC (Bass Strait), WA (Central W coast); in all oceans but rare in Mediterranean Sea, SE Atlantic Ocean and southern California.

Ecology: marine, planktonic; water temperature 13–29°C, salinity 34.7–37.4 parts per thousand.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.

Stegosoma Chun, 1888

Stegosoma Chun, C. (1887). Die pelagische Thierwelt in grösseren Meerestiefen und ihre Beziehungen zu der Oberflächenfauna. *Bibl. Zool., Stuttgart* 1(1): 1–66 pls i–v [37].

Type species: *Stegosoma pellucidum* Chun, 1888 (= *Oikopleura magnum* Langerhans, 1880) by monotypy.

Extralimital distribution: worldwide. See: Lohmann, H. (1933). Appendicularia. pp. 3–192 in Kükenthal, W. & Krumbach, T. (eds) *Handbuch der Zoologie*. Berlin : Walter de Gruyter Vol. 5(2); Tokioka, T. (1960). Studies on the distribution of appendicularians and some thaliaceans of the North Pacific, with some morphological notes. *Publ. Seto Mar. Biol. Lab. Kyoto Univ.* 8(2): 351–443.

Stegosoma magnum (Langerhans, 1880)

Oikopleura magnum Langerhans, P. (1880). Über Madeira's Appendicularien. *Zeit. Wiss. Zool.* 34: 144–146 pl. vi [145].

Type data: type status and whereabouts unknown.

Type locality: Madeira, NE Atlantic Ocean.

Stegosoma pellucidum Chun, C. (1887). Die pelagische Thierwelt in grösseren Meerestiefen und ihre Beziehungen zu der Oberflächenfauna. *Bibl. Zool., Stuttgart* 1(1): 1–66 pls i–v [37].

Type data: type status and whereabouts unknown.

Type locality: to 1300 m, Mediterranean Sea.

OIKOPLEURIDAE: OIKOPLEURINAE

Megalocercus diegensis Essenberg, C.E. (1926). Copelata from the San Diego Region. *Univ. Calif. Publ. Zool.* **28**(22): 399–521 [508].

Type data: type status unknown.

Type locality: off San Diego, California.

Taxonomic decision for synonymy: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls [52].

Distribution: NSW (Lower E coast), QLD (Central E coast*); Indian Ocean and Pacific Ocean, Mediterranean Sea.

Ecology: marine, planktonic; surface waters of warmer oceanic regions, down to 1300 m in Mediterranean Sea.

Reference: Thompson, H. (1945). *Pelagic Tunicates of Australia*. Melbourne : Council for Scientific and Industrial Research 196 pp. 75 pls.