Transactions of the Royal Society of S. Aust. (2003), **127**(2), 205-241.

ENCOUNTER 2002 EXPEDITION TO THE ISLES OF ST FRANCIS, SOUTH AUSTRALIA: MEDUSAE, SIPHONOPHORES AND CTENOPHORES

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Summary

GERSHWIN, L. & ZEIDLER, W. Encounter 2002 expedition to the Isles of St Francis, South Australia: Medusae, siphonophores and ctenophores of the Nuyts Archipelago. *Trans. R. Soc. S. Aust.* **127**(2), 205-241, 28 November, 2003.

The medusae and ctenophores of the Nuyts Archipelago are reported for the first time. In all, the collection includes at least 17 species of Hydromedusae (eight described here as new to science), one species of Siphonophorae, one species of Scyphomedusae, and two species of Ctenophora (one possibly new to science). The localized evolutionary radiation in the hydrozoan family Zancleidae is also discussed.

KEY WORDS: Hydromedusae, Scyphomedusae, Siphonophora, Ctenophora, Nuyts Archipelago, Great Australian Bight, South Australia, new species.

Introduction

The medusae and ctenophores of the Nuyts Archipelago have not been previously surveyed. Our results from a short survey of six days indicate that a longer-term study would likely reveal a rich, endemic, pelagic coelenterate fauna.

The waters of Southern Australia are known for high rates of endemism (Wilson & Allen 1987). While our gelatinous plankton surveys of the coastal waters of S.A., W.A., N.T., Queensland, and Tasmania over the last few years have revealed many new species, comparatively few were found at the Nuyts Archipelago. Hydroids of most species were not found, despite extensive searching by members of the expedition; thus, life cycles remain unknown.

Some researchers have recently advocated caution in describing new species of hydrozoans unless the complete life cycle is known (Schuchert 1996; Bouillon & Boero 2000). Hence, we do not propose specific names for the species of *Hydractinia* and *Ectopleura* described here. However, we have proceeded to describe four species of *Zanclea* as new to science because we believe that the medusae have several morphological characters that distinguish them from other known species and each other, and we hope to back this up with DNA sequence information in the near future.

Zanclea as the hydroid was not found at the Nuyts Archipelago and is absent from recent collections from southern Australia (J. Watson, pers comm.). Thus, it seems likely that, in southern Australia, the life cycle of *Zanclea* species will only be discovered by rearing them in the laborartory.

We were also unable to collect information on the nematocysts in the field and found it difficult to obtain meaningful data from preserved specimens. Thus, this important information is unavailable at this stage.

Materials and Methods

Most of the material examined in this study was collected from Petrel Bay, St Francis Island (32° 30′ 00.6″ S, 133° 17′ 45.6″ E). Specimens were captured with a one-third metre (0.3 m) diameter plankton net with a 500μm mesh, with a solid cod-end. Plankton tows were conducted from an anchored vessel (RV *Ngerin* or tenders), with the currents alone providing the flow rate. Durations of tows were haphazard, varying from 10 minutes to 6 hours. Whenever possible, living material was observed and photographed to record colour and behavioural patterns. Specimens were relaxed in menthol or magnesium chloride, then fixed in a solution of 50% concentrated formalin and 50% propylene glycol, to equal approximately 5% formalin in seawater (= 2% formaldehyde). Chemically relaxed specimens were gently transferred into chilled 5% formalin solution (Dr P. Alderslade, pers. comm. 2000), this method yielding the closest approximation to living form, with only negligible or no distortion. Measurements of bell height (BH) and bell diameter (BD) were made on preserved specimens with Max-Cal digital calipers, to the nearest 0.05 mm. Collectors' names are abbreviated as follows: LG - Lisa Gershwin; TL - Thierry Laperousaz; WZ - Wolfgang Zeidler.

Specimens are deposited in the collections of the South Australian Museum (prefixed "H") and the Tasmanian Museum and Art Gallery (TMAG). For all species with multiple specimens, one or more were frozen in liquid nitrogen and deposited in the

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SAM frozen tissue bank. In addition, some specimens were fixed in 100% alcohol (prefix "XH"). Colour images of photographed specimens have been deposited in the photo-index collection of the South Australian Museum and the specimens are distinguished by an additional number (prefix "PH"), cross-referencing them to the image. Additional unsorted material is available for further study.

Classifications of higher taxa were adopted as follows: Hydrozoa and Scyphozoa following the traditional classification of Kramp (1961b); Siphonophorae loosely following Totton (1965); and ctenophores following Mills (1998-2002). Families, genera, and species are arranged alphabetically within each higher classification. All taxon names have been verified with the orginal literature, except as noted.

Illustrations were made from preserved specimens.

Systematics

Phylum Cnidaria Verrill, 1865
Subphylum Medusozoa Petersen, 1979
Class Hydrozoa Owen, 1843
Order Anthomedusae Haeckel, 1879
Suborder Filifera Kühn, 1913
Family Hydractiniidae L. Agassiz, 1862
Genus *Hydractinia* van Beneden, 1841

Hydractinia sp. (Fig. 1)

Material Examined

Gravid female, BH 1.11 mm, BD 0.81 mm (H1308), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002. One immature specimen, BH 0.88 mm, BD 0.99 mm (H1245), same collection data as H1308; 8 specimens (H1218), one gravid female (H1321), Brennan's Wharf, Port Lincoln, coll. LG & TL, 15 & 16 Feb. 2002; 8 specimens (H1315), Murat Bay jetty, Ceduna, coll. LG & WZ, 15 Dec. 2000.

Description

Body bell-shaped, with a thickened, rounded apical mass. Exumbrellar surface smooth. Stomach mounted upon a very shallow gelatinous peduncle, without mesenteries; flask-shaped. Gonads 4, interradial, occupying the upper $^4/_5$ of the stomach wall; mature ova arranged along the vertical midline, with the unripe ova along both sides. Mouth with 4 short, slightly recurved lips, with a terminal, adaxial tuft of nematocysts; reaching the velar margin. Tentacles 8, 4 perradial and 4 interradial, filiform with a thickened tip; approximately BH in length. Tentacle bulbs 8, triangular, with a short abaxial extension up onto the endodermal surface of the subumbrella, but not onto the exumbrella. Radial canals 4, very narrow, lacking pigment. Ring canal slightly wider than the radial canals. Velum moderately wide. Statocysts and ocelli lacking. Colouration in life: gonads, stomach, and tentacles and bulbs white; all other parts transparent and colourless.

Remarks

The family Hydractiniidae is badly in need of a revision, as was noted by Schuchert (1996). Although we are unable to clearly differentiate all taxa in the group, the present form seems to differ from some of the better known species (see Table 1). However, because of the dearth of characters on *Hydractinia* medusae, we are hesitant to describe the present form as new without knowledge of its complete life cycle. *Hydractinia* sp. appears to be most similar to *H. australis* (Shuchert, 1996), *H. carnea* (Sars, 1846), and *H. tenuis* (Browne, 1902). In comparison, *H. tenuis* has medusa buds and a well-developed peduncle, whereas *H.* sp. does not, and *H. australis* typically has more than 8 tentacles and reduced oral arms, whereas *H.* sp. has well-developed oral arms and only 8 tentacles. *Hydractinia* sp. might be mistaken for falling within the range of variation of *H. carnea*, but the latter name is given to forms representing a clinal range of character states in Europe and the Mediterranean, and we feel that it would be simplistic to include the southern Australian form, which apparently has a stable morphology, into the more variable European form.

A combined morphological and molecular comparison of a wide range of geographical forms would likely answer many questions that have hindered the furtherance of knowledge of this group. The Hydractiniidae is a geographically widespread group but rather narrow in its known species diversity; a better understanding of the species' boundaries will very likely significantly increase its taxonomic biodiversity.

Suborder Pandeida Petersen, 1979
Family Bythotiaridae Maas, 1905
Genus *Heterotiara* Maas, 1905

Heterotiara ausgeoana sp. nov. (Fig. 2)

Material Examined

Holotype: Gravid female, BH 0.85 mm, BD 0.95 mm (H1311), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Diagnosis

Heterotiara with 4 short, stiff, thick tentacles; with gonad completely surrounding manubrium.

Description

Bell wider than tall, with thickened, rounded apex; with sparsely scattered nematocysts. Radial canals 4, simple, straight, moderately thick; ring canal

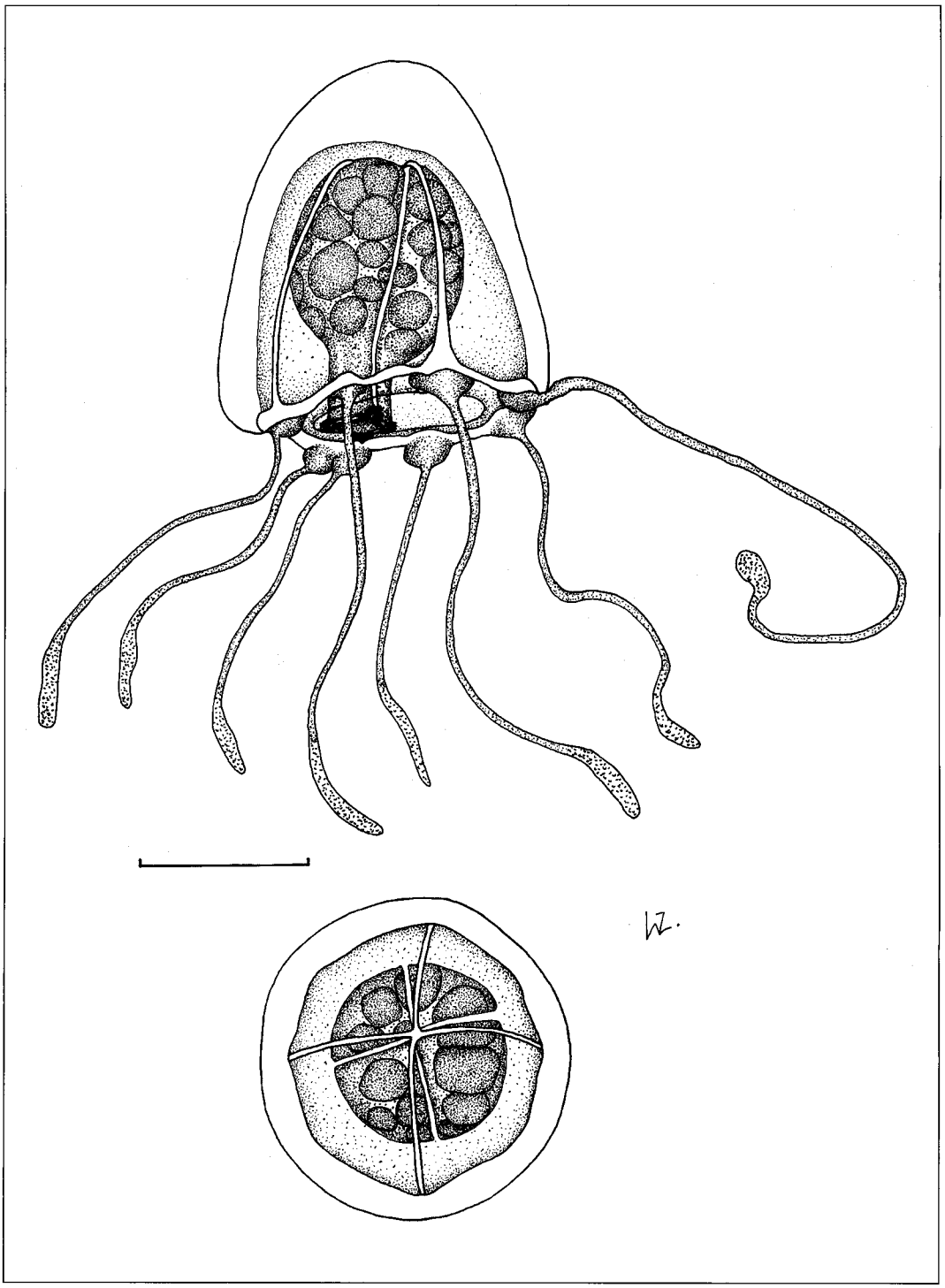

Fig. 1. *Hydractinia* sp., female (H1308), lateral & aboral view. Scale bar = 0.5 mm.

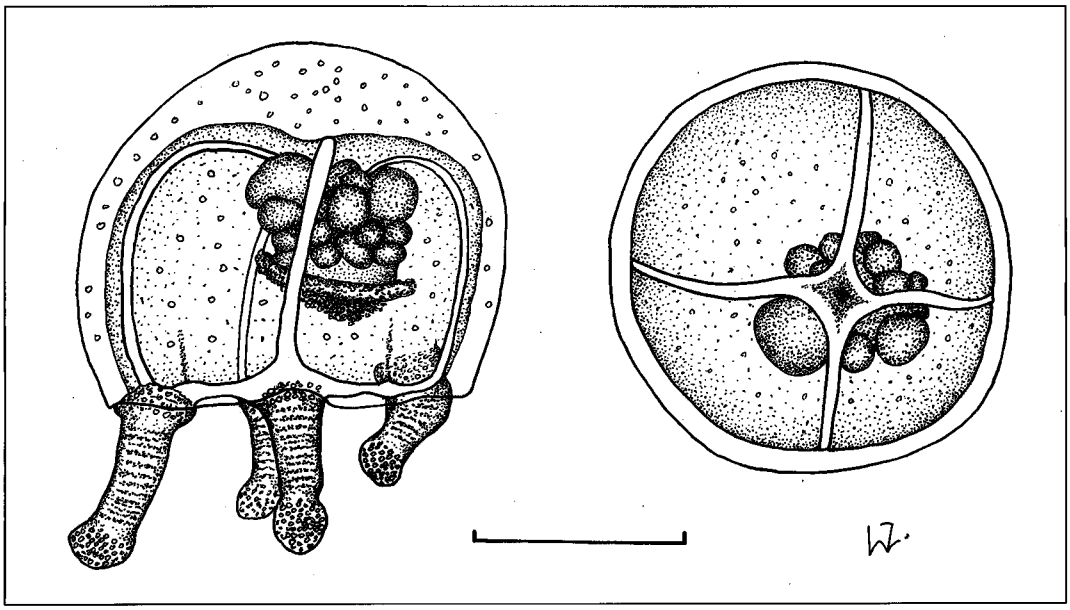

Fig. 2. *Heterotiara ausgeoana* sp. nov., holotype female, lateral & aboral view. Scale bar = 0.5 mm.

comparable. Tentacles 4, thick, short, straight, hollow; the distal 1/3 thickened and densely covered with nematocysts. Tentacles connected directly to bell with a thickened mass, but not tentacular bulbs in the true sense. Manubrium smooth, set upon a very shallow gelatinous peduncle, flask-shaped, round in cross section. Mouth small, simple and round. In life, the mouth reaches nearly to the bell margin; in the preserved specimen, it is considerably contracted. Gonad completely surrounding stomach on upper half of manubrium, crowded with eggs of many sizes. Ocelli lacking.

Etymology

Named to honour "Australian Geographic" magazine, a sponsor of the expedition.

Remarks

Heterotiara ausgeoana sp. nov. is immediately distinguished from its congeners in only having 4 tentacles, and in having the gonad completely surrounding the stomach, whereas the gonads of other two species are interradial and the tentacles more numerous. *Heterotiara anonyma* Maas, 1905, from the Malayan Archipelago, reaches about 22 mm and has 8-12 tentacles, and *H. minor* Vanhöffen, 1911, from Nias I. in the Indian Ocean, reaches 10 mm and has about 20 tentacles. Although *H. ausgeoana* is much smaller and has fewer tentacles, it is unlikely that this is an ontogenetic difference. The gonads appeared to be fully mature, and there was no sign of additional tentacles beginning to develop.

The species might also be superficially confused with *Bythotiara parasitica sensu* Schuchert (1996), which has bell nematocysts as a juvenile, but loses them as it grows. However, *H. ausgeoana* has bell nematocysts in its sexually mature state. Furthermore, the manubrium and mouth of *B. parasitica* are cruciform, and about 1/2 subumbrellar height, whereas in *H. ausgeoana* they are round in cross section without the slightest hint of corners, and they nearly reach the manubrium in life. Schuchert (1996) surmised that the mature *Bythotiara* medusae he found were probably *B. parasitica*, but pending full knowledge of the life cycle, he kept them separate. However, if they are indeed the adult form of the medusae he raised in captivity, then they are even more dissimilar to *H. ausgeoana*, with the gonads of his *Bythotiara* growing into the characteristic folds that separate the two genera, while the gonads of *H. ausgeoana* remain smooth. Furthermore, Schuchert's medusae are 3 – 4 mm BH at maturity, whereas *H. ausgeoana* is less than 1 mm.

We found a similar form at Ulverstone Wharf, northern Tasmania, on 4 February 2002 (H1116). While the Nuyts specimen appeared to be mature, the Tasmanian specimen was larger but appeared to have immature gonads and a remnant of the umbilical canal. The relationship between the two forms is not yet clear.

TABLE 1. *Comparison of the characters of the better-known* Hydractinia *medusae. The genus is badly in need of a revision, and many of the taxa are not known well enough to be reasonably compared. Literature used: All original descriptions, plus Mayer (1910), Kramp (1961b), and Edwards (1972).*

	Bell height	No. of tentacles	Peduncle	Apical shape	Oral lips	Gonads	Ocelli	Type locality
H. americana (Mayer, 1910)	3.5 mm	16-32, usually about 24	Lacking	Slightly thickened, evenly rounded	4, short, unbranched radially situated oral tentacles	4, interradial, lacking medusa buds	Not described	East coast USA, north of the Carolinas
H. apicata (Kramp, 1959)	1.2 mm	4, long, with large bulbs, densely covered with nematocysts in distal half	Distinct	Bluntly conical	4, small, simple, with small nematocyst cluster	4, interradial, completely covering entire length of stomach	Large, red, abaxial	Strait of Malacca
H. areolata (Alder, 1862)	4 mm	25-30, with large bulbs; 16 at liberation	Lacking	Thick, subglobose	4, long, narrow, bifurcate, with nematocyst knobs	Not described	Lacking, but with entodermal pigment	British coasts
H. australis (Schuchert, 1996)	1.6 mm	Typically 10-14 (8-16)	Slight or lacking	Thickened	Reduced	Interradial	Not noted	New Zealand
H. borealis (Mayer, 1900a)	3-5 mm	16-32, short, stiff	Described as lacking but illustrated as slight	Bluntly conical	Bifurcated once or twice, each branch with tuft of stalked nematocysts	Interradial, covering greater part of stomach	Lacking	Maine
H. carnea (Sars, 1846)	1 to 3.5 mm	4-8-16	Lacking	Not noted	Simple, short, with terminal nematocyst cluster	Interradial, lacking medusa buds	Lacking	Norway
H. dubia (Mayer, 1900b)	1.5 mm	8, stiff, club-shaped	Lacking	Not thickened	Short, simple	?A small swelling in the middle of each radial canal	Large, black, adaxial	Tortugas, Florida
Hydractinia sp.	ca. 1 mm	8, all alike, with thickened tip; bulbs small, triangular, with abaxial extension	Very shallow	Thickened, rounded	4, short, simple, slightly recurved, with terminal nematocyst cluster	4, interradial, occupying upper 4/5 of stomach, lacking medusa buds	Lacking	Great Australian Bight
H. meteoris (Thiel, 1938)	1 to 1.5 mm	8	Lacking	Thickened	12, simple, club-shaped	Medusa buds on stomach	Not determined	Cape Verde Islands
H. minima (Trinci, 1903)	< 1 mm	4	Well developed	Slightly thickened	4, simple, elongated, with terminal nematocyst knob	Interradial medusa buds	Lacking	Gulf of Naples
H. minuta (Mayer, 1900b)	0.3 mm	8, with well developed basal bulbs	Well developed; short, wide	Solid and bluntly pointed	4, simple, elongated, with terminal nematocyst knob	Interradial medusa buds	Lacking	Tortugas, Florida

TABLE 1. Cont.

	Bell height	No. of tentacles	Peduncle	Apical shape	Oral lips	Gonads	Ocelli	Type locality
H. ocellata (Agassiz & Mayer, 1902)	4 mm	50, short, stiff, with large basal bulbs	Well developed, broad; with highly vacuolated endodermal cells	Flat on top	4, divided 4 times, with nematocyst bristles on main trunk; each of the 16 tips with a knob of fusiform nematocysts	4, interradial	Prominent, adaxial	Paumotos, South Pacific
H. selena (Mills, 1976)	1 to 1.5 mm; max 1.8 mm	Ca. 8 at release; up to 14 at maturity	Lacking	Thickened	4, simple, short, each with a battery of pendant nematocysts	Lacking medusa buds; nearly mature at release	Not noted	North-western Florida
H. simplex (Kramp, 1928) ?= *H. minima*	0.75 mm	4 (2 larger, 2 smaller), with broad bulbs	Short	A little thickened	4, simple, with small, spherical nematocyst knobs	Interradial, surrounding stomach in its whole length; with medusa buds	Lacking	Japan
H. tenuis (Browne, 1902)	2 mm	8, of equal size	Well developed	Thickened, with slight constriction	4, short, with terminal nematocyst clusters	Gonads not developed, with interradial medusa buds	Lacking	Falkland Islands
H. tournieri (Picard & Rahm, 1954)	Not noted	4, with spirally arrngd nematocyst clusters and large tentacular bulbs	Lacking	Thick	4, sessile, with nematocyst cluster	Gonads not developed, with medusa buds on stomach	Carmine, adaxial	Ivory Coast, W. Africa

The genus *Heterotiara* has not been previously reported in Australian waters. However, Hamond (1974) reported the closely related *Calycopsis* from Bass Strait, and *Bythotiara* (as *Endocrypta*) was reported by Briggs and Gardiner (1931) from the Great Barrier Reef.

Family Pandeidae Haeckel, 1879
Genus *Amphinema* Haeckel, 1879
Amphinema cheshirei sp. nov. (Fig. 3)

Material Examined

Holotype: Female, BH 2.83 mm, BD 3.17 mm (H1095), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Paratypes: 30, 14, 10 & 11 specimens (H1134, H1335, H1133 & H1142), type locality, coll. LG, 22, 23, 24 & 25 Feb. 2002 respectively; 3 specimens (H1132), approximately 200 m west of North Point, St. Francis I. [32° 29′ 33.9″ S, 133° 16′ 59.6″ E], coll. LG & TL, 22 Feb. 2002.

Type Locality

Petrel Bay, St. Francis I., Nuyts Archipelago, S.A.

Diagnosis

Amphinema with long, narrow apical projection; with gonad in 8 smooth adradial cushions; with up to 5 tentaculae per quadrant; lacking apical chamber, mesenteries, and ocelli.

Description

Body bell-shaped with very long, narrow, solid, pointed, apical process, about one half BH. Bell with four shallow furrows more or less evenly spaced between radial canals, possibly an artifact of preservation. Exumbrella smooth, without apparent nematocysts. Peduncle lacking. Radial canals typically 4, narrow, straight or very rarely branched. Ring canal about half the width of the radial canals. Stomach strongly cruciform in cross section, flask-shaped when viewed laterally. Gonads 8, smooth, paired at the perradii, on the upper half of the stomach only. Mesenteries absent. Manubrium strongly cruciform; protruding below and half the width of the gonad. Mouth with 4 short, simple, recurved lips, studded with scattered nematocysts along the very edge; reaching the bell margin. Tentacles 2, opposite, more than 10x BH in length prior to chemical relaxation, but capable of being contracted to about 2x BH. Tentacle bulbs 2, conical, slender, laterally compressed but somewhat elongated vertically along the exumbrella, orientated straight outward in life, rather than downward when fixed; the 2 perradii without tentacles lack bulbs or any form of rudiments.

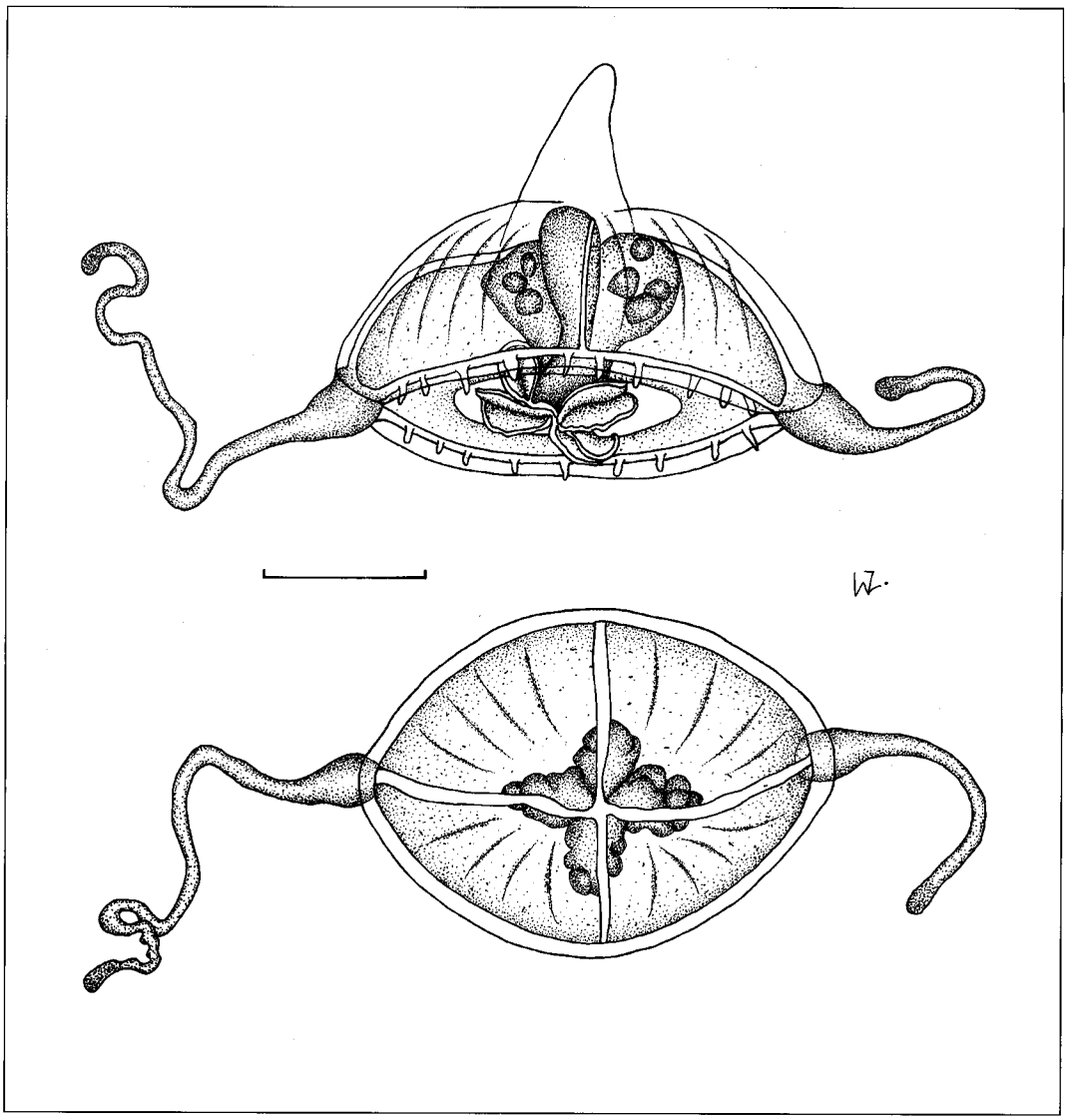

Fig. 3. *Amphinema chesheri* sp. nov., holotype female, lateral & aboral view. Scale bar = 1.0 mm.

Tentaculae short, narrow, up to about 20 total in the largest individuals, evenly spaced, not necessarily in correspondence with main radii. Velum wide or narrow; relatively sturdy. Statocysts and ocelli lacking. Colouration in life: tentacle bulbs deep orange-red internally, somewhat violet externally; gonad translucent whitish, greenish, or yellowish; manubrium and tentacles whitish; all other parts transparent and colourless.

Development

The youngest specimens have no trace of gonads, only a short apical process, and only 10 tentaculae.

Appearance

Immediately recognizable in a plankton sample by two dark pink spots, each at the base of a whitish tentacle, and a whitish, greenish, or yellowish stomach between; upon closer inspection, the long, narrow apical cone can be discerned. This species is relatively inactive, likely to be found relaxing or pulsating along the bottom of the sorting bowl, only occasionally at the surface. See comparison with *Zanclea sardii* sp. nov.

TABLE 2. *Comparison of the characters of Amphinema medusae. We were not able to obtain the original description of* A. tsingtauensis *Kao* et al., *1958, which was thought by Bouillon and Boero (2000) to be identical with* A. rugosum. *Literature used: All original descriptions, plus Kramp (1961b).*

	Bell height	Apical projection	Apical chamber	Tentacles	Marginal wart or tentaculae #	Mesenteries	Gonad position	Ocelli	Colour	Other characters	Locality
A. australis (Mayer, 1900b)	2.5 mm	Prominent	Absent	2, with long, conical bulbs	2 rudimentary perradial bulbs	Absent	Corrugated on sides of stomach [adradial in figure]	8, 4 abaxial on tentacle bulbs, 4 midway on margin	Manubrium and tentacle bulbs greenish yellow, ocelli orange	Radial canals smooth	Florida
A. cheshirei sp. nov.	2-3 mm, incl. apical projection	Very long, narrow	Absent	2, with slender, conical, laterally compressed bulbs	Tentaculae: 2 perradial or not, up to 5 per quadrant	Absent	8, smooth adradial cushions on upper half of stomach	Absent	Gonads and manubrium whitish to faintly green; tentacle bulbs deep orange-red internally, red-violet externally	Tentacle bulbs compressed laterally, elongated vertically along the exumbrella	Great Australian Bight
A. dinema (Peron & Lesueur, 1810)	6 mm	Large, conical	Absent	2, with large, elongated conical bulbs	14-24 small marginal warts	Absent	Simple, adradial	Absent	Umbrella rose, stomach and tentacles green		Coast of La Manche, France
A. krampi Russell, 1956	6 mm	Absent	Absent	2, with swollen elongated bulbs	Tentaculae: 8, irregularly placed	Absent	4, smooth interradial cushions	Absent	Stomach rich reddish brown, core of brownish pigment in ring canal and tentacle bulbs	Cellular connecting strands between RCs and exumbrella	English Channel
A. modernisme Bouillon *et al.* 2000	10 mm, including apical projection	Conical, without constriction	Present, egg-shaped	2, with conical elongated basal bulbs	Tentaculae: 2 perradial, 4 interradial	Present	Perradial, smooth	Absent	Endoderm of manubrium dark brown	With cellular strands as above	S. Shetland Islands
A. physophorum (Uchida, 1927)	2 mm, including apical projection	Small	Absent	2, with large bulbs and nematocyst rings	Tentaculae: 14 (2 perradial, 4 interradial, 8 adradial)	Not described; presumed absent	8, paired interradially, folded several times	Not mentioned; presumed absent	Radial canals brown, tentacle bulbs and lips yellowish brown, manubrium greyish	Accessory bulbs present on inside of tentacle bulbs; canals broad and jagged	Japan
A. platyhedos Arai & Brinckmann -Voss, 1983	2.5 mm + 2mm apical projection	Prominent; pointed and delicate	Absent	2, with large, broad heart-shaped bulbs	Tentaculae: 26, up to 1/2 subumbrellar height	1/3 length of radial canals	Irregularly-shaped horseshoe, interradial	Not observed	Not reported	Lacking abaxial spurs on tentacle bulbs	British Columbia, Canada
A. rubrum (Kramp, 1957)	7 mm, including apical projection	Slender and pointed	Present, broad, conical	2, with very large conical basal bulbs	Tentaculae: 2 perradial, 4 interradial	Very long	Interradial, smooth	Not seen	Stomach deep reddish brown	Canals narrow, smooth	South Orkney Islands

	Bell height	Apical projection	Apical chamber	Tentacles	Marginal wart or tentaculae #	Mesenteries	Gonad position	Ocelli	Colour	Other characters	Locality
A. rugosum (Mayer, 1900a)	5 mm	Variable: long & slender to short & blunt	Absent	2, with abaxial spurs on bulbs	Tentaculae: 14	Absent	Adradial, series of ridges in upper portion of manubrium	Absent	Bell transparent, entoderm of tentacle bulbs and manubrium brick red; RCs faint red in some	Proboscis flask-shaped; ring canal jagged	Newport, RI to Charleston SC; variety with coal black tentacle bulbs and proboscis at Tortugas, FL
A. shantungensis Chow & Huang, 1958	5-10 mm	Elongated-conical to hemispherical	Absent	2, with large, elongated, conical	14-24 small marginal warts; basal bulbs	Present as illustrated no tentaculae	Adradial, large, with several oblique folds	Absent	Preserved: Manubrium and gonads orange, tentacles and bulbs milky-yellow, warts reddish-orange	Canals smooth	Chefoo, China [said by Bouillon & Boero, 2000, to be = *A. rugosum*]
A. turrida (Mayer, 1900b)	4 mm	Prominent, hollow, cone-shaped	Hollow	2, with elongated basal bulbs	Tentaculae: 14	Not mentioned, but the gonads are actually on the canals	On proximal half of radial canals, with several folds	16, abaxial, one at the base of each tentacle	Entoderm of proboscis and tentacles delicate green; gonads and ring canal pink	Lips crenulated	Tortugas, Florida

Etymology

Named to honour Professor Anthony Cheshire, Chief Scientist, South Australian Research and Development Institute (SARDI), Aquatic Science Division.

Distribution

Currently known only from St. Francis I., Nuyts Archipelago, S.A.

Remarks

Amphinema cheshirei is easily distinguished from all other species of *Amphinema* by its unique coloration, and in structural characters as outlined in Table 2. This is the first report of *Amphinema* from South Australian waters.

Family Protiaridae Haeckel, 1879

Genus *Halitiara* Fewkes, 1882

Halitiara thierryi sp. nov. (Fig. 4)

Material Examined

Holotype: Male, BH 1.54 mm, BD 1.32 mm (H1147), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Paratypes: 31, 17, 4 & 30 specimens (H1138, H1392, H1140 & H1148), type locality, coll. LG, 22, 23, 24 & 25 Feb. 2002 respectively; 7 specimens (H1139), approximately 200 m west of North Point, St. Francis I., coll. LG & TL, 22 Feb. 2002; numerous specimens (H1217, H1323 & H1393), Brennan's Wharf, Port Lincoln, coll. LG & TL, 15 & 16 Feb. 2002; 5 specimens (XH 0117), Port Lincoln, from salmon farms, coll. LG, 21 Feb. 1999; one specimen (H1234), Whyalla marina, coll. LG & TL, 14 Feb. 2002; numerous specimens (H1297), Murat Bay jetty, Ceduna, coll. LG & WZ, 15 Dec. 2000; 5 specimens (H1227), Streaky Bay jetty, coll. LG & TL, 19 Feb. 2002.

Additional Material

17 specimens, BH 0.5-1.0 mm (H1088), St. Helens, Tas., coll. LG & WZ, 24 Jan. 2002.

Etymology

Named to honour Thierry Laperousaz, the collection manager at the South Australian Museum.

Type Locality

Petrel Bay, St. Francis I., Nuyts Archipelago, S.A.

Diagnosis

Halitiara with solid, pyramidal apical projection; with 3-6 marginal cirri per quadrant; with small gonads confined to the stomach wall, lacking mesenteries; with conspicuously pink colouration.

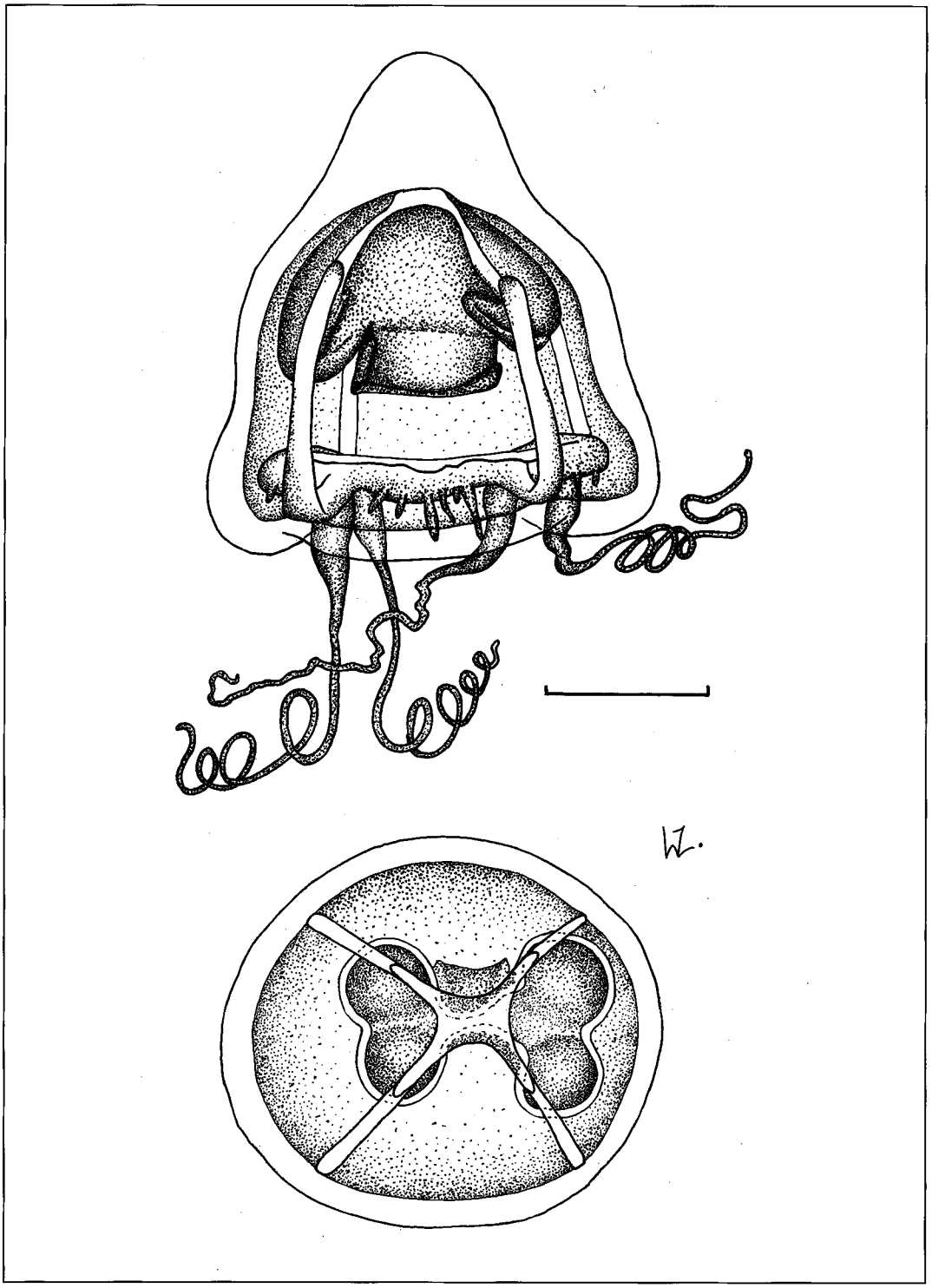

Fig. 4. *Halitiara thierryi* sp. nov., holotype male, lateral & aboral view. Scale bar = 0.5 mm.

Description of Holotype

Body bell-shaped, globular with a rounded conical apex. Exumbrellar surface covered with extremely fine gelatinous warts. Radial canals 4, straight, smooth-edged, relatively wide. Ring canal somewhat wider than radial canals. Stomach large, globular to wine-glass-shaped in lateral view, more or less completely filling top half of bell cavity; cruciform in cross section at base, extending out along radial canals for a short distance, rounded through remaining length; lacking a peduncle or an apical chamber. Gonads 4, smooth, large, occupying the whole stomach wall between the radial canals, lacking mesenteries. Mouth simple, quadrate with rounded corners but without proper lips; the margin of the lips is simple, lacking a thickened edge or other decoration; extending to about $^1/_2$-$^3/_4$ the length of the bell cavity in life, shorter preserved. Tentacles all coiled, of two types: 4 larger, perradial tentacles with long, evenly tapered basal bulbs; about 6 smaller, cirrus-like tentacles between adjacent main tentacles, without distinct basal bulbs. Velum narrow. Lacking statocysts, ocelli, and excretory papillae. Colouration in life: bell colourless and transparent; tentacles, bulbs, and gonads brilliantly pink.

In the preserved specimen, there is a conspicuous dip in the radial canals midway up the gonad, with a corresponding fold in the gonads at this point. This appears to be an artifact of preservation, as it was not observed in photographs of living animals.

Variation from Holotype

Seventeen specimens from St Helens, northern Tasmania, resemble the South Australian material in all respects except that the apex of the stomach protrudes considerably into the gelatinous apical mass. Unfortunately, the specimens were not examined live, and so the exact nature and significance of this difference cannot be ascertained.

Behaviour

This species is immediately identifiable in a plankton tow by its erratic swimming behaviour. It pulsates rapidly, rocking back and forth with each stroke, as it makes its way to and along the air-water interface. After bursts of swimming, it sinks to the bottom of the jar, where it alternately flattens then regains its normal shape after several minutes.

Remarks

Halitiara thierryi differs in only a few respects from its congeners (Table 3), but these differences seem worthy of recognition as a species. In overall body shape, it is most similar to *H. formosa* Fewkes, 1882, with *H. inflexa* Bouillon, 1980, and *H. rigida* Bouillon, 1980, having interradially and perradially bulging gonads, respectively. Furthermore, the latter two species, both from Papua New Guinea, have mesenteries, whereas *H. formosa* and *H. thierryi* do not. *Halitiara thierryi* differs from *H. formosa* in tentacle number, body size, colour, and habitat. In *H. thierryi*, the number of smaller tentacles appears to be about half the number of those found in *H. formosa*, and *H. thierryi* never reaches more than about 1mm, whereas *H. formosa* is typically about 3 mm. Furthermore, the colouration of *H. thierryi* differs considerably from the type population of *H. formosa* from southeastern USA. Mayer (1910) noted that the manubrium and tentacle bulbs in his specimens were green in the females, brown in the males; in contrast, those of both sexes of *H. thierryi* are brilliantly pink. Finally, *H. thierryi* is endemic to the cooler waters of southern Australia, while *H. formosa* is common in the warmer waters of Florida.

Halitiara formosa has been reported from many localities throughout the warmer parts of the world; however, we doubt that all are identical. Uchida (1927) reported a small, pink *Halitiara* from Misaki, Japan, which he presumed to be a colour variety of *H. formosa*. It seems logical that the Japanese form might be more closely related to *H. thierryi*, based on its colour and geographical proximity, but Uchida's descriptions were inadequate for proper comparison.

Distribution

Apart from the type locality, this species was found in abundance in the waters off Port Lincoln, S.A., in vertical hauls from 10 m to the surface, at the jetties at Ceduna, Streaky Bay and in the quiet surface waters of the Whyalla marina. Material from St Helens, Tasmania, is also referred to this species, pending a more detailed examination of the specimens. This is the first record of the genus in Australian waters.

Order Capitata Kühn, 1913
Suborder Tubulariida Petersen, 1979
Family Tubulariidae Fleming, 1828
Genus *Ectopleura* L. Agassiz, 1862
***Ectopleura* sp. (Fig. 5)**

Material Examined

Male, BH 0.74 mm, BD 0.69 mm (H1309), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002; two specimens, BH about 0.5 mm (H1394), same locality, coll. LG, 23 Feb. 2002.

Description

Body barrel-shaped, wider in the middle than at either the oral or aboral end, lacking aboral projection. Apical canal funnel-shaped, conspicuously expanded distally. Exumbrella with 8 longitudinal nematocyst tracks, 2 emitting laterally

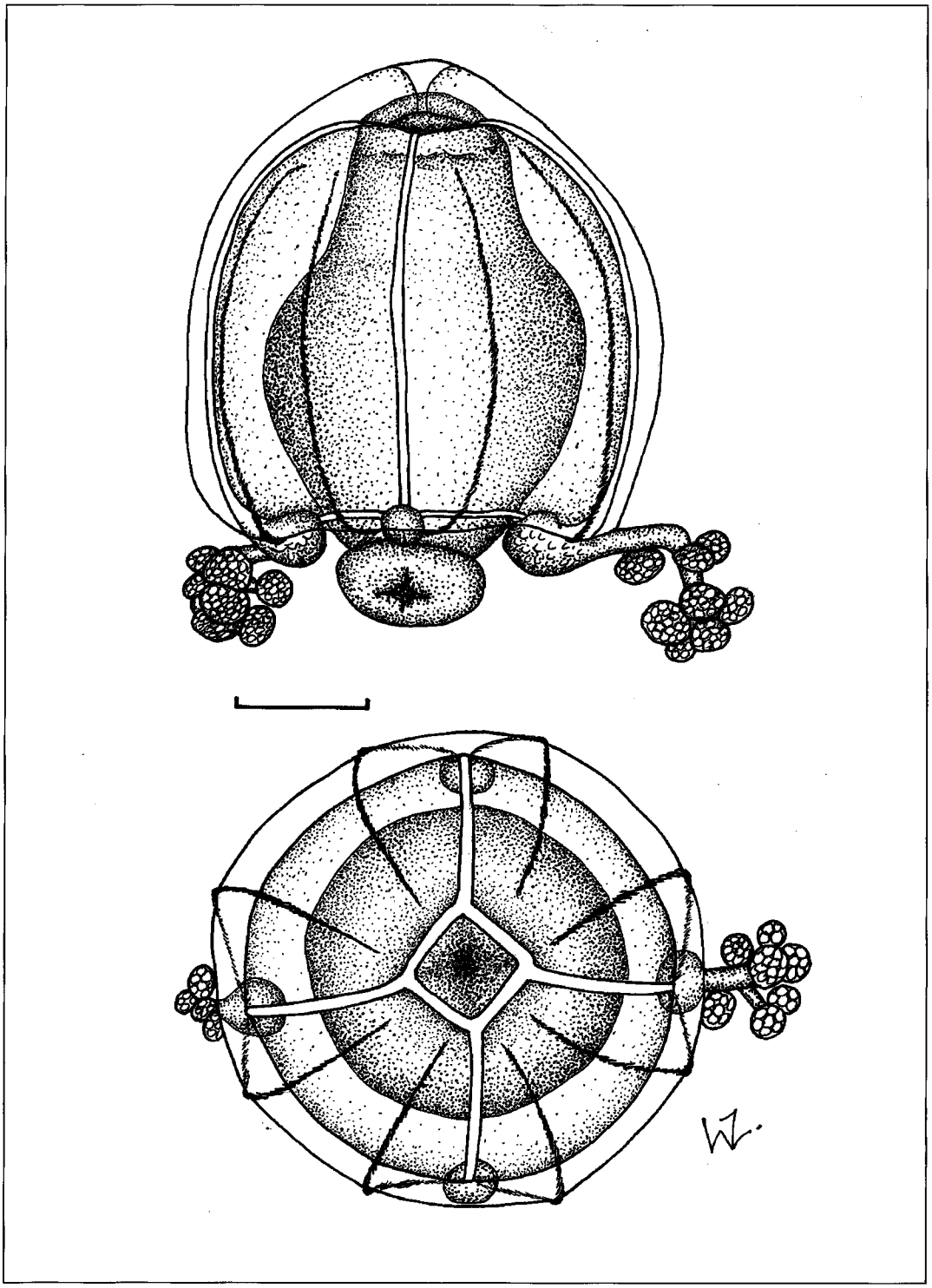

Fig. 5. *Ectopleura* sp., male (H1309), lateral & aboral view. Scale bar = 0.2 mm.

TABLE 3. *Comparison of characters of species of* Halitiara. *Literature used: Fewkes (1882); Mayer (1910); Kramp (1961b); Bouillon (1980); Bouillon & Boero (2000).*

	H. formosa Fewkes, 1882	*H. inflexa* Bouillon, 1980	*H. rigida* Bouillon, 1980	*H. thierryi* sp. nov.
Bell height	3 mm	3 mm	3 mm	1 mm
Bell shape	Pear-shaped with solid apical projection	Egg-shaped, without apical projection	Tall and narrow, with short, spike-like apical projection	Pear-shaped with solid, pyramidal apical projection
# marginal cirri per quadrant	6-9	7-10	Typically 4	3-6
Mesenteries	Lacking	Present	Present	Lacking
Manubrium length	1/2 bell cavity	3/4 bell cavity	3/4 bell cavity, extending along radial canals	Approx. 1/2 bell cavity
Stomach and manubrium	Pyriform	Quadrangular	Small, cruciform, with apical diverticulum	Wine-glass-shaped
Gonad form	Inconspicuous	Voluminous, smooth, bulging interradially	Large, smooth, extending perradially along the canals	Small, smooth, confined to manubrium
Colour	Endoderm of manubrium and tentacle bulbs green in females, light brown in males	Colour is greenish-sallow	Gonads and apical expansion green; tentacle bulbs tinted yellow	Soft pink along the mainland, deep pink in the Archipelago
Type locality	Tortugas, Florida	Papua New Guinea	Papua New Guinea	Great Australian Bight

from each of the 4 tentacle bulbs, nearly 180° apart, then extending vertically up the body wall, nearly reaching the apex. Stomach massive, occupying most of the subumbrellar cavity; circular in cross section, lacking a peduncle but with a slight apical chamber filled with sparkly granules. The apical chamber joins with the funnel of the exumbrellar apical cone, but it is unclear whether there is an actual opening. Gonad covering the entire central 3/4 of the stomach wall, leaving the proximal end and the mouth free; unbroken around the circumference. Mouth short, circular, simple, nearly reaching the velar margin in life. Tentacles 2, opposite, coiled, with approximately 10-12 nematocyst knobs sequentially along the abaxial surface. Tentacle bulbs 4; more or less circular in outline, but smooth against the exumbrellar surface, with a slightly raised nematocyst pad beneath the velar margin. Radial canals 4, very fine, straight; ring canal about the same width as the radials, but more conspicuous. Velum moderately narrow. Statocyst and ocelli lacking. Colouration in life: subumbrellar ectoderm is transparent brightly green; the gonad is translucent whitish; tentacles and tentacle bulbs are opaque off-white.

Appearance

Difficult to see in a plankton sample without the aid of a dissecting scope. Small and inactive, resting on the bottom.

Remarks

According to Schuchert (1996), identification of *Ectopleura* species relies on the nematocysts and the morphology of the polyp; therefore, we are reluctant to name this form, even though we are inclined to conclude that it is distinct from other *Ectopleura* medusae. A comparison of the characters of named *Ectopleura* medusae is listed in Table 4. A similar form is common on the mainland, differing from the Nuyts form in having 4 tentacles, each with about 15 nematocyst knobs, and having a golden subumbrellar ectoderm rather than green. A third form is common in Tasmania, having 4 tentacles, a narrower separation of the nematocyst tracks (only about 90°), and having dimorphic expression of the coloured subumbrellar ectoderm, with about 2/3 of the specimens having green and the rest having red.

Suborder Zancleida Russell, 1953
Family Zancleidae Russell, 1953
Genus *Zanclea* Gegenbaur, 1857
Zanclea sardii sp. nov. (Fig. 6)

Material Examined

Holotype: male, BH 3.45 mm, BD 2.60 mm (H1094), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Paratypes: 8, 6, 5 & 30 specimens (H1089, H1395, H1137 & H1141), type locality, coll. LG, 22-25 Feb. 2002 respectively; 4 specimens (H1136), about 200m west of North Point, St. Francis I., coll. LG & TL, 22 Feb. 2002.

Additional material

2 specimens, BH ca. 0.5 mm (H1086), Port Sorell, Tas., coll. LG & WZ, 24 Jan. 2002; 1 specimen, BH

TABLE 4. *Comparison of the characters of the species of* Ectopleura *medusae, except* E. latitaeniata *Xu & Zhang, 1978, which could not be obtained. Note that many nominal species are not included due to lack of knowledge of the medusa (see Bouillon & Boero, 2000, p. 148). Literature used: all original descriptions, plus Russell (1953).*

	Umbrella shape	Bell height	Manubrium length	Tentacle number	Tentacle nematocyst arrangement	Exumbrellar nematocyst tracks	Colour & Distribution
E. dumortieri (van Beneden, 1844)	Nearly spherical	1.75 mm	Beyond velum, very large, tapered	4, perradial	Abaxial clusters	8, extending to summit of body	Tentacle bulbs brownish or yellow flecked with red, mouth orange or red, with band of fine red spots around center of stomach, and brownish or yellow circle of pigment around the base of stomach
E. guangdongensis Xu *et al.*, 1991	Pear-shaped, with solid, bluntly rounded apical projection	0.8 mm	About half as long as bell height	4, perradial	7-9 abaxial warts, without terminal knob	8, from tentacle bulbs to apex	Colour not described; China
E. minerva Mayer, 1900b	Pear-shaped, with well developed apical projection	2.5 mm	2/3 BH, pear-shaped, with apical canal	2, plus 2 other smaller bulbs	6-9 wart-like swellings	8, from tentacle bulbs to apex	Endoderm of mouth and tentacles delicate purple, subumbrellar surface green; many yellow spots on radial canals & tentacle bulbs; Florida and Bermuda
E. octagona Thiel, 1938	Octagonal	1 to 1.5 mm	Actual length not given, but with medusa buds	2, without rudiments	Not described	8, nearly reaching apex	Colour not described; Fernando Po (Equitorial Guinea)
E. sacculifera Kramp 1957	Conical, tall and narrow	3 mm	1/2 subumbrellar cavity, no peduncle; with 4 large interradial gonadal sacs	2, with large conical basal bulbs; 2 rudimentary bulbs	Moniliform	8, broad below, tapering upward, on ridges, separated by well-marked perradial and interradial grooves	Colour not described; near the coast of Ecuador
E. wrighti Petersen, 1979	Nearly hemispherical	Not described	Nearly as long as subumbrellar cavity	2	with terminal knob, 1-2 distal knobs encircling tentacle, and 1 proximal abaxial cluster	4 meridional pairs	Type loc: Devon, England; Mediterranean
E. xiamenensis Zhang & Lin, 1984	Nearly spherical or dome-shaped, without apical canal or projection	0.5-0.75 mm	2/3 bell cavity to protruding	2 well developed opposite tentacles, and 2 rudimentary bulbs	6-12 wart-like nematocyst swellings on abaxial side	8, from tentacles to apex	Colour not specified; Xiamen Harbour, China
Ectopleura sp.	Barrel-shaped, with aboral, funnel-shaped canal	About 1 mm	Protruding below margin	2, well developed opposite tentacles, plus two rudimentary bulbs	10-12 abaxial clusters	8, not reaching apex; 180° apart at tentacle bulbs	Subumbrellar ectoderm bright green; Nuyts Archipelago

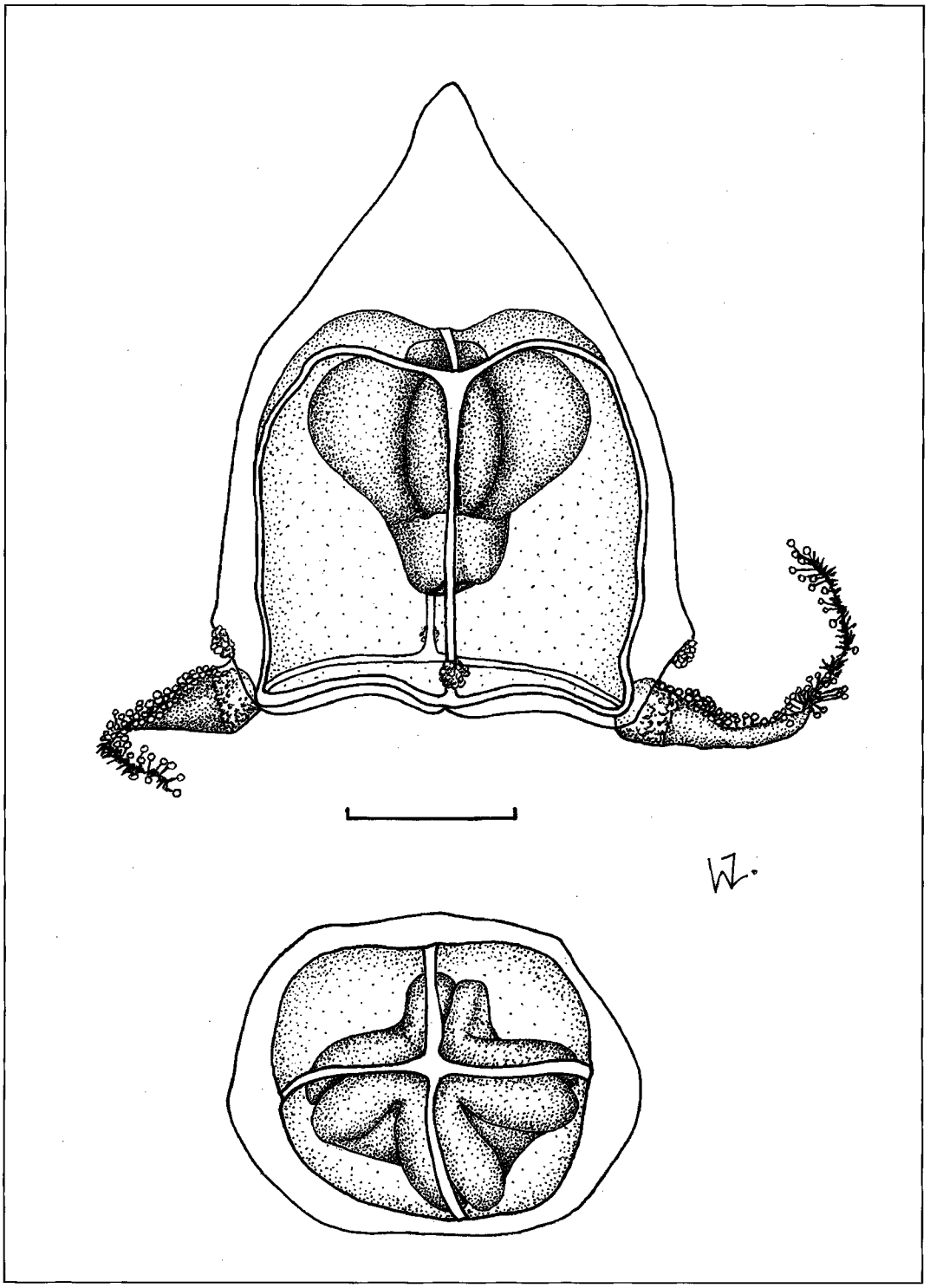

Fig. 6. *Zanclea sardii* sp. nov., holotype male, lateral & aboral view. Scale bar = 1.0 mm.

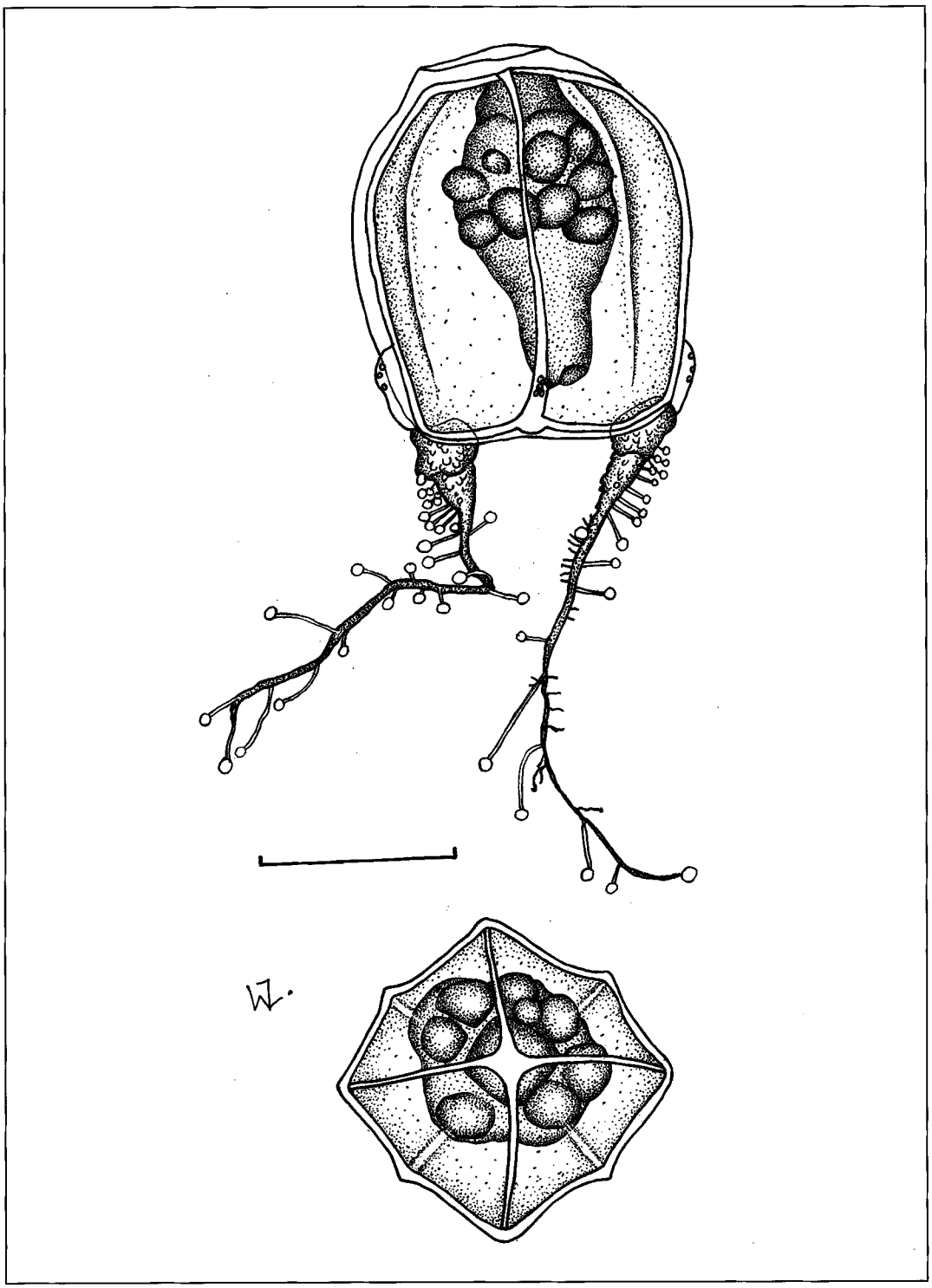

Fig. 7. *Zanclea ngeriana* sp. nov., holotype female, lateral & aboral view. Scale bar = 0.5 mm.

1.0 mm (H1087), Stanley, Tas., coll. LG & WZ, 3 Feb. 2002.

Type Locality

Petrel Bay, St. Francis I., Nuyts Archipelago, SA.

Diagnosis

Zanclea with a solid, pyramidal apical projection; with about 100 cnidophores per tentacle; with gonads divided at the perradii and interradii; lacking mesenteries and a peduncle.

Description

Body bell-shaped, with a prominent, pyramidal, solid apical process, about $^1/_2$ the total height of the animal. Exumbrella with 4 perradial cnidocyst pouches, the two above the tentacles about twice as large as the other two, on raised gelatinous processes a short distance above the tentacle bulbs and rudiments. Tentacles 2, each with about 100 cnidophores on the abaxial side; to about 2 x BH relaxed in life, about 0.5x BH when swimming. Tentacle bulbs 4, 2 fully developed, 2 rudimentary; the two with tentacles conical, about $^1/_2$ the height of the body, excluding apical process. Stomach mounted upon a very shallow gelatinous peduncle; cruciform in cross section, broadly flask-shaped in lateral view. Gonads 8, divided on the perradii and interradii; on the upper $^2/_3$ of the stomach wall. Manubrium protruding below gonad, narrow, round in cross section, with simple, round mouth reaching beyond velum. Velum narrow and flimsy. Radial canals narrow; ring canal same width as radial canals. Mesenteries absent. Statocysts and ocelli absent.

Colouration in life: the two well developed tentacle bulbs are deep purple proximally grading to magenta pink and orange distally; the two rudimentary bulbs are purple; tentacles faintly red, with whitish cnidophores; gonad opaque or translucent whitish with a greenish tint throughout and a hint of purple where it joins with the peduncle; manubrium and mouth translucent whitish; in some specimens the subumbrellar epithelium has a faintly greenish tint, while in others it is completely colourless.

Appearance

Very similar to *Amphinema cheshirei*, except *Z. sardii* sometimes has relatively more purple and magenta in the tentacle bulbs, whereas the bulbs of *A. cheshirei* tend to be slightly more orange. Also, the tentacles of *Z. sardii* are typically held tightly contracted while swimming, whereas those of *A. cheshirei* often stream tens of BHs in length.

Etymology

Named in recognition of the South Australian Research and Development Institute (SARDI).

Distribution

Thus far only known from the northern bays of St. Francis Island; younger forms, which may be conspecific, were found in northern Tasmania.

Behaviour in Life

While swimming, the medusa contracts the tentacles so that the cnidophores are clustered on the very distal portion of the abaxial surface. While at rest, the medusa occasionally relaxes the tentacles to about 2 x BH. More often, it sits on the bottom of the Petri dish and alternately swings the tentacle bulbs up laterally across the velar opening, then relaxes them out again. It is an active species, swimming at the surface and resting at the bottom.

Remarks

The remarks for all the species of *Zanclea* will be treated together at the end of this section.

Zanclea ngeriana sp. nov. (Fig. 7)

Material examined

Holotype: gravid female, BH about 1.0 mm (H1143), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Paratypes: 4 specimens (H1144), same data as holotype.

Type Locality

Petrel Bay, St. Francis I., Nuyts Archipelago, S.A.

Diagnosis

Zanclea with a smooth, undivided gonad, surrounding the upper half of the stomach; with a moderate gelatinous peduncle; with about 20 cnidophores per tentacle; lacking an apical projection.

Description of the holotype

Body bell-shaped, thickened apically, with a slight depression instead of an apical projection. Exumbrella when viewed from above is box-shaped with rounded corners, and with 4 interradial keels along the upper $^3/_4$ of the body. Cnidocyst pouches 4, upon raised gelatinous processes; unequal in size, the two above each tentacle are about twice the size of the two on the other perradii. Radial canals 4, narrow, straight; ring canal the same width as radial canals. Stomach flask-shaped, round in cross section, upon a shallow gelatinous peduncle; lacking mesenteries. Gonad completely surrounding stomach in upper half; the eggs are subspherical, arranged in haphazard vertical rows of 2-3, embedded in the gonad wall. Mouth round, simple, at the end of a

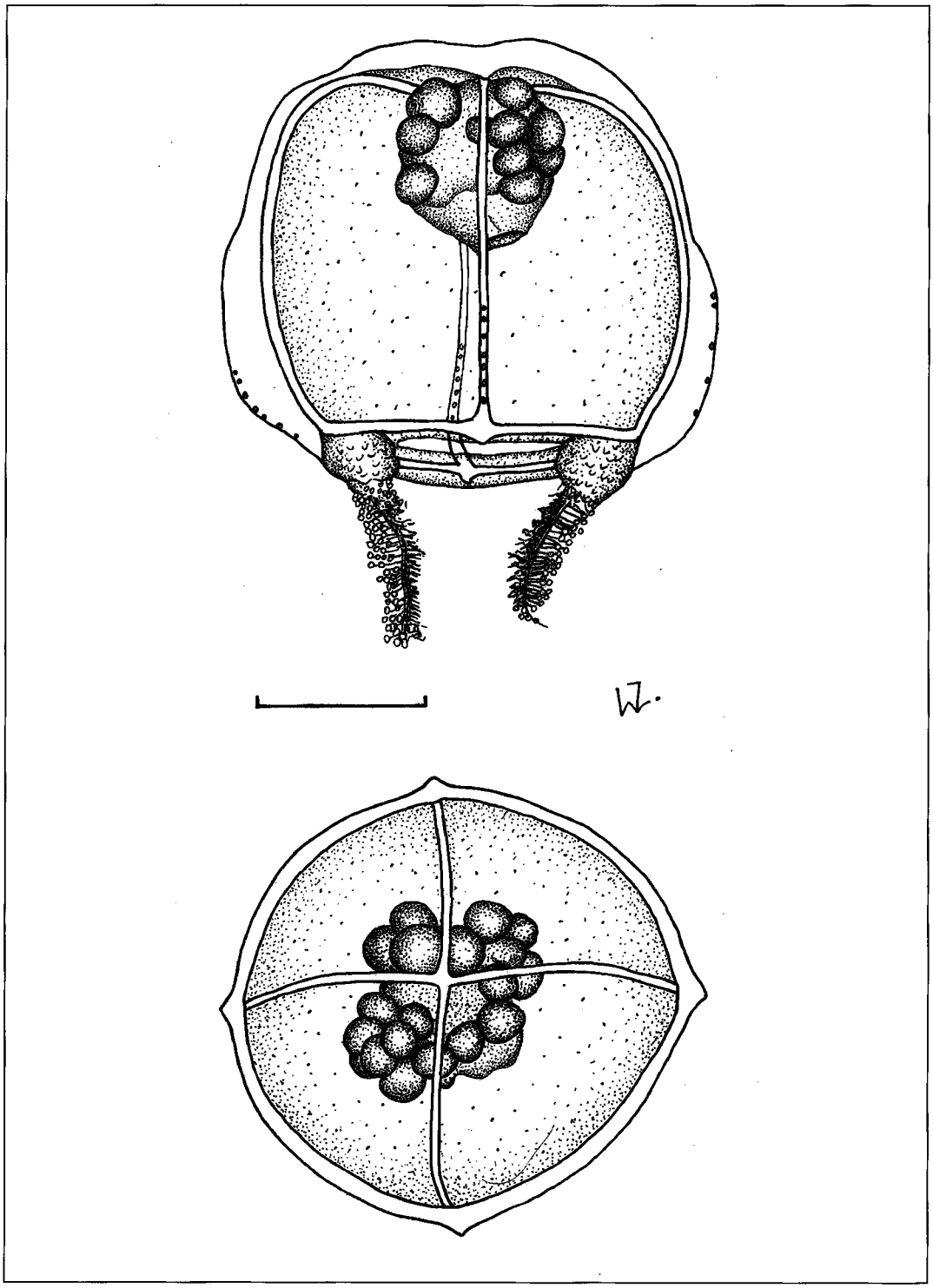

Fig. 8. *Zanclea carinata* sp. nov., holotype female, lateral & aboral view. Scale bar = 0.5 mm.

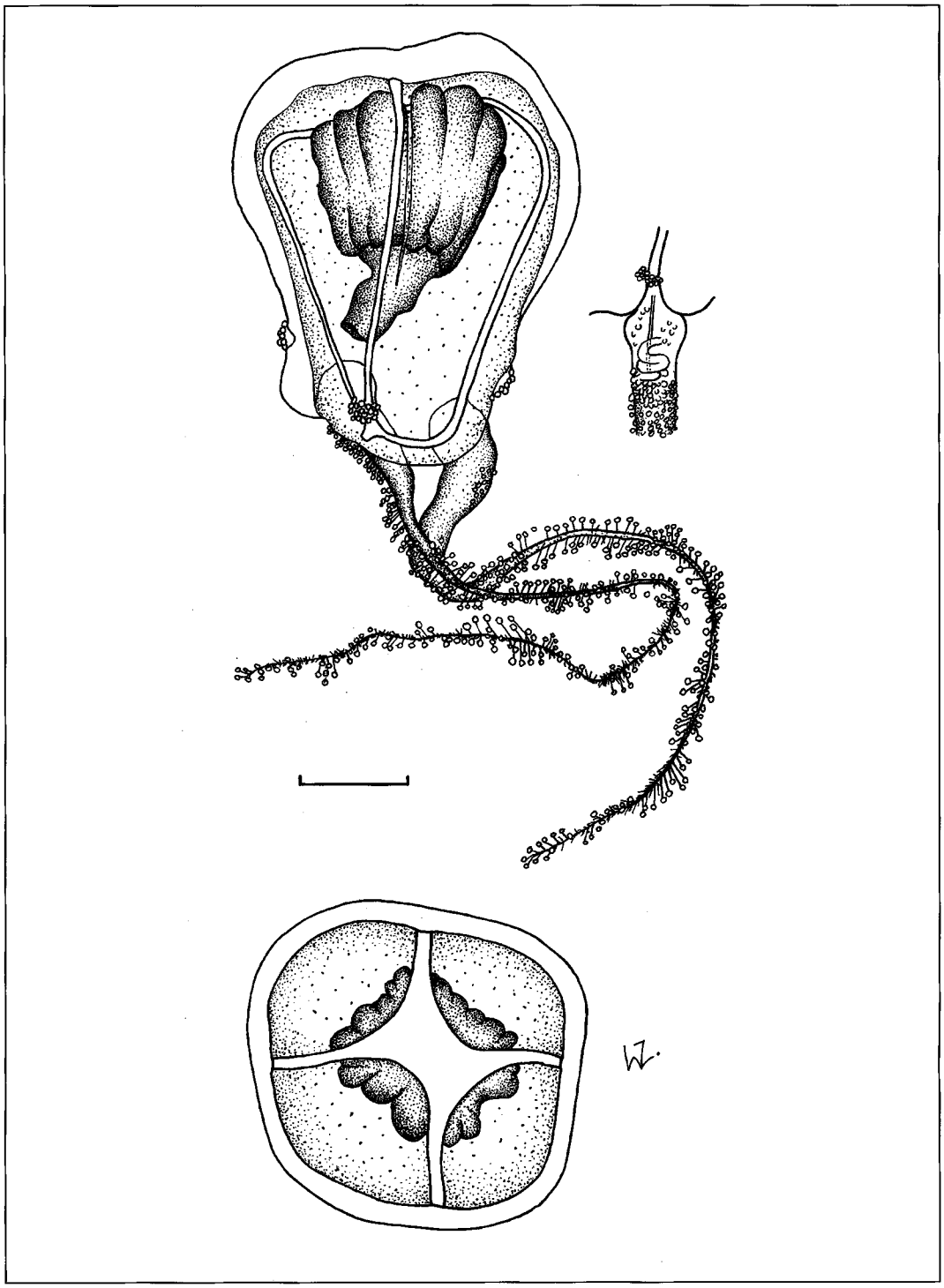

Fig. 9. *Zanclea baudini* sp. nov., holotype male (?); A & C, lateral & aboral view; B, base of one of the tentacles. Scale bar = 0.5 mm.

relatively long proboscis, reaching slightly below the velar opening in life, not quite reaching it when preserved. Tentacles 2, about half BH when relaxed naturally. Cnidophores about 20 per tentacle, on the abaxial side; in lateral rows of 3 across proximally, grading to 2 across midway, and finally arranged singly distally. The shafts of the tentacles and the cnidophores are minutely ringed, giving a rough appearance. Tentacle bulbs short, tapered; on the two perradii lacking tentacles the bulbs are completely reduced to only a thickening of the ring canal. Velum narrow. Statocysts and ocelli absent.

Colouration in life: the radial canals, ring canal, and tentacle bulbs are reflective opaque white; the stomach and tentacles are whitish but less bright; the bell jelly is transparent and colourless.

Variation from the Holotype

Two of the paratypes (1 male, 1 female) have a very shallow, rounded apical projection, rather than a slight depression.

Appearance

Extremely difficult to identify with the naked eye, very small and non-descript. Inactive, stays on the bottom of the sorting bowl.

Etymology

The specific epithet, "*ngeriana*" is derived from the RV *Ngerin*, named for the aboriginal word meaning "good fishing."

Zanclea carinata sp. nov. (Fig. 8)

Material Examined

Holotype: gravid female, BH 1.21 mm, BD 1.38 mm (H1149), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Type Locality

Petrel Bay, St. Francis I., Nuyts Archipelago, SA.

Diagnosis

Zanclea with about 50 cnidophores per tentacle; with a pronounced keel on each of the 4 main radii, about half the height of the bell; with a narrow track of nematocysts running the entire length of the 4 keels; lacking an apical projection and peduncle.

Description

Body nearly spherical, with 4 relatively large perradial paravanes on the lower half of the bell; apex slightly concave, lacking apical mass. Exumbrella devoid of nematocysts except for a narrow track running along the entire length of the crest of each paravane. Stomach short, broad, flask-shaped, round in cross section; on a very short peduncle; lacking mesenteries. Gonads 4, each a globular mass projecting outward at the interradii midway down the stomach wall. Mouth round, simple, reaching a little less than halfway toward the velar margin. Tentacles 2, each with about 50 abaxial cnidophores and about 20 adaxial narrow papillae; about half BH in length when preserved. Tentacle bulbs 4, of two sizes; the two beneath the tentacles are small and globular; on the two perradii lacking tentacles, the bulbs are greatly reduced, about $^{1}/_{10}$ the size of the normal bulbs. Velum moderately narrow, thin but rigid. Statocysts lacking. Ocelli lacking. Radial canals 4, prominent but narrow. Ring canal about the same width as the radial canals.

Colouration in life: stomach, gonads, radial canals, tentacles and bulbs white; the remainder of the body colourless and transparent.

Appearance

Unlikely to be noticed with the unaided eye.

Etymology

The specific name is derived from the Latin for "keeled" referring to the perradial paravanes that characterise this species.

Zanclea baudini sp. nov. (Fig. 9)

Material Examined

Holotype: male (?), BH 1.81 mm, BD 1.62 mm (H1150), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Type locality

Petrel Bay, St. Francis I., Nuyts Archipelago, S.A.

Diagnosis

Zanclea with a tall body, with a well developed apophysis on each of the 4 perradii, facing downward; with well over 100 cnidocysts per tentacle; lacking an apical projection or peduncle.

Description

Body of holotype specimen badly crumpled, when preserved, balloon-shaped with a wide, flat apex and the margin pursed inward. Exumbrella smooth, with 4 relatively large, gelatinous perradial prominences, on the ends of which lie the exumbrellar cnidocyst pouches. Stomach large and imperfectly cruciform at the base, quadrate throughout its length; large and flask-shaped when viewed laterally, with a narrow proboscis and simple, round mouth, reaching to about the level of the velar opening; without a peduncle or mesenteries. Gonads 4, broad, flattened, with several vertical thickenings, occupying the entire stomach wall above the proboscis, separated

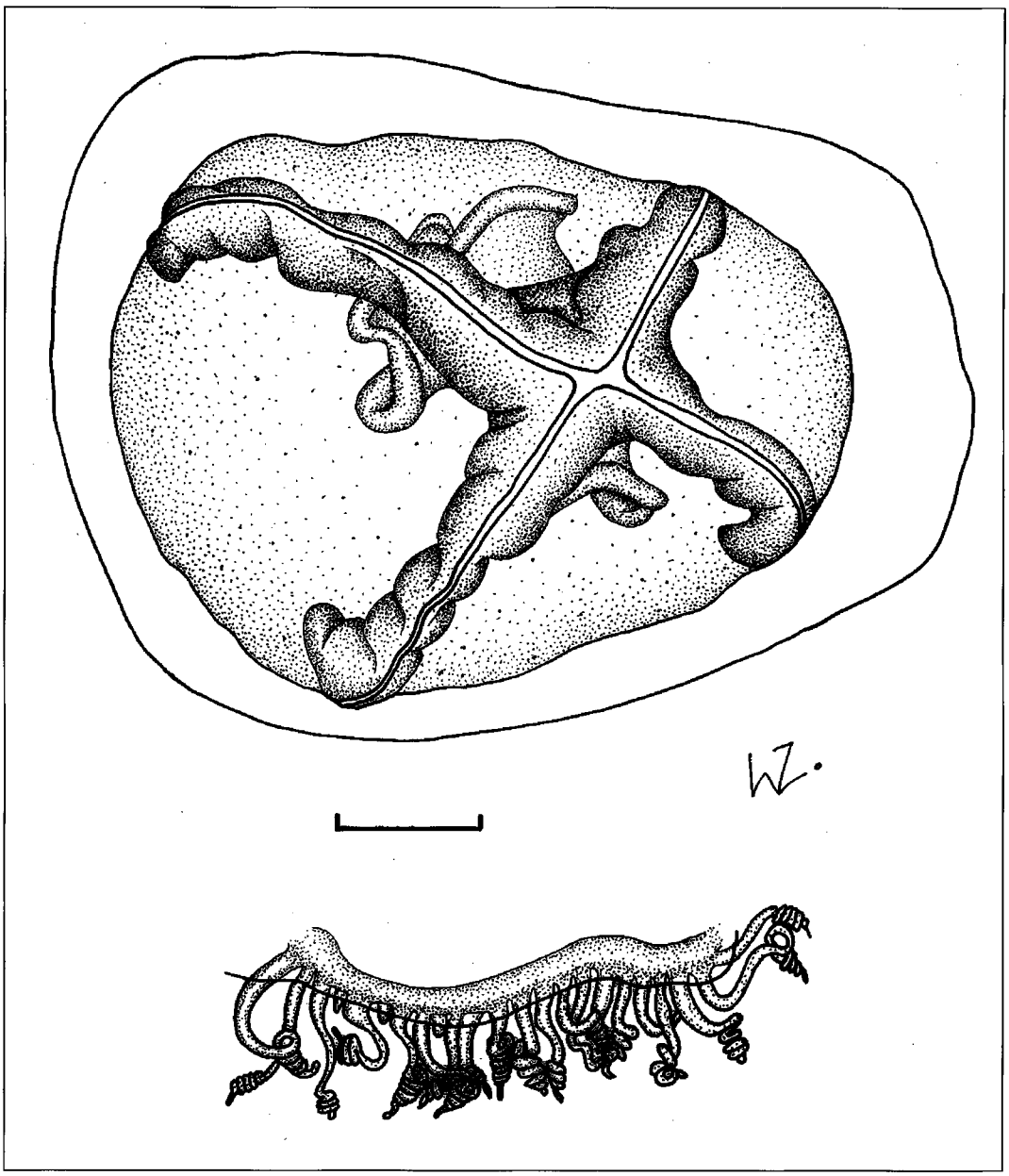

Fig. 10. *Laodicia sp.* (H1237), Petrel Bay, St. Francis Island, Nuyts Archipelago, S.A.; A, aboral view; B, external view of tentacles from one of the quadrants. Scale bar = 1.0 mm.

only narrowly at the perradii. Tentacles 2, about 1.5 x BH when relaxed naturally; with smoothly tapered tentacle bulbs, with a short abaxial exumbrellar clasp. The upper portion of the tentacle bulb is smooth, with a short region of abaxial curled corrugations proximal to the cnidophores. Cnidophores abaxial, extremely numerous and densely crowded, well over 100 per tentacle. On the two perradii lacking tentacles, the bulbs are completely reduced. Velum moderately wide. Statocysts absent. Ocelli absent. Radial canals 4, moderately narrow, but conspicuous; smooth-edged,

TABLE 5. *Comparison of the characters of adult* Zanclea *medusae; species for which the adult medusa is unknown are not included (see Boero* et al., *2000). Literature used: all original descriptions, plus Boero* et al. *(2000).*

	Umbrella shape	Marginal bulbs	Tentacle #	Cnidophores	Nematocyst pouches	Gonads	Manubrium	Mesenteries	Apical projection	Colour
Z. bomala Boero *et al.*, 2000	Bell shaped	4	4	Hundreds	Round, small, on apophyses above tentacle bulbs	4 interradial	Reaching $^2/_3$ of subumbrella; stomach wide	Small	Small	Transparent
Z. costata Gegenbaur, 1857	Almost spherical	4	2 or 4	Hundreds	Small, on projections, far from bell margin	4 interradial	Tubular, $^2/_3$ of bell cavity	Absent	Absent	Not reported
Z. dubia Kramp, 1959	Bell shaped, w/ rounded apex	2 big and 2 small	None	Absent	4 elongated, $^1/_3$ of exumbrella	4 interradial, filling subumbrellar cavity	Long, protruding, with lips	Absent	Absent	Not reported
Z. giancarloi Boero *et al.*, 2000	Not described	4	2	About 50	Round, small, on apophyses above tentacle bulbs	4, interradial, with few large eggs	$^2/_3$ of subumbrella, mouth round	Absent	Absent	Transparent
Z. gilii Boero et al., 2000	Cylindrical, with round apex	2	2	Hundreds	2 long ones above tentacle bulbs, the other two small	4 interradial, with median furrow	Elongated, $^3/_4$ of subumbrellar cavity	Absent	Absent	Transparent, with white bulbs and oral region
Z. medusapolypata Boero *et al.*, 2000	Bell-shaped, with flattened apex	2	2	Hundreds, on outer part of tentacles	Narrow, on ridges, often reaching apex	Not seen	$^1/_3$ to $^1/_2$ of subumbrella, mouth round or cruciform	Absent	Absent	Transparent
Z. polymorpha Schuchert, 1996	Bell-shaped	4	2	About 70	Reduced to narrow bands	4 bulging interradial pads	Almost reaching velar opening, stomach wide	Absent	Present in wild, absent in laboratory reared medusae	Unreported
Z. protecta Hastings, 1930	Bell-shaped, elongate	4, two non- tentacular ones reduced or absent	2	More than 100	2 big, rounded, on downward-facing apophyses, and 2 small, not on apophyses	4 interradial, with medial furrow	Cylindrical, $^2/_3$ of bell cavity	Absent	Short, blunt	Transparent
Z. sessilis (Gosse, 1853)	Bell-shaped	4	2	Hundreds	2 long and 2 short, linear, above bulbs	4 interradial masses of gametes	Reaching velar opening, stomach wide, pharynx long	Absent	Absent	Greenish
Z. baudini sp. nov.	Taller than wide	2 at base of tentacles with abaxial clasp; other two lacking	2	Well over 100 per tentacle	4, all on prominent, downward-facing apophyses	4 broad, flat, occupying entire stomach wall	Reaching velum; mouth round; lacking peduncle	Absent	Absent	Mostly white, with faint orange endoderm

	Umbrella shape	Marginal bulbs	Tentacle #	Cnidophores	Nematocyst	Gonads pouches	Manubrium	Mesenteries	Apical	Colour projection
Z. carinata sp. nov.	Nearly spherical, with 4 large perradial paravanes	2 at base of tentacles small; other 2 about $^{1}/_{10}$ as large	2	About 50, abaxial, with about 20 adaxial papillae	Lacking in the proper sense, but crest of each paravane with narrow track	4 globular interradial masses	Reaching $^{1}/_{2}$-way to velum; mouth round, simple	Absent	Absent	White
Z. ngeriana sp. nov.	Bell-shaped, thickened apically	2 at base of tentacles short; others lacking	2	About 20, abaxial, more dense proximally	2 tentacular about 2x the size of the other two	Completely surrounding upper half of stomach, undivided	Reaching velum; with simple, round mouth	Absent	Absent	White
Z. sardii sp. nov.	Bell-shaped	2 fully developed, plus 2 rudimentary	2	About 100, abaxial	2 tentacular about 2x the size of the other two	8 (divided on perradii and interradii)	Protruding beyond velum, round in cross section	Absent	Pyramidal, solid	Tentacle bulbs purple, pink, orange

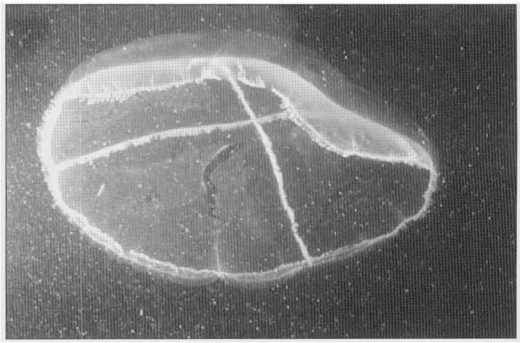

Fig. 11. *Staurophora falklandica* Browne, 1907 (H1061/PH 0388), Vivonne Bay, Kangaroo Island. Photo: K.L. Gowlett-Holmes.

straight. Ring canal about the same width as the radial canals. Colouration in life: stomach and tentacle bulbs whitish, with orange endoderm at base of stomach and on adaxial side of tentacles; the medusa has a mostly white appearance, with transparent, colourless mesoglea.

Appearance

Unlikely to be noticed by the unaided eye.

Etymology

Named to honour the French explorer Nicholas Baudin in celebration of the bicentenary of his historic meeting with Matthew Flinders.

Remarks for all Species of Zanclea *from the Nuyts Archipelago*

The four new species of *Zanclea* listed above are distinguished from their congeners as summarized in Table 5. Of the species with a hundred or more cnidophores per tentacle, only *Z. protecta* Hastings, 1930, *Z. bomala* Boero *et al.*, 2000 and *Z. sardii* have an apical projection. *Zanclea sardii* is easily separated from *Z. protecta*, which has an elongate body and only 4 gonads with a median furrow, in the gonads being so deeply furrowed that they have the appearance of 8 separate organs, and in the body being wider than long. Nor would *Zanclea sardii* be easily mistaken for *Z. bomala*, which has 4 tentacles, 4 gonads, and small mesenteries; Z. *sardii*, in contrast, has 2 tentacles, 8 gonads, and no mesenteries.

Zanclea baudini is most similar to *Z. protecta*, with both characterized by a tall bell with prominent, downward-facing apophyses. However, *Z. protecta* has a bluntly rounded, conspicuous apical projection, whereas this structure is entirely lacking in *Z. baudini*. Furthermore, *Z. protecta* has apophyses only above the two tentacular bulbs, whereas in

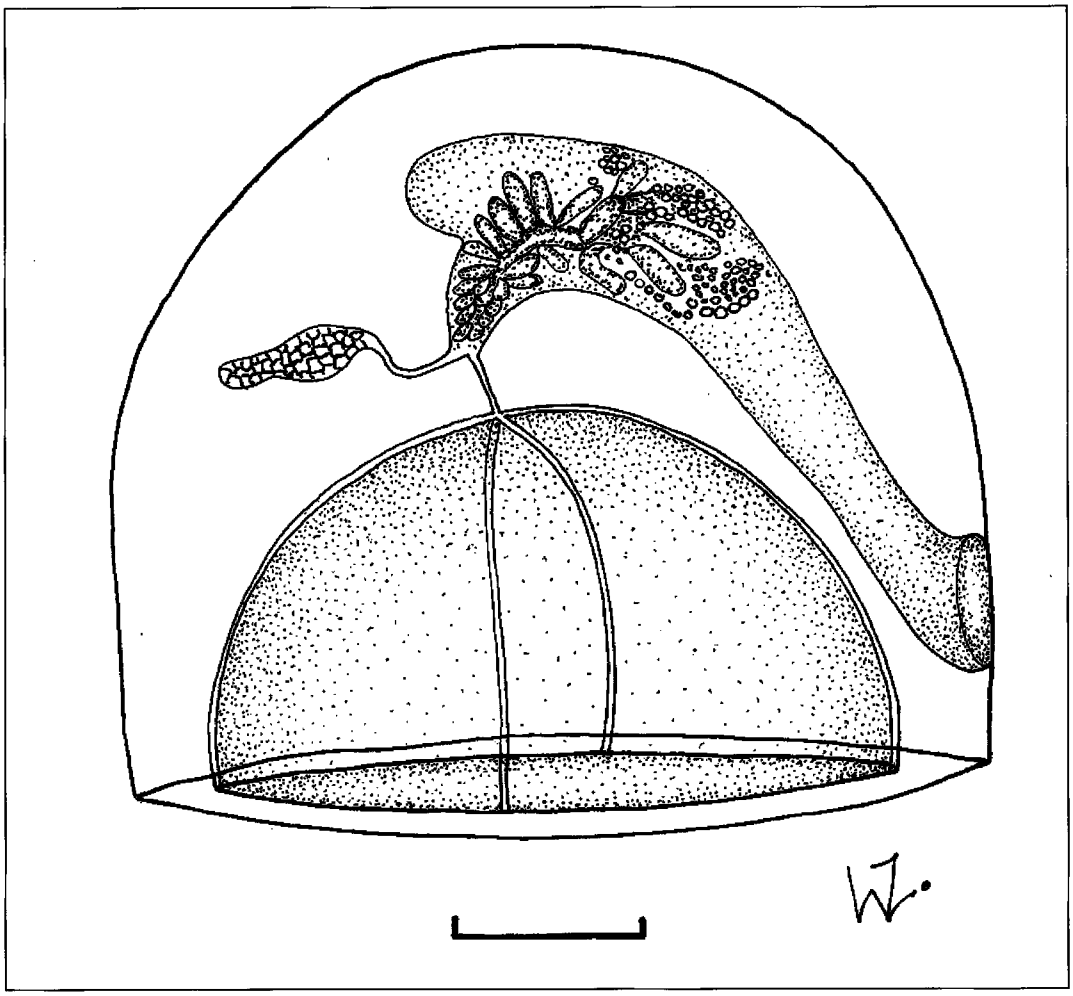

Fig. 12. *Sphaeronectes* sp. (H1236), Smooth Island, Nuyts Archipelago, S.A.; lateral view. Scale bar = 1.0 mm.

Z. baudini they are on all four perradii.

The other two species are also easily distinguished from their congeners. *Zanclea carinata*, with about 50 cnidophores per tentacle, and *Z. ngeriana*, with about 20, are most similar to *Z. giancarloi* Boero *et al.*, 2000 with about 50, and *Z. polymorpha* Schuchert, 1996, with about 70. Live specimens of *Z. polymorpha* typically have an apical projection, whereas such a structure is absent in both *Z. carinata* and *Z. ngeriana*. *Zanclea carinata* has a conspicuous keel or paravane along the entire length of the body in each of the four perradii; these structures are absent in both *Z. polymorpha* and *Z. giancarloi*. The gonad of *Z. ngeriana* makes the species quite distinct, being undivided and completely surrounding the upper half of the stomach. In all other species of *Zanclea*, the gonad is divided into 4 or 8 parts.

Another closely related genus, *Zanclella* Boero & Hewitt, 1992, is distinguished from *Zanclea* by characters specific to the polyps. The medusa of *Zanclella glomboides* Boero *et al.*, 2000 is superficially comparable to that of *Zanclea ngeriana*, in that both have only about 20 cnidophores per tentacle. However, *Zanclea ngeriana* lacks the mesenteries characteristic of *Zanclella glomboides*, and has a single continuous gonad, whereas *Z. glomboides* has at least 4 distinct masses. While it is possible that *Zanclea ngeriana* may eventually be placed in the genus *Zanclella* when the life cycle is elucidated, the unique medusa characters would still keep it separate from *Z. glomboides*.

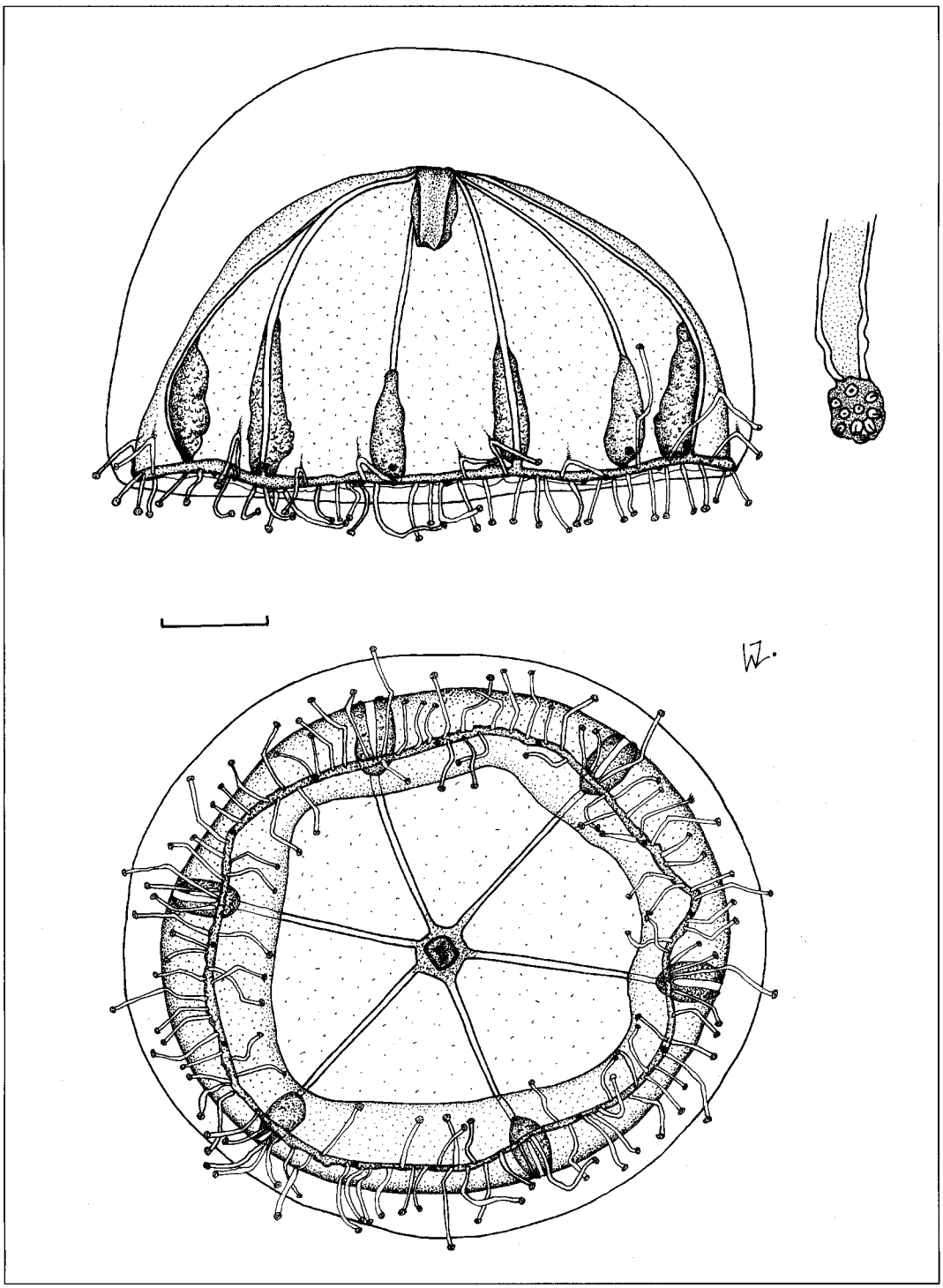

Fig. 13. *Hexaphilia scoresbyi* gen. *et.* sp. nov., holotype female; A & C, lateral & aboral view; B, terminal end of one of the tentacles. Scale bar = 1.0 mm.

Sub-class Leptomedusae Haeckel, 1866
Order Conica Broch, 1910
Family Aequoreidae Eschscholtz, 1829
Genus *Aequorea* Peron & Lesueur, 1810

Remarks

Two different forms of *Aequorea* (spp. A & B), were found at Masillon Island. A third form (sp. C) was found in large numbers coastally throughout much of southern Australia, so we expected to find it at the Nuyts Archipelago. All three species are thought to be undescribed forms, which will be described as part of a revision of the Aequoreidae.

Sp. A. Bright pink, with enlarged tentacle bulbs and a very long manubrium.

Sp. B. Pale blue, with many fine canals and tentacles.

Sp. C. Transparent and colourless, with 16 radial canals and 2-3 times as many tentacles.

Family Laodiceidae L. Agassiz, 1862
Genus *Laodicea* Lesson, 1843
Laodicea sp. (Fig. 10)

Material Examined

One specimen, BD 15 mm (H1237), Petrel Bay, St. Francis I., coll. LG, 23 Feb. 2002.

Remarks

Unfortunately, the single specimen captured curled during observation, so could not be fully studied. Observations of the living animal were noted as follows: radial canals and stomach pale pink; bell flatter than a hemisphere; 2 of the 4 radial canals appear "braided"; numerous tentacles, each long one with 1 black adaxial ocellus; between tentacles lies 1 cordylus and 1 cirrus, without ocelli; velum narrow. Further notes added after preservation included: about 20 tentacles per quadrant – exact limit of quadrant difficult to distinguish; stomach with undulating lobes.

Laodicea indica Browne, 1905 was reported by Southcott (1982) from southern Australian waters, but the relationship of the present form to Southcott's specimen, or whether either is referrable to *L. indica,* is unknown.

Genus *Staurophora* Brandt, 1835
Staurophora falklandica Browne (Fig. 11)

Staurophora falklandica Browne, 1907, pp 472-473; Browne, 1908, pp 235-236, pl. 1, figs. 1-7, as new species; Mayer, 1910, pp 293; Kramp, 1919, pp 39-47, comparison with *S. mertensii*, said to be identical; Russell, 1953, pp 239-240, possible synonym of *S. mertensii*; Kramp, 1957, pp 29-30, junior synonym of *S. mertensii*; Kramp, 1961b, pp 148-149, junior synonym of *S. mertensii.*

Material Examined

Holotype: BD 84.56mm (NHM 1941.3.20.202), Falkland Is., 7.1.1903, "Scotia" Coll., studied by LG Feb 2001.

South Australian Material: 4 specimens (H1384), Petrel Bay, St. Francis I., Nuyts Archipelago, coll. LG, 26 Feb. 2002; 2 specimens (H1385), Dog I., Nuyts Archipelago, coll. LG, 24 Feb. 2002; 3 specimens (H1386), north side of Flinders I., Investigator Group, coll. S.A. Shepherd, 26 May 1999; numerous specimens, BD to 200 mm (H1061, also PH 0048 & XH 0097-101), Vivonne Bay, Kangaroo I., coll. LG, 4 May 1999; 9 specimens (H1387), American River, Kangaroo I., coll. LG & WZ, 2 May 1999; 1 specimen (H1388), Penneshaw jetty, Kangaroo I., coll. K.L. Gowlett-Holmes, 30 Apr. 1999; 1 specimen (H1060 = PH 0048), Edithburgh jetty, Yorke Pen., coll. K.L. Gowlett-Holmes, 18 May 1992; 1 specimen (H1389 = PH 0043), same data as previous but coll. 11 Apr.; 8 specimens (H1390), off Edithburgh, 20 km S. of Marion Reef, in trawl 37 m, coll. W. Rumball, 26 Jun. 2001. Approximately 200 additional specimens (BD about 200 mm) casually examined in the field and released, Vivonne Bay and American River, Kangaroo I.

Diagnosis

Staurophora with large and small tentacles alternating in size; with ocelli on umbrella margin at base of large tentacles only; lacking diverticula of the radial canals.

Description of South Australian Material

BD up to 223 mm. Bell extremely flattened in life; with thin mesoglea, only 7-8 mm thick in the largest individuals, tapering to margin; transparent. Exumbrella smooth. Radial canals 4, straight, lacking diverticula. Mouth set along entire length of 4 radial canals, crenulated, with thickened margin; H-shaped in many individuals, X-shaped in most; whitish in juveniles, bright pink in mature live individuals. Gonads upon walls of mouth, equally spread upon inner and outer portions of folds. Tentacles extremely numerous, in two size classes in separate whorls upon margin; coiled; white in small specimens, purple in large live individuals. Large tentacles higher upon margin than small tentacles; both with exumbrellar clasping bulbs; large and small tentacles in 1:1 alternation in specimens of all sizes. Marginal cordyli approximately 0.20 mm long, with narrow stalk and swollen head, connected directly to margin, singly between every two

tentacles (large and small), nearer to small tentacle. A single ocellus at base of each large tentacle only; on margin of umbrella, not actually on tentacle bulb; black. Velum narrow. Statocysts could not be found.

Variation

Symmetry variation found in a few individuals exhibiting triradial or pentaradial form. Other variants found with canals branching such that there are more canals reaching the margin than stomach, or the opposite, resulting in a ring around the centre point.

Remarks

Kramp (1957) mistakenly stated that *Staurophora falklandica* is identical with *S. mertensii* Brandt, 1835. In his re-examination of North Atlantic and Falkland specimens, he found that both exhibited similar variation in tentacle size; Browne (1908) expressed concern over this character in his description of *S. falklandica* based on a single 90 mm specimen. However, the present collection of numerous large and small specimens matches perfectly the description for *S. falklandica*, i.e., all specimens having two sizes of tentacles, lacking the variation seen by Kramp. Furthermore, the radial canals do not match the form known for *S. mertensii* (illustrated in Brandt, 1838).

The most complete description available for *S. mertensii* is given by Russell (1953). He describes lateral branched diverticula of the radial canals, with the gonads on the diverticula. This contrasts sharply with the radial canals of the Australian specimens, which lack any trace of diverticula; the gonads are set upon the side-walls of the stomach or mouth. Russell (1953) also states that there is an adaxial ocellus on each marginal tentacle bulb and that there are no marginal cirri. However, in the Australian material, each full-sized tentacle alternates with a very small tentacle or cirrus; the ocelli are only at the base of each large tentacle, but not on the bulb itself. This arrangement of tentacle sizes and ocelli is the same in specimens of all sizes studied (105-223 mm BD). Curiously, Browne's (1908, pl. 1, fig. 4) medusa had ocelli on the tentacle bulbs themselves. The colour differs as well, with the British medusae having light rosy tentacles and rosy or yellowish lips, and the Australian medusae having bright pink lips and purple tentacles. It is unclear why Kramp (1957) chose to synonymize the two species based on tentacle size alone, ignoring the differences in canal form and arrangement of ocelli.

The marginal cordyli (= clubs) are worthy of brief discussion. Hartlaub (1897) stated that they develop into tentacles; Mayer's (1910, pl. 26, fig. 5) illustration of *S. mertensii* certainly appears to show converting cordyli, as they are long, set upon bulbs, and have an ocellus at the base. Browne (1907) discussed this phenomenon in depth for *Laodicea* and concluded that conversion is not the normal course of development, but instead arises only when the margin is over-crowded with rapidly developing tentacles, as in young medusae. The present specimens do not suggest conversion, as the cordyli are extremely small, connected directly to the margin, and occurring in regular arrangement closest to the small tentacles. The two classes of tentacles and the cordyli do not exhibit structural or size intermediates in the present collection. Perhaps most importantly, the cordyli are of undoubted cordylus form, having a narrow stalk, a swollen head, no nematocysts, no marginal bulb, and no ocelli; they do not appear to be transforming into tentacles.

There has been some discussion about the proposed bipolar distribution of *Staurophora*. Mayer (1910) commented that if *S. falklandica* were synonymous with *S. mertensii*, it would be a remarkable case of bipolar distribution. Kramp (1957) attempted to settle the argument by stating that there is but a single, bipolar species, namely *S. mertensii*. However, we consider them worthy of specific recognition because the two forms differ morphologically and geographically.

Distribution

This is the first record of this genus in Australia, where so far it has only been found in South Australia. Elsewhere, it has only been reported from the Falkland Islands, South Atlantic (Browne 1908; Mayer 1910).

Sub-class Siphonophorae Eschscholtz, 1829
Order Calycophorae Leuckart, 1854
Family Sphaeronectidae Huxley, 1859
Genus *Sphaeronectes* Huxley, 1859
Sphaeronectes sp. (Fig. 12)

Material Examined

One specimen, BH about 4.0 mm, BD about 4.7 mm (H1236), Smooth I., coll. LG, 24 Feb. 2002; 2 specimens approximately 6 mm BD (disintegrated prior to fixation and not kept), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Description

Body asymmetrical dome-shaped. Nectosac large, about half the height of the body. Somatocyst straight, not curving toward the dorsal side of the hydroecium; scalpel-shaped, with the dorsal side flat and the ventral side evenly rounded; long, extending outward even with the outer boundary of the somatocyst; bluish or yellowish. Radial canals arising from the apex of the nectosac. Stem yellowish-white, with red flecks.

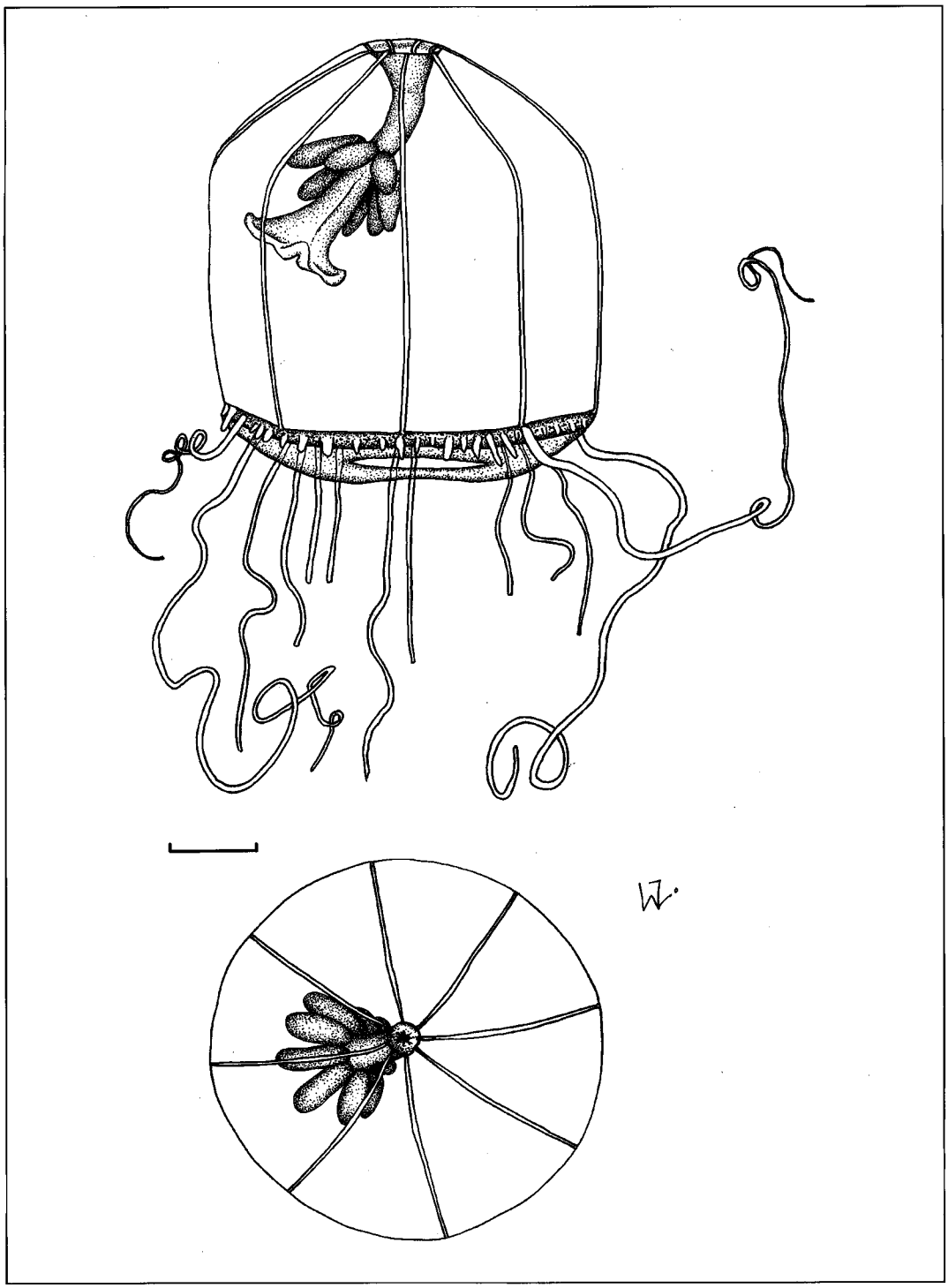

Fig. 14. *Aglaura* sp. (H1311), Petrel Bay, St. Francis Island, Nuyts Archipelago, S.A., lateral & aboral view. Scale bar = 0.5 mm.

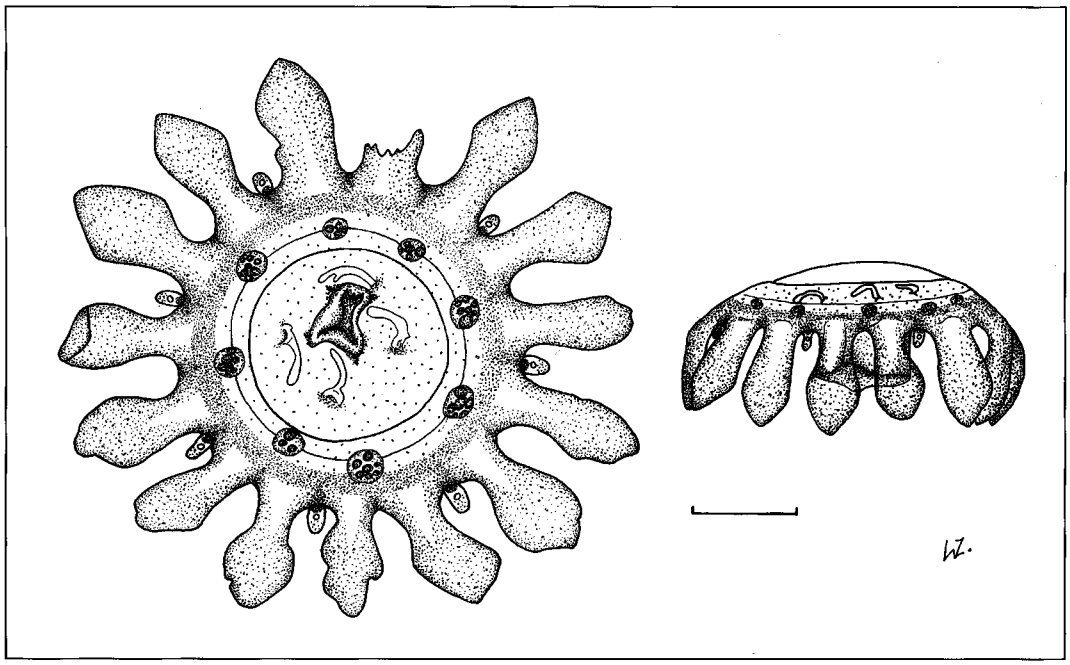

Fig. 15. *Nausithoe* sp. (H1244), Petrel Bay, St. Francis Island, Nuyts Archipelago, S.A.; A, aboral view of female; B, lateral view of smaller male. Scale bar = 0.5 mm.

Appearance

Body spherical to egg-shaped, hollow in the middle, with a faintly bluish somatocyst arching over the hollow and a whitish stem coming down one side.

Remarks

This is the first report of *Sphaeronectes* from the Great Australian Bight.

Sub-class Limnomedusae Kramp, 1938
Family Olindiidae Haeckel, 1879
Genus *Hexaphilia* gen. nov.

Type species

Hexaphilia scoresbyi sp. nov.

Diagnosis

Olindiidae with hexamerous radial symmetry; with short, linear gonads on the distal portion of the radial canals; with numerous tentacles all alike, with terminal nematocyst cluster but lacking adhesive pad; with 2 statocysts per paramere.

Etymology

Named for the strong expression of six-parted radial symmetry.

Remarks

Hexaphilia is distinguished from the other genera in the family Olindiidae on numerous characters, as summarized in Table 6.

The issue of symmetry in medusae is of particular interest. It was not uncommon in the older literature for species and even genera to be described merely on the basis of their symmetry, when, in fact, they were merely variations (often clonal variations) within the norm of an established species (see discussion in Gershwin 1999). However, while most medusa species are fundamentally tetramerous, there are a few which have a body plan based on some other symmetry. Still others are a chimera of symmetries, with a tetramerous manubrium but hexamerous body, or a similar combination. In the present case, *Hexaphilia scoresbyi* sp. nov. is hexamerous throughout, and does not appear to be structurally identifiable with any known tetramerous genus or species.

Hexaphilia scoresbyi sp. nov. (Fig. 13)

Material Examined

Holotype: gravid female, BD 6.35 mm (H1145), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

TABLE 6. *Comparison of characters in the genera of the family Olindiidae. The genera* Astrohydra *Hashimoto, 1981,* Keralica *Khatri, 1984,* Mansariella *Malhotra,* et al., *1976 and* Monobrachium *Mereshkowsky, 1877 are not included due to insufficient knowledge of the medusae (see Bouillon & Boero, 2000). Literature used: Russell, 1939; Kramp, 1961b; Mills* et al., *1976; and Bouillon & Boero, 2000.*

	Centripetal canals	Radial canals	Gonad location	Tentacle # and form	Tentacle adhesive pads	Statocysts	Habitat	Other characters
Aglauropsis F. Müller, 1865: 143	Absent	4	On radial canals; lobed, smooth, or wavy curtain	Numerous, all alike, with nematocyst rings	Lacking	Numerous, enclosed marginal	Marine, temperate	
Craspedacusta Lankester, 1880: 147	Absent	4	Pouch-like, on radial canals	Numerous, all alike, with scattered nematocyst warts or clasps	Lacking	In enclosed vesicles in the velum	Freshwater	
Cubaia Mayer, 1894: 237	Absent	4	Papilliform on middle region of radial canals	2 series: 20 issuing from exumbrella, with about 8 nematocyst rings and with terminal adhesive disks, and 50-60 arising from margin, with 25-30 nematocyst rings and without adhesive disks	Terminal on exumbrellar tentacles only; absent on marginal tentacles	Numerous, enclosed	Marine, tropical	
Eperetmus Bigelow, 1915: 399	3-6 per quadrant (Mills, 1976), or to 16 per quadrant (Kramp, 1961b)	4	Wavy curtain along radial canals	Numerous, originating at different positions above margin; all alike with nematocyst rings	Lacking	Numerous, nearly alternating with tentacles	Marine, boreal	Oral lips with nematocyst knobs
Gonionemus A. Agassiz, 1862: 530	Absent	4	Folded, on radial canals only	Numerous, all alike, sharply bent, with rings of nematocysts	Abaxial on all, near distal end	Numerous, enclosed	Marine, cold temperate	With or without peduncle
Gossea L. Agassiz, 1862: 366	Absent	4	Only on radial canals, folded & ribbon-like	Solid, arranged in groups, long ones with nematocyst rings and small ones with terminal knob	Lacking	Enclosed in exumbrellar mesoglea	Marine, temperate to sub-tropical	With or without peduncle
Limnocnida Günther, 1893: 269	Absent	4	Only on manubrium	Numerous, all alike	Lacking	Numerous, enclosed marginal	Freshwater	Circular manubrium and gonad
Maeotias Ostroumoff, 1896: 402	Numerous	4	On radial canals, ribbon-like	Very numerous, crowded, all alike with fine nematocyst rings	Lacking	Internal, numerous	Brackish water	With long, crenulated lips, and with numerous marginal clubs
Nauarchus Bigelow, 1912a: 258; 1919: 321, PL. 43	Absent	6	On radial canals, flat and leaflike	12, equidistant, supra-marginal, all with distal nematocyst rings	Lacking	At base of tentacles in exumbrellar ridges	Marine, tropical	Stomach hexagonal, mouth simple and circular

	Centripetal canals	Radial canals	Gonad location	Tentacle # and form	Tentacle adhesive pads	Statocysts	Habitat	Other characters
Olindias F. Müller, 1861: 312	Numerous	4	On radial canals, with papilliform processes	Numerous, 2 kinds: 1° above bell margin with transverse nematocyst clasps and distal adhesive pads; 2° marginal with nematocyst rings	Terminal on exumbrellar tentacles; absent on marginal tentacles	Usually in pairs at base of primary tentacles	Marine, warm temperate to tropical	Numerous marginal clubs
Scolionema Kishinouye, 1910: 31	Absent	4	$^{1}/_{3}$ to $^{1}/_{2}$ of distal RCs, ribbon-shaped and much folded	40-70, all alike, with globular bulbs with brownish pigment spots; ringed throughout length, distal end sharply bent	Rudimentary, on all tentacles	Never more than 16, enclosed in mesoglea	Marine, tropical to temperate	With or without peduncle; stomach cruciform
Vallentinia Browne, 1902: 283	Absent	4	On radial canals; ruffled or sac-like	2 kinds: 4-8 hollow, with terminal adhesive pads, plus numerous moniliform without adhesive pads	Terminal on some tentacles	16 or more	Marine, temperate	Semi-sedentary
Hexaphilia gen. nov.	Absent	6	On distal $^{1}/_{4}$ to $^{1}/_{6}$ of radial canals, linear	Numerous, without bulbs, all alike short, solid, with terminal nematocyst cluster	Lacking	12, located nearer to perradii than interradii	Marine, temperate	Ocelli and cirri lacking

Paratypes: 5 specimens, BD 1.19-4.39 mm (H1146), same data as holotype; 2 specimens, BH 3.97, 3.83 mm, BD 4.81, 3.93 mm respectively (H1090), Port Sorell, Tas, coll. LG & WZ, 5 Feb. 2002; 1 specimen (TMAG – K2810), same data as previous; 7 specimens (H1092) and 7 specimens (TMAG - K2809), BH 1.3-4.16 mm, BD 1.62-3.94 mm, same data as previous but coll. 24 Feb.; 1 specimen, BH 1.09 mm, BD 1.43 mm (H1091), George Town, Tas., coll. LG & WZ, 24 Jan. 2002; 1 juv. specimen, BH about 0.25 mm (H1112), Ulverstone, Tas., coll. LG & WZ, 4 Feb. 2002.

Type Locality

Petrel Bay, St. Francis I., Nuyts Archipelago, SA.

Etymology

Named to honour Dr. Scoresby Shepherd.

Description of Holotype

Body hemispherical. Exumbrella smoothly rounded, without nematocysts. Radial canals 6, narrow, simple, straight. Ring canal about the same width as radial canals. Gonads elongate teardrop-shaped, tapered proximally, widest distally; on the distal $^{1}/_{3}$ of each radial canal, touching ring canal; each with a mass of red granules embedded in the wide end. Two small, marginal thickenings of tissue on either side of one gonad; both have red granules inside and appear to be reduced gonads upon the ring canal. Tentacles numerous, ungrouped, short, solid; naked along length, with a very small, terminal ball of nematocysts. All tentacles arise from the outermost edge of the ring canal, lacking true tentacle bulbs. However, most tentacles are basally affixed to the exumbrella, with the free portion of the tentacle issuing from some distance up along the bell wall. The length of attachment varies considerably from one tentacle to another. Other tentacles arise directly, with no sessile portion. The margin of the bell has a slight overhang that is divided by the sessile tentacle bases, reminiscent to the narcomedusan bell margin that is scalloped by the peronia. Statocysts 2 per hextant; free ectodermal; equidistant between the perradii or located slightly nearer to the perradii than to the interradii. Stomach flask-shaped, very narrow and short; with 6 external, perradial, longitudinal ridges; connected directly to subumbrella, without a peduncle or mesenteries; with a small cluster of red granules in the center. Mouth simple, more or less round but contorted in formalin, lacking lips. Velum moderately wide. Ocelli and cirri lacking.

Colouration in life: stomach and gonads light brownish pink, bell transparent and colourless.

Variation from the Holotype

One individual (from H1146) has imperfect radial

canals and gonads; only 5 radial canals connect with the stomach, and one of those is bifurcated and anastomosed back onto itself; the 6th canal connects only with the ring canal, not with the stomach. There are 3 normal sized gonads, all on normal canals; one normal canal lacks a gonad altogether, while the bifurcated canal has a reduced gonad. The centripetal canal has a rudimentary gonad.

Appearance

Somewhat flatter than a hemisphere, pinkish brown, with 6 conspicuous gonads near the margin. Inactive swimmer, spending most of the time neutrally buoyant or near the bottom.

Development

Only one early juvenile specimen is known (H1112). With a BH of about 0.25 mm, it has a bluntly rounded, solid, conical apical mass; the body is tall and bell-shaped, rather than hemispherical; the stomach is flask-shaped, with the mouth reaching about 1/3 the distance toward the velar margin; the gonads are merely thickened regions along the extremeties of the six radial canals; there are 2-4 tentacles per hextant, of the same form as in the adult. Statocysts were not yet developed. The velum is extremely wide, closing off all but a small hole in the center of the subumbrellar cavity. An older specimen (from H1146) is nearly 4 times the BH, and already resembles the adult form, including the possession of gonads.

Distribution

Presently known only from the Nuyts Archipelago in S.A. and northern Tasmania from Port Sorell, Georgetown and Ulverstone.

Remarks

We believe that the marginal thickenings of tissue near one of the gonads was an aberration, as it only appeared in one paramere of the holotype and was not found on other specimens. For the tentacles, we could find no pattern to the lengths of the affixed bases, or to the ratio of free tentacles to affixed tentacles, except that the perradial bases typically have a longer attachement.

Another hexamerous olindiid was described by Bigelow (1912a, 1919), *Nauarchus halius* (often incorrectly spelled "*Nuarchus*"). *Hexaphilia scoresbyi* differs from *N. halius* in many important respects. First, in *N. halius* the gonads are flat and leaf-like, expanded laterally, whereas in *H. scoresbyi* they are linear to slightly vertically pocket-like and not laterally expanded. Furthermore, the gonads occupy most of the length of the radial canals in *N. halius*, shifted toward the proximal end, whereas they are confined to the distal regions in *H. scoresbyi*. Second, in *N. halius* each of the 12 tentacles is ringed with nematocysts distally and provided with a statocyst adjacent to its base, whereas in *H. scoresbyi* the tentacles are naked except for a small ball of nematocysts at the end, and the 12 statocysts do not correspond with any of the tentacles. Third, in *N. halius* the tentacles are pressed against the exumbrella into furrows, thus appearing to emerge from above the margin; *H. scoresbyi*, in contrast, lacks such furrows and many of the tentacles really do arise from the exumbrella. Fourth, the BD of *N. halius* typically reaches about 12 mm, whereas in *H. scoresbyi* it is only half that size.

Class Trachylina Haeckel, 1879
Sub-class Trachymedusae Haeckel, 1866
(Order Trachymedusae Haeckel, 1866)
Family Rhopalonematidae Russell, 1953
Genus *Aglaura* Péron & Lesueur, 1810

Aglaura sp. (Fig. 14)

Material Examined

Male, BH 2.36 mm, BD 2.33 mm, illustrated (H1310), Petrel Bay, coll. LG, 25 Feb. 2002; 8 specimens (H1243), same data; 17 specimens (H1391), same data but coll. 22 Feb.

Description of Nuyts Archipelago Material

Body bell-shaped, with straight sides, the upper 1/3 straight but at about a 45° angle, and a conically concave apex with a straight rim, giving the appearance of a flat top. Exumbrellar surface free of nematocyst warts, but with numerous fine longitudinal ridges; mesoglea very thin, sticky to glass and plastic surfaces. Stomach mounted at the end of a long, tapered gelatinous peduncle; small, round in cross section. Mouth quadrate, with 4 short lips, rounded at the corners, reaching into the lower half of the subumbrellar cavity. Gonads 8, sausage-shaped, projecting laterally into subumbrellar space from the lower portion of the peduncle, not connected to the stomach. Tentacles 5 per octant; narrow, solid, with a swollen tip; most broken off close to the body, those present are up to about BH in length. Statocysts 8 observed in living specimens, but not apparent in preserved material. Ocelli absent. Radial canals 8, straight, smooth-edged, narrow; even finer along the peduncle. Ring canal about twice as thick as radial canals. Velum very wide.

Colouration in life: completely transparent and colourless.

Variation

Most of the specimens have 4 tentacles per octant, though this does not appear to be related to body size, as the other specimens are about the same size. However, a young specimen (BH 1.42 mm) had only 3 tentacles per octant.

Appearance

This species is completely clear and therefore hard to see in a plankton sample, and is only observed against a strong upwardly directed light. It is almost always found on the bottom of the sorting bowl, sometimes with its side or apex stuck to the bowl.

Remarks

Aglaura hemistoma is said to be more or less cosmopolitan, and has long been the only recognized species in the genus. However, the description is so general that it allows for the inclusion of multiple forms. We have specimens from the Nuyts Archipelago and from Tasmania which do not appear to be conspecific with each other, but both fit the broad description of *A. hemistoma*, originally described from the coast of Nice. We therefore believe that there is more than one species of *Aglaura*, but will not revise the group until a more comprehensive collection can be studied.

Aglaura was reported by Blackburn (1955) as being the most common medusa off the south-eastern Australian coast; it has also been reported off southern W.A. We have also found it off the S.A. and Tasmanian coasts.

Subclass Narcomedusae Haeckel, 1879
Order Narcomedusae Haeckel, 1879
Family Solmarisidae Haeckel, 1879
Genus *Solmaris* Haeckel, 1879
Solmaris sp.

Material Examined

One specimen, Dog Island, north side, in lagoon, Nuyts Archipelago, coll. LG, 24 Feb. 2002; numerous specimens, Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002.

Remarks

This southern Australian form of *Solmaris* matches descriptions in Kramp (1961b) and Mayer (1910) of *S. rhodoloma*. However, with the taxonomy based on tentacle number, it is doubtful that different forms can be recognized. The Narcomedusae are badly in need of revision and it is likely that the southern Australian species will eventually prove to be different from the Chilean form; thus, this assignment should be considered premilinary.

Class Scyphozoa Goette, 1887
Order Coronatae Vanhöffen, 1892
Family Nausithoidae Haeckel, 1880
Genus Nausithoe Kölliker, 1853
Nausithoe sp. (Fig. 15)

Material Examined

Three specimens (H1244), Petrel Bay, St. Francis I., coll. LG, 25 Feb. 2002. One specimen, a gravid female has BD 2.66 mm (including lappets), the other two, apparently males, are curled, but appear to be about the same size.

Remarks

These specimens could not be assigned to species with confidence. They were much smaller than typical *Nausithoe*, and lacked any distinctive pigmentation but had mature gonads. Typical of *Nausithoe* ephyrae, they lacked tentacles and had only a single gastric filament in each quadrant (see da Silveira & Morandini 1997). Possibly they were ephyrae or some peculiar neotenic form.

Kramp (1961a) reported *Nausithoe punctata* from Green I., North Queensland; this is the first report of *Nausithoe* in the waters of South Australia.

Phylum Ctenophora Eschscholtz, 1829
Class Tentaculata Eschscholtz, 1825
Order Lobata Eschscholtz, 1825
Family Bolinopsidae Bigelow, 1912b
Bolinopsis sp.

Remarks

Many specimens of *Bolinopsis* sp. were caught, but could not be positively identified as, or distinguished from, the known small-lobed species. They occurred less densely in the Nuyts Archipelago than on the mainland, where they sometimes blanket the surface of the water in the middle to late summer.

Family Leucotheidae Krumbach, 1925
Genus *Leucothea* Mertens, 1833
Leucothea sp.

Material Examined

One fragmentary specimen in alcohol and liquid nitrogen, near North Point, St. Francis I., [32° 29′ 33.9″ S, 133° 16′ 59.6″ E], coll. S. Murray-Jones, 23 Feb. 2002. One specimen (BL ca. 150 mm), used for bioluminescence experiments, Fenelon I., [32° 34.474′ S, 133° 17.550′ E], coll. LG, 25 Feb 2002. Several specimens were observed at Masillon I., [32° 33.581′ S, 133° 17.041′ E], LG, 25 Feb 2002.

Diagnosis

Leucothea with narrow blind pits, large lobes, bimorphic meridional canal diverticula, and lacking any distinctive body pigmentation.

Description of South Australian Material

Body barrel-shaped, to about 15 cm body length; with aboral extensions of the body on the substomodeal plane with respect to the subtentacular plane. Body surface with evenly spaced, narrow, conical, gelatinous papillae; not numerous,

particularly sparse on the lobes. Lobes huge, estimated to be as long as the body, but severely damaged in all 4 specimens; inner surface finely meshed. Auricles 4, about 5 cm long when fully uncoiled, narrow, round in cross section, evenly tapered; with two rows of cilia on slight aboral ridges. Tentacles very fine, broken in all specimens at about 5-10 mm from body; total length could not be estimated. Blind pits emitting from tentacle bulbs paired orally and aborally, with the aboral branch being approximately 3 times as long as the oral branch, both the same width. Statocyst within deep cavity at aboral end of body. Substomodeal ctene rows run the complete length from the aboral crest, out onto the lobes to about the level of the mouth. Subtentacular ctene rows complete length from aboral crest to somewhat oral of the auricles. Meridional canals underlying the comb rows with continually adjacent narrow blind diverticula, alternating shorter with longer on the subtentacular canals but all the same length on the substomodeal rows.

Colouration in life: transparent to slightly translucent, faintly orange throughout.

Appearance

Most likely to be collected completely fragmented; extremely soft and diaphanous. Much of the body surface is covered with gelatinous papillae, and the auricles are long, narrow, smooth, and cylindrical to gradually tapered, and often held coiled in a bee-hive form.

Distribution

We have found at least two different forms of *Leucothea* around southern and eastern Australia, one along the coast of the mainland, and another in southern Tasmania. The exact range of this form of *Leucothea* has not been determined, as we are not confident that it is conspecific with specimens we have caught in the Bass Strait or southern Queensland.

Remarks

The species delimitations and recognition criteria within the genus *Leucothea* are not well determined. Specimens are extremely difficult to collect intact, cannot be relaxed in MgCl, menthol or other household chemicals, and fragment into an unidentifiable mass of cells in formalin or alcohol.

For most species of *Leucothea* only the general morphology is described, with little or no information on the internal structures, the exception being the description of *L. pulchra* Matsumoto, 1988, from the California coast. Characteristic internal blind pits of *L. pulchra* were illustrated by Matsumoto (fig. 2, B.P.) as being rather robust; in contrast, in this form of *Leucothea* the pits are very narrow. The diverticula of the meridional canals beneath the ctene rows are of two different forms, being alternately wide and narrow below the subtentacular rows but all the same width on the substomodeal rows; this bimorphic state of the canals has not been described for any other species. Furthermore, the colouration of this form of *Leucothea* appears to be unique, being a translucent dull orange throughout, without particular pigmented parts in the stomach, the papillae, or the lobes.

The remaining species descriptions are inadequate for complete comparison, and apparently no type specimens exist. However, based upon the available figures and descriptions, this form of *Leucothea* can be distinguished from the recognized species as follows: *Leucothea multicornis* (Quoy & Gaimard, 1824) from the Mediterranean has a dull brownish body with a brown tint to the lobes; the Nuyts Archipelago form, in contrast, is a slightly translucent orange, with no distinctly colored organs or body parts. *Leucothea grandiformis* (Agassiz & Mayer, 1899), from Fiji, has small lobes and cinnamon-yellow colouration of the ctene plates, gastric cavity, and canals. In contrast, the lobes of the Nuyts Archipelago form are at least as large as the body, and the above-mentioned structures are not coloured. *Leucothea ochracea* Mayer, 1912, from the Tortugas, is characterized by having lateral filaments on the tentacles, pairs of distinctive yellow regions on the outer sides of each lobe, and simple windings of the canals. Unfortunately, the tentacles of our specimens were broken off and thus could not be examined, but the colouration is quite different between the two species. *Leucothea japonica* Komai, 1918, from Misaki, Japan, is characterized by longer ctene rows, distinctly shorter pharyngeal folds, and a brick-red body with yellowish margins of the lobes. *Leucothea tiedemanni* (Eschscholtz, 1829) from near Japan is too imperfectly described to be distinguished from other species, and is not generally considered valid (Mills 1998-2002). Another species, *L. harmata*, was referred to by Mills (1998-2002) as being valid, but we were unable to find any information on this species, including its original description, to compare its characters.

Discussion

The discovery of so many new taxa is not surprising considering the high endemicity of the southern Australian fauna (Wilson & Allen 1987) and our poor knowledge of the gelatinous plankton. However, despite the incredibly rich bloom of gelatinous zooplankton, we did not catch any representatives of several major groups, i.e., the scyphozoan orders Rhizostomeae, Semaeostomeae,

and the ctenophoran class Nuda. All of these groups are well represented in the Australian coastal fauna.

It is particularly notable that we found so many species of *Zanclea* sympatrically, often finding multiple *Zanclea* spp. in the same plankton tow. This contrasts with the lack of species clustering found on the mainland. As no *Zanclea* polyps were found in the Archipelago during the Expedition, we do not know if the medusae were living locally or just passing through. Since *Zanclea* medusae are not known to be long lived, it seems likely that there must be a local breeding ground. And given the massive numbers caught it seems plausible that *Zanclea* spp. comprise an important part of the local ecosystem. Furthermore, with four species found in less than one week of sampling, it is possible that greater diversity would be discovered with sampling throughout the spring, summer, and autumn faunal changes. Boero *et al.* (2000) also found evidence of a significant radiation of *Zanclea* in the waters of Laing Island, Papua New Guinea where they found eight species of *Zanclea*, including six new to science. Given the diversity both to the north and south of Australia, it seems likely that additional species will be found in the mid-latitude Australian waters. There is insufficient data to fully explain this apparent speciation phenomenon, but we believe that it should be a priority for further study.

Boero *et al.* (2000) noted that *Zanclea* medusae in the northern hemisphere temperate zones seem to develop four tentacles during ontogeny, whereas all Australian temperate species we found had only two. It therefore seems likely that *Zanclea* from the northern and southern hemispheres represent two different evolutionary radiations.

Acknowledgments

We thank two anonymous reviewers for valuable comments on the manuscript, and Scoresby Shepherd for his patience and editorial contributions. We are indebted to the staff and volunteers of the South Australian Museum and the staff at South Australian Research and Development Institute (SARDI), with special thanks to the following people for organizing the Encounter 2002 Expedition or otherwise helping us obtain specimens and information (in alphabetical order): Anthony Cheshire, Karen Gowlett-Holmes, John Keesing, Thierry Laperousaz, Sue Murray-Jones, Scoresby Shepherd, and the crew of RV *Ngerin*. In addition, L.G. is exceedingly grateful to Anna and Scoresby Shepherd and Lyn and Wolfgang Zeidler for warm hospitality. This work was carried out at the South Australian Museum and SARDI, as part of a grant from the Australian Biological Resources Study (ABRS grant No. 20045) to L.G. and W.Z. This work was also part of a project started under a Fulbright Fellowship through the Australian-American Fulbright Foundation to L.G.

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