The New Crustacean Amphipod
Genus Kapalana from Australian Waters
(Senticaudata, Ischyroceridae, Ischyrocerinae, Cerapodini)

Penelope B. Berents* and J. K. Lowry

Abstract
Kapalana g. nov. is proposed and described for seven new species of Australian cerapodin amphipods: K. amelga sp. nov.; K. durraween sp. nov.; K. kimbla sp. nov.; K. maia sp. nov.; K. michaelmas sp. nov.; K. stebbingi sp. nov. and K. wadei sp. nov. In all of these species the females show a form of parental care in that the juveniles build their initial tubes in a ring around the tube of the adult female. Cerapus flindersi Stebbing, 1888 is tentatively assigned to the new genus Kapalana.

Keywords
Crustacea; Amphipoda; Ischyroceridae; Ischyrocerinae; Kapalana; Australia; new genus; new species; taxonomy; parental care.


Just (2017) established the tribe Cerapodini Smith, 1880 within the ischyrocerine subfamily based on clades described by Lowry & Berents (1996). The tribe comprised five genera (Bathypoma Lowry & Berents, 1996; Cerapus Say, 1817; Notopoma Lowry & Berents, 1996; Paracerapus Budnikova, 1989; Runanga J. L. Barnard, 1961) and was confirmed by Souza-Filho & Serejo (2014). The Cerapodini is currently represented in Australian waters by five species of Cerapus, the deep water species Bathypoma enigma Lowry & Berents, 1995 from off the Tasmanian coast, Notopoma stoddartae Lowry & Berents, 1996 from Elizabeth and Middleton Reefs and Runanga coxalis J. L. Barnard, 1961 in the Tasman Sea.

A group of eight species in the Cerapodini, also found in Australian waters, is described here in the new genus Kapalana defined by: (a) the posterior margin of peduncular article 1 modified into a strong projection; (b) the peduncles of antennae 1 and 2 covered in scales; and (c) juveniles attach their initial tubes to tubes of the female parent (Figs 4, 12) forming a ring which encircles the tube. There may be at least two generations attached to a female parent tube at any one time.

Apomorphous character states, common in some genera, such as the tiny scales on the peduncles of the antennae in the apparently endemic Australian genus Kapalana, are reported in one species of Notopoma (N. argentina) living in southern South America, and the presence of a holdfast on the tube in one species of Kapalana (K. michaelmas) is also known in the South African species Notopoma africana, indicating the possibility of a common ancestor for Kapalana and Notopoma. Therefore, there appears to be an ancient connection between Kapalana and Notopoma. Notopoma is a diverse, widespread genus mainly defined by the peduncle of antenna 1 which folds into a neat operculum. The genus

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Material and methods

The generic diagnostic description and the species descriptions were generated from a DELTA database (Dallwitz, 2010) to the Cerapodini Cerapus clade.

Checklist and distribution of the Cerapodini Smith, 1880; 6 genera, 48 species.

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<th>general distribution</th>
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<td>Bathypoma enigma Lowry &amp; Berents, 1996</td>
<td>Australia: Tasmania</td>
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<td>Australia: Victoria</td>
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<td>Cerapus benthophilus Thomas &amp; Heard, 1979</td>
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<td>Cerapus jonsoni Valério-Berardo, Souza &amp; Rodrigues, 2008</td>
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<td>Cerapus longirostris Shen, 1936</td>
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<td>Red Sea</td>
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<td>Cerapus ortze Ortiz &amp; Thomas, 2007</td>
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<td>Cerapus tubaliris Say, 1817</td>
<td>USA: north-east coast</td>
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<td>Cerapus volacola Lowry &amp; Berents, 2005</td>
<td>Australia: Queensland; Papua New Guinea, Madang Lagoon</td>
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<tr>
<td>Cerapus yanatalay Lowry &amp; Berents, 2002</td>
<td>Thailand, Sika district</td>
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<tr>
<td>Kapalana anvelga sp. nov.</td>
<td>Australia: New South Wales</td>
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<td>Kapalana durraeven sp. nov.</td>
<td>Australia: South Australia</td>
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<td>Kapalana flindersi (Stebbing, 1888)</td>
<td>Australia: Queensland</td>
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<td>Kapalana kimbla sp. nov.</td>
<td>Australia: Victoria; South Australia</td>
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<td>Kapalana maia sp. nov.</td>
<td>Australia: Victoria; Tasmania</td>
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<td>Kapalana michaemlas sp. nov.</td>
<td>Australia: South Australia; Western Australia</td>
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<td>Kapalana stebbingi sp. nov.</td>
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<td>Notopoma africana Lowry &amp; Berents, 1996</td>
<td>South Africa: south-east of St Lucia</td>
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<td>Notopoma argentina Alonso de Pina, 2005</td>
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<td>Notopoma cidaridis Berge, Vader &amp; Lockhart, 2004</td>
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<td>Notopoma crassiconis (Spence Bate, 1855)</td>
<td>United Kingdom: England; Northumberland</td>
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<td>Notopoma falloheidae (Lowry, 1981)</td>
<td>New Zealand: Kaikoura</td>
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<td>Notopoma flaminense Valério-Berardo, et al., 2008</td>
<td>Brazil: Campos Basin</td>
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<td>Notopoma harfoota (Lowry, 1981)</td>
<td>New Zealand: Kaikoura; Wellington</td>
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<td>Notopoma lovryi Souza-Filho &amp; Serejo, 2014</td>
<td>Brazil</td>
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<td>Notopoma lukini (Tvzvetkova, 1992)</td>
<td>Russia: Kurile Islands</td>
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<td>Notopoma moorea Lowry &amp; Berents, 1996</td>
<td>Society Islands: Moorea</td>
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<td>Notopoma opposita (K. H. Barnard, 1932)</td>
<td>Antarctica: South Georgia; Palmer Archipelago</td>
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<tr>
<td>Notopoma simithii (Stebbing, 1888)</td>
<td>Subantarctic: Kerguelen Islands; Macquarie Island</td>
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<td>Notopoma stoddartae Lowry &amp; Berents, 1996</td>
<td>Australia: Elizabeth and Middleton Reefs, Tasman Sea</td>
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<td>Notopoma stoora (Lowry, 1981)</td>
<td>New Zealand: Kaikoura</td>
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<tr>
<td>Notopoma teresae Souza-Filho &amp; Serejo, 2014</td>
<td>Brazil</td>
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<tr>
<td>Paracerapus comparativus (Kudrjaschov, 1975)</td>
<td>Russia: Kurile Islands</td>
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<td>Paracerapus polutovi (Gurjanova, 1951)</td>
<td>Russia: East Kamchatka, Bering Sea</td>
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<td>Runanga coxalis J. L. Barnard, 1961</td>
<td>Tasman Sea</td>
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<tr>
<td>Runanga wairoa McCain, 1969</td>
<td>New Zealand: East of Dunedin</td>
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Key to genera of Cerapodini

1 Antenna 1 peduncular article 3 forming an opercular cap ........................................... 2
   — Antenna 1 peduncular article 3 not forming an opercular cap ................................... 3
2 Gnathopod 2 male subchelate ...................................................... Bathypoma Lowry & Berents, 1996
   — Gnathopod 2 male carapcholete .............................................. Notopoma Lowry & Berents, 1996
3 Antenna 1 with vestigial accessory flagellum ......................... Runanga J. L. Barnard, 1961
   — Antenna 1 without vestigial accessory flagellum ........................................... 4
4 Pereopods 5–7 directed posteriorly ....................................................... 5
   — Pereopods 5 directed posteriorly, pereopods 6–7 directed anteriorly
     ........................................................ Paracerapus Budnikova, 1989
5 Antenna 1 peduncular article 1 posterior margin without strong
   posterior projection ........................................................................... Cerapus Say, 1817
   — Antenna 1 peduncular article 1 posterior margin with strong
     posterior projection ........................................................................ Kapalana g. nov.

Suborder Senticaudata Lowry & Myers, 2013
Infraorder Corophiida Leach, 1814
Parvorder Caprellidira Leach, 1814
Superfamily Photoidea Boeck, 1872
Family Ischyroceridae Stebbing, 1899
Subfamily Ischyrocerinae Stebbing, 1899
Tribe Cerapodini Smith, 1880

[Further information on higher classification given in Lowry & Myers (2013) and Just (2017)]

Kapalana g. nov.

Type species. Kapalana durraween sp. nov., present designation.

Included species. Kapalana includes 8 species: K. amelga sp. nov.; K. durraween sp. nov.; K. flindersi (Stebbing, 1888) comb. nov.; K. kimbla sp. nov.; K. maia sp. nov.; K. michaelmas sp. nov.; K. stebbingi sp. nov.; K. wadei sp. nov.

Etymology. Named for the retired New South Wales Fisheries vessel FRV Kapala, the source of many Australian Museum fish and invertebrate collections from 1971 to 1997. The name is feminine in gender.

Diagnostic description. Head with eyes present, rostrum long to very long. Antenna 1 without accessory flagellum; peduncular article 1 not produced anterodistally and anteromedially into an opercular cap, posterior margin with strong subquadrate or acute posterior projection. Antennae 1–2 peduncular articles 1–3 covered in scales [except K. amelga, K. maia and K. flindersi]. Gnathopod 2 carapcholeate in male. Pereopod 5 propod 5 propod inserted on posterior concave side of carpus. Pereopods 5–7 directed posteriorly. Pereopods 6–7 similar, much longer than pereopod 5. Uropod 1 peduncle with disoventral fan of robust setae. Uropod 2–3 uniramous. Tubes of juveniles attached in a ring, circling the tube of adult female (not known for K. flindersi).

Remarks. Kapalana has the strongest similarities to Runanga J. L. Barnard, 1961, Cerapus and Paracerapus Budnikova, 1989. Kapalana differs from these genera in having a projection on the posterior margin of the first article of antenna 1 and in Kapalana, the juveniles attach their initial tubes to the mother tube.

The species known as Cerapus flindersi Stebbing, 1888 is based on a female from Flinders Passage in Torres Strait, northern Queensland. It has never been re-collected and the tube is not known. The specimen is held in The Natural History Museum, London (BMNH 89.5.15.147) and consists of four microscope slides. Based on the morphology of antenna 1 peduncular article 1, we tentatively move it to the genus Kapalana.

Walker & Scott (1903) reported a female from Abd al Kuri, in the Gulf of Aden that they called Cerapus flindersi and Chilton (1892) reported a male Cerapus flindersi from Port Jackson, Australia, but in both cases the species identification is dubious. Walker & Scott’s specimen is poorly illustrated. Chilton’s specimen lacks a projection on the posterior margin of the first article of antenna 1 and represents an undescribed species of Cerapus.

Kapalana amelga sp. nov.

Figs 1–3

Holotype, male, 8.8 mm, AM P.99050, south-west side of Grasshopper Island, New South Wales, Australia (35°38'01"S 150°19'51"E), hand collected on scuba, in the red alga Peyssonnelia novaehollandiacea, 11 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV Baragula, 10 February 2003, Hermon Slade Batemans Bay Expedition, NSW 2038.


Additional material examined. One female, 3 juveniles, AM P.99052, type locality, hand collected on scuba in red alga Peyssonnelia novaehollandiacea, 11 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV Baragula, 10 February 2003, Hermon Slade Batemans Bay Expedition,
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**Type locality.** South-west side of Grasshopper Island, New South Wales, Australia (35°38'01"S 150°19'51"E).

**Etymology.** From the Spanish word *amelga*, meaning a ridge between two furrows and referring to the ridged posterior margin on the propodus of gnathopod 2.

**Description.** Based on Holotype, male, 8.8 mm, AM P.99050.

**Head.** Rostrum long, length 0.4 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner subacute, subocular margin deeply recessed, reaching beyond eye, anteroventral corner subquadrate, ventral margin horizontal, posterior margin vertical. *Antenna 1* length, length 0.5 × body length; peduncle with scales; peduncular article 1 longer than article 3, length 1.2 × peduncular article 3, not produced anterodistally and anteriomedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner without distal projection; flagellum 8-articulate; article 1 short. *Antenna 2* length equal to antenna 1; flagellum 7-articulate.

Epistome and upper lip fused, produced, broad base, apically subquadrate.

**Pereon.** Pereonite 1 with lateral keel, without sternal keel. Pereonites 2–3 with sternal keel. Pereonite 5 length 1.6 × depth.

*Gnathopod 1* coxa not fused to pereonite 1, length 1.1 × depth, without anteroventral lobe; basis length 2.5 × depth; carpus broad, length 1.4 × depth with setose posterior lobe; propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.6 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.9 × breadth, without anteroproximal group of long slender setae; carpus long, length 1.3 × breadth, broad, posterior margin with row of small spines, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 1.1 × width; propodus slender, curved, length 4.5 × width, without tooth on posterior margin, posterodistal corner smooth, with 1 tooth; dactylus length 0.5 × propodus. *Pereopod 3* coxa not fused to pereonite 3; basis length 2.2 × breadth, evenly rounded, with simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2.2 × breadth; merus length 1.1 × breadth; short; without ridges. *Pereopod 4* coxa not fused to pereonite 4, with anterior lobe separated from an anteroventral lobe; basis length 1.6 × breadth, with simple setae along anteroproximal group of small setae, with setae along anterodistal margin few or absent; merus long, length 1.6 × breadth. *Pereopod 5* coxa length 1.5 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe extending beyond anterodistal margin of carpus, posterior lobe with 5 plumose setae; propodus with 2 setae along posterior margin; dactylus short, uninate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; ischium long, length 2.4 × breadth; merus long, length 1.6 × breadth. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; merus length 1.4 × breadth; dactylus short, uninate, with 2 accessory hooks.

**Pleon.** Pleopods 1–3 biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 8-articulate; outer ramus 6-articulate, article 1 evenly swollen; *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus, broad, 1-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad 1-articulate. *Uropod 1* biramous; peduncle, length 1.1 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, without medial setae, with 5 lateral setae, with large apical robust seta, without smaller slender setae; inner ramus length 0.5 × outer ramus, with 4–5 medial and no lateral setae, with large

*Figure 1. Kapalana amelga* sp. nov., holotype, male, 8.8 mm, AM P.99050, Grasshopper Island, New South Wales, Australia.
apical robust seta. Uropod 2 uniramous, peduncle, length $2.6 \times$ breadth, $3.8 \times$ length of ramus; ramus small with 3 denticles and 1 slender apical seta. Uropod 3 uniramous, peduncle length $1.9 \times$ breadth; ramus with 2 curved hooks. Telson length $0.5 \times$ breadth, weakly cleft (28%), each lobe with 22–24 anteriorly directed hooks in 2 rows.

**Female** (sexually dimorphic characters). Based on paratype female, 6.5 mm, AM P.99051. Antenna 1 peduncle without scales; flagellum 6-articulate. Antenna 2 flagellum 6-articulate. Pereonite 1 without lateral keel. Pereonite 2–3 without sternal keel. Pereonite 5, length $2.2 \times$ depth. Gnathopod 1 coxa, length $1.3 \times$ depth; basis, length $2.6 \times$ depth; carpus length $1.6 \times$ depth with setose posterior lobe. Gnathopod 2 subchelate; palm extremely acute. Pereopod 5 coxa, length $1.3 \times$ depth. Oostegites from gnathopod 2 to pereopod 5.

**Tube.** Encrusted with detritus; tubes of juveniles attached in a ring, circling the tube of adult female.

**Habitat.** Sublittoral (11–13 m depth).

**Remarks.** Kapalana amelga, like *K. flindersi* and *K. maia*, lacks scales on the peduncles of antennae 1 and 2. It differs from other species in the genus in having the posterior margin of the gnathopod 2 carpus with a row of small spines and three apical denticles on the ramus of uropod 2.

**Distribution.** Australia. *New South Wales*: Grasshopper Island.
Figure 3. *Kapalana amelga* sp. nov., holotype, male, 8.8 mm, AM P.99050, Grasshopper Island, New South Wales, Australia. Scales represent 0.2 mm.
Kapalana durraween sp. nov.

Figs 4–6

Holotype, male, 9.4 mm, AM P.21868, off Disaster Bay, New South Wales, Australia (37°16′S 150°5′E), 91 m, K. Moller, May 1930. Paratypes: 1 male, 6.9 mm, AM P.10721, off Twofold Bay, New South Wales, Australia (37°5′S 150°9′E), 82 m, K. Moller on Durraween, August 1929; 1 male, 8.2 mm, AM P.76108; 1 female, 7.0 mm, AM P.76109; 4 males, 1 female, AM P.10719, off Twofold Bay, New South Wales, Australia (37°5′S 150°7′E), 82 m, K. Moller on Durraween, July 1929.

Additional material examined. 10 specimens, AM P.21867, 35 km east of Port Jackson, New South Wales, Australia (33°50′S 151°40′E), 366 m, 27 March 1905; 1 female, AM P.10720, west-south-west of Gabo Island, Victoria, Australia (37°34′S 149°55′E), 128 m, K. Moller on Durraween, December 1929; 1 female, 2 juveniles, AM P.76107, off Disaster Bay, New South Wales, Australia (37°16′S 150°5′E), 91 m K. Moller, May 1930.

Etymology. Named for the trawler Durraween, whose Master, Captain K. Moller, contributed many natural history specimens to the Australian Museum. Used as a noun in apposition.

Description. Based on Holotype, male 9.4 mm, AM P.21868.

Head. Rostrum long, length 0.3 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anterocentral corner rounded, ventral margin sloping. Antenna 1 very long, length 0.8 × body length, peduncle with scales; peduncular article 1 shorter than article 3, length 0.7 × peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner with distal projection flagellum 10-articulate; article 1 short. Antenna 2 length equal to antenna 1; flagellum 9-articulate.

Epistome and upper lip fused, produced, broad base, apically acute.

Pereon. Pereonite 1 with lateral keel, without sternal keel. Pereonites 2–3 with sternal keel. Pereonite 5 length 1.4 × depth.

Gnathopod 1 subchelate; coxa not fused to pereonite 1, without anterocentral lobe; basis length 2.1 × depth; carpus broad, length 1.5 × depth with setose posterior lobe, propodius palm acute, robust setae absent. Gnathopod 2 carpopodiate; coxa not fused to pereonite 2, length 1.6 × depth, without anterocentral lobe or cusp; basis short, broad, length 1.4 × breadth, basis without anteroproximal group of long slender setae, basis without anteroproximal bulge; carpus long, length 1.2 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, median length, length 1.2 × width; propodus broad, curved, length 4.5 × width, without tooth on posterior margin, posterodistal corner smooth, without spines; dactylus length 0.4 × propodus.

Pereopod 3 coxa not fused to pereonite 3, with broad anterocentral lobe, length 1.9 × depth; basis, length 1.9 × breadth, with proximal, subquadrate anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2 × breadth; merus length 1.1 × breadth; short; without ridges. Pereopod 4 coxa not fused to pereonite 4, length 2.1 × depth, with anteroventral lobe; basis length 1.7 × breadth, with plumose setal group midway along anterior margin or with simple setae along entire anterior margin; ischium long, length 2.5 × breadth; merus long, length 1.4 × breadth. Pereopod 5 coxa length 1.2 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 6 plumose setae; propodius with 4 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. Pereopod 6 coxa with setal fringe ventrally, without patches of small setae near margins; basis without patch of small setae near anterior margin; merus length 1.6 × breadth; dactylus short, uncinate, with 2 accessory hooks. Pereopod 7 coxa without posterodorsal lobe; merus length 2.1 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. Pleopods 1–3 biramous, decreasing in size anteroposteriorly. Pleopod 1 inner ramus 9-articulate; outer ramus 9-articulate, article 1 evenly swollen. Pleopod 2 inner ramus reduced, 1-articulate; outer ramus, broad, 1-articulate. Pleopod 3 inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. Uropod 1 biramous; peduncle, length 1.4 × outer ramus; rami with disloventral fan of robust setae; outer ramus with lateral row of denticles, without medial setae, with 14 lateral setae, with large apical robust seta and smaller slender setae; inner ramus length 0.5 × outer ramus, with 1 medial, and 3 lateral setae, without large apical robust seta. Uropod 2 uniramous, peduncle, length 2.8 × breadth, 4.4 × length of ramus; ramus small with 7 denticles and 1 slender apical seta. Uropod 3 uniramous, peduncle length 1.5 × breadth; ramus with 2 curved hooks. Telson length 0.6 × breadth, moderately cleft (58%), each lobe with 26–30 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on paratype female 7.0 mm, AM P.76109. Antenna 1 flagellum 9-articulate. Pereonite 1 without lateral keel. Pereonites 2–3 without sternal keel. Pereonite 5, length 1.9 × depth. Gnathopod 1 coxa, length 1.1 × depth; basis, length 2 × depth; carpus length 1.3 × depth with setose posterior lobe. Gnathopod 2 subchelate; coxa, length 1.7 × depth; basis, length 2.2 × breadth. Pereopod 5, coxa, length 1.4 × depth. Oostegites from gnathopod 2 to pereopod 5.

Tube. Tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Continental shelf and slope (82–366 m depth).

Remarks. The shape of gnathopod 2 propodus and carpus changes as males grow, with the carpus becoming longer than wide and the propodus becoming curved and slender in large males. In males less than 7 mm, the length and breadth of the carpus are equal and the propodus is less than three times as long as wide.

Three species, K. amelga, K. durraween and K. maia, have an evenly tapered rostrum. Neither Kapalana durraween nor K. maia have a large apical seta on the inner ramus of uropod 1. Kapalana durraween differs from K. maia in having scales on the peduncle of antenna 1, a lateral keel on pereonite 1 and a sternal keel on pereonite 3.
Figure 4. *Kapalana durraween* sp. nov., AM P.21867, central maternal tube with encircling juvenile tubes, 35 km east of Port Jackson, New South Wales, Australia (diameter of central tube = 2mm).

**Distribution.** Australia. *New South Wales*: east of Port Jackson; off Twofold Bay; off Disaster Bay. *Victoria*: west south west of Gabo Island.

*Kapalana kimbla* sp. nov.

Holotype, male, 9.4 mm, MV J70496, 26 km south-west of Cape Otway, Bass Strait, Victoria, Australia (39°01'00"S 143°22'06"E), 84 m, M. F. Gomon, 31 January 1981, MV Bass Strait Survey, BSS 120 S. Paratypes, ovigerous female, 9.6 mm, MV J70497; male, 6.8 mm, MV J70498; male, 7.4 mm, MV J70499; male, 5.7 mm, MV J70500; male, 4.6
Figure 5. *Kapalana durraween* sp. nov., holotype, male, 9.4 mm, AM P.21868; paratype, female, 6.96 mm, AM P.76109; paratype male “a”, 6.9 mm, AM P.10721; Disaster Bay, New South Wales, Australia. Gnathopod 2 male “a” and pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

mm, MV J70501; male, 3.9 mm, MV J70502; same data as holotype. One female, 1 male, MV J11259, cove on south shore Leonard Point, Wilsons Promontory, Victoria, Australia, (39°01'30"S 146°17'30"E), 3 February 1982, WPNPA. One male, 1 juvenile, MV J11295, north east end Vancouver Peninsula, Western Australia, Australia, (39°03'24"S 117°56'012"E), 7 m, 8 April 1984, SWA 18. Many specimens, AM P.99049, off Venus Bay township, Venus Bay, South Australia, Australia, (33°13'48"S 134°40'06"E), sand in channel, 3 m, G. C. B. Poore, 23 April 1985, SA 85.
**Additional material examined.** Many specimens, MV J11297, type locality, M. F. Gomon, 31 January 1981, MV Bass Strait Survey, BSS 120 S.

**Type locality.** 26 km south-west of Cape Otway, Bass Strait, Victoria, Australia (39°01'00"S 143°22'06"E).

**Etymology.** Named for HMAS *Kimbla* in recognition of many collections made for museums in Australia by this ship. Used as a noun in apposition.

**Description.** Based on Holotype, male, 9.4 mm, MV J70496.

**Head.** Rostrum long, length 0.5 × head, forming a basal shoulder, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner subquadrate, ventral margin horizontal, posterior margin vertical. *Antenna 1* long, length...
Figure 7. Kapalana kimbla sp. nov., holotype, male, 9.4 mm, MV J70496; paratype male “a”, 3.9 mm, MV J70502; paratype, male “b”, 4.6 mm, MV J70501; paratype, male “c”, 5.7 mm, MV J70500; paratype, male “d”, 6.8 mm, MV J70498; paratype, male “e”, 7.4 mm, MV J70499; paratype female, 9.6 mm, MV J70497; Bass Strait, Victoria, Australia. Gnathopod 2 males “a”, “b”, “c”, “d”, “e” insertion points of setae are indicated by small circles. Scales represent 0.1 mm.
Figure 8. *Kapalana kimbla* sp. nov., holotype, male, 9.4 mm, MV J70496; paratype, female, 9.6 mm, MV J70497; Bass Strait, Victoria, Australia. Pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

0.6 × body length; peduncle with scales; peduncular article 1 subequal to article 3, length 1.1 × peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner without distal projection; flagellum 9-articulate; article 1 short. *Antenna* 2 length 1.1 × antenna 1; flagellum 9-articulate.
Epistome and upper lip fused, produced, broad base, apically subquadrate.

**Pereon.** Pereonite 1 with lateral keel. Pereonites 1–3 with sternal keel. Pereonite 5 length 2 × depth. Gnathopod 1 coxa not fused to pereonite 1, length 1.4 × depth, without anteroventral lobe; basis length 2.2 × depth; carpus broad, length 1.4 × depth with setose posterior lobe, propodus palm acute, robust setae absent. Gnathopod 2 carpopodulate; coxa not fused to pereonite 2, length 1.8 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.4 × breadth, without anteroproximal group of long slender setae; carpus long, length 1.1 × breadth, broad, with smooth posterior margin; palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length equal to width; propodus slender, curved, length 4.9 × width, without tooth on posterior margin, posterodistal corner smooth with 1 tooth; dactylus length 0.4 × propodus.

**Pereopod 3** coxa not fused to pereonite 3, without anteroventral lobe, length 1.6 × depth; basis, length 1.9 × breadth, with proximal rounded anterodorsal corner, with simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2 × breadth; merus length 1.1 × breadth, short, without ridges. Pereopod 4 coxa not fused to pereonite 4, length 2.3 × depth, with anterior lobe separated from several small anteroventral lobes; basis, length 1.6 × breadth, with simple setal group midway along anterior margin; ischium long, length 2.4 × breadth; merus long, length 1.5 × breadth. Pereopod 5 coxa, length 1.4 × depth, without patches of small setae; setae along ventral margin few or absent; merus with anterior lobe not extending beyond anterior margin of carpus posterior lobe with 5 plumose setae; propodus with 3 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. Pereopod 6 coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; merus length 1.7 × breadth; dactylus short, uncinate, with 2 accessory hooks. Pereopod 7 coxa with posterodorsal lobe, without patch of small setae; merus length 2 × breadth; dactylus short, uncinate, with 2 accessory hooks.

**Pleon.** Pleopods 1–3 biramous, decreasing in size anteroposteriorly. Pleopod 1 inner ramus 10-articulate; outer ramus 7-articulate, article 1 evenly swollen. Pleopod 2 inner ramus reduced, 1-articulate; outer ramus broad, 3-articulate. Pleopod 3 inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. Uropod 1 biramous; peduncle length 1.3 × outer ramus; rami with disoventral fan of robust setae; outer ramus with lateral row of denticles, without medial and lateral setae, with large apical robust seta and smaller slender setae; inner ramus, length 0.6 × outer ramus, without medial setae, with 4 lateral setae. Uropod 2 uniramous, peduncle length 2.5 × breadth, 5 × length of ramus; ramus small with 5 denticles and 1 slender apical seta. Uropod 3 uniramous, peduncle length 1.7 × breadth; ramus with 3 curved hooks. Telson length 0.6 × breadth, weakly cleft (25 %), each lobe with 26–27 anteriorly directed hooks in 2 rows.

**Female** (sexually dimorphic characters). Based on female 9.6 mm, MV J11297. Antenna 1 flagellum 10-articulate. Antenna 2 flagellum 10-articulate. Pereonite 1 without lateral keel. Pereonites 1–3 without sternal keel. Pereonite 5 length 1.5 × depth. Gnathopod 1 basis, length 2.2 × depth; carpus length 0.7 × depth with setose posterior lobe. Gnathopod 2 subchelate; coxa, length 1.6 × depth; basis, length 1.9 × breadth. Pereopod 5 coxa, length 1.4 × depth. Oostegites from gnathopod 2 to pereopod 5.

**Tube.** Granular, fine or coarse grained, tubes of juveniles attached in a ring, circling the tube of adult female.

**Habitat.** Sub-littoral (3–84 m depth).

**Remarks.** The shape of gnathopod 2 propodus and carpus changes as males grow, with the propodus becoming curved and slender in large males. In males less than 5 mm in length, gnathopod 2 is subchelate and the carpus has a straight posterior margin. In males longer than 5 mm, gnathopod 2 becomes carpopodulate and the carpus develops an excavate posterior margin with the excavate margin becoming shallower and wider in large males longer than 9 mm.

**Kapalana kimbla** and **K. amelga** both have a strong subquadrate projection along the posterior margin of peduncular article 1 of antenna 1, a large apical robust seta on the inner ramus of uropod 1 and a shallow excavate palm on gnathopod 2. They differ in a number of characters including the posterior margin of the carpus of gnathopod 2 which is smooth in **K. kimbla**, but has a row of small spines in **K. amelga**. **Kapalana kimbla** is the only species with 3 curved hooks on uropod 3.

**Distribution.** Australia. **Victoria:** Bass Strait; Wilsons Promontory. **South Australia:** Venus Bay.

**Kapalana maia** sp. nov.

Figs 9–11

**Holotype.** male, 10.0 mm, MV J70540, 60 km east of North Point, Flinders Island, Bass Strait, (39°41’42”S 148°39’30”E), naturalist’s dredge, 115 m, 27 March 1979, G. C. B. Poore on HMAS *Kimbla*, BSS 32. **Paratypes,** female, 12.5 mm, MV J70541; 2 males, 3 females, 2 juveniles, MV J13712, same data as holotype. 1 male, 1 female, MV J11270, 63 km east of North Point, Flinders Island, Bass Strait, (39°44’48”S 148°40’36”E), WHOI epibenthic sled, 124 m, 14 November 1981, R. S. Wilson, BSS 167 S; 2 females, 2 juveniles, MV J1705, 25 km south of Cape Otway, Bass Strait, (39°06’00”S 143°35’48”E), grab, and shallow excavate tube, 95 m, M.F. Gomon, 31 January 1981, BSS 118.

**Additional material examined.** One female, MV J1706, 25 km south of Cape Otway, Bass Strait, (39°06’00”S 143°35’48”E), grab, and shallow excavate tube, 95 m, M.F. Gomon, 31 January 1981, BSS 118; 1 male, MV J11264 and 1 male, 2 females, 4 juveniles, MV J11257, 75 km south-west of Port Fairy, Bass Strait, (39°01’14”S 142°35’46”E), Smith-McIntyre grab/pipe dredge, 90 m, G.C.B. Poore, 9 October 1980, BSS 63; 1 female, MV J11258, 46 km south west of Lakes Entrance, Bass Strait, (38°17’15”S 147°29”E), otter trawl, 29–31 m, M.F. Gomon and R.S. Wilson, 31 July 1983, BSS 211 T; 1 female, MV J11260, 52 km west north-west of Cape Farewell, King Island, Bass Strait, (39°26’51”S 143°25’23”E), Smith-McIntyre grab/pipe dredge, 103 m, G.C.B. Poore, 10 October 1980, BSS 80; 20 specimens, MV J11265, 44 km NE of Cape Wickham, King Island, Bass Strait, (39°22’00”S 144°18’18”E), grab, and shallow excavate tube, 60 m, R.S. Wilson, 23 November 1981, BSS 203; 1 female, MV J11267, 80 km west south-west of Cape
Otway, Bass Strait, (39°59'S 142°37'E), Smith-McIntyre grab/pipe dredge, 94 m, G.C.B. Poore, 9 October 1980, BSS 62; 1 male, MV J11291, 79 km south south-east of Port Fairy, Bass Strait, (39°02'S 142°38'E), Smith-McIntyre grab/pipe dredge, 119m, G.C.B. Poore, 9 October 1980, BSS 64; 1 male, 2 females, MV J11292, 15 km south of Cape Wellington, Wilsons Promontory, Bass Strait (39°03'12"S 146°39'30"E), 55 m, WHOI epibenthic sled, R.S. Wilson, 18 November 1981, BSS 179 S; 1 male, MV J11519, off Crib Point, Western Port, Victoria (38°20'56"S 145°13'20"E), Smith-McIntyre grab, 8 m, A.J. Gilmour, 29 March 1965, CPBS-N; 6 specimens, MV J13710, 60 km east of North

Figure 9. *Kapalana maia* sp. nov., holotype, male, 10.0 mm, MV J70540, Bass Strait, Victoria, Australia. Scales represent 0.1 mm.
Figure 10. Kapalana maia sp. nov., holotype, male, 10.0 mm, MV J70540; paratype, female, 12.5 mm, MV J70541; Bass Strait, Victoria, Australia. Scales represent 0.1 mm.

Point, Flinders Island, Bass Strait, (39°41'42"S 148°39'30"E), naturalist's dredge, 115 m, G.C.B. Poore, 27 March 1979, BSS 32; 1 female, 200 m west of Kinghorne Point, Woodbridge, Tasmania, (43°10'00"S 147°17'00"E), pipe dredge, 27 m, R.S. Wilson, 17 April 1985, TAS 5; 1 female, MV J70505, 30 km north of North Point, Flinders Island, Bass Strait, (39°26'18"S 144°18'18"E), grab, sled and trawl, 49 m, R.S. Wilson, 17 November 1981, BSS 173; 1 female, AM P.99055, south east of Lakes Entrance, Bass Strait, (38°08'50"S 148°35'00"E), sandy clay, 146 m, C. Phipps on Esso Gipps, 5–7 May 1969, Stn. 9; 3 males, AM P.99056, 65 km south of Cape Schanck, Bass Strait (39°08'18"S 144°43'54"E), coarse sand, 66 m, R.S. Wilson on RV Tangaroa, 23 November 1981, BSS 201; 2 males, 1 female, 1 juvenile, AM P.99057, 23 km east of Cape Rochon, Three Hummock Island, Bass Strait (40°22'12"S 145°17'00"E), sand, epibenthic sled, 40 m, M.F. Gomon and G.C.B. Poore on RV Sarda, 3 November 1980, BSS 112.

Type locality. 60 km east of North Point, Flinders Island, Bass Strait, (39°41'42"S 148°39'30"E).
Etymology. The species name is derived from the Greek maia, meaning “good mother”, in reference to the juveniles living in tubes which are attached to the female tube.

Description. Based on Holotype, male, 10.0 mm, MV J70540. Head. Rostrum long, length 0.4 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin sloping. Antenna 1 very long, length 0.8 × body length; peduncle without scales; peduncular article 1 shorter than peduncular article 3; peduncular article 2 with medial triangular projection; flagellum 10-articulate; article 1 long. Antenna 2 length equal to antenna 1; flagellum 9-articulate.

Epistome and upper lip fused, produced, broad base, apically acute.

Pereon. Pereonite 1 without lateral keel or sternal keel. Pereonite 2 with sternal keel. Pereonite 3 length 1.3 × depth.

Gnathopod 1 coxa not fused to pereonite 1, length 2.2 × depth, without anteroventral lobe; basis, length 2.3 × depth; carpus broad, length 1.4 × depth with setose posterior lobe; propodus palm acute, robust setae absent. Gnathopod 2 carpochelate; coxa not fused to pereonite 2, length 1.5 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.6 × breadth; carpus long, length 1.2 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 1.1 × width; propodus broad, curved, length 4 × width, without tooth on posterior margin, posterodistal corner smooth, with 1 tooth; dactylus length 0.4 × propodus.

Gnathopod 3 coxa not fused to pereonite 3, with broad anteroventral lobe, length 1.8 × depth; basis, length 1.8 × breadth, evenly rounded, with simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2.3 × breadth; merus long, length 1.1 × breadth, short, without ridges. Pereopod 4 coxa not fused to pereonite 4, length 2.4 × depth, with anterior lobe separated from an anteroventral lobe; basis, length 1.9 × breadth, with simple setal group midway along anterior margin; ischium long, length 2.5 × breadth; merus long, length 1.3 × breadth. Pereopod 5 coxa, length 1.3 × depth, without patches of small setae; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 3 plumose setae; propodus with 2 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. Pereopod 6 coxa with setal fringe ventrally, without patches of small setae near margins; basis without patch of small setae near anterior margin; merus length 2 × breadth; dactylus short, uncinate, with 2 accessory hooks. Pereopod 7 coxa without posterodorsal lobe, without patch of small setae; merus length 2.5 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. Pleopods 1–3 biramous, decreasing in size anteroposteriorly. Pleopod 1 inner ramus 9-articulate; outer ramus 8-articulate, article 1 evenly swollen. Pleopod 2 inner ramus reduced, 1-articulate; outer ramus broad, 4-articulate. Pleopod 3 inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. Uropod 1 biramous; peduncle, length 1.5 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, with 2 medial setae, lateral setae absent, with large apical robust seta and smaller slender setae; inner ramus, length 0.5 × outer ramus, with 6 medial, and 5 lateral setae, without large apical robust seta. Uropod 2 uniramous, peduncle, length 3 × breadth, 5.1 × length of ramus; ramus small with 7 denticles and 1 slender apical seta. Uropod 3 uniramous, peduncle length 1.8 × breadth; ramus with 2 curved hooks. Telson length 0.7 × breadth, weakly cleft (27 %), each lobe with 28–29 anteriorly directed hooks in 2 rows.


Tube. Encrusted with fine sediment; tubes of juveniles attached in a ring, circling the tube of adult female.
Remarks. Kapalana maia belongs to the species group with a subquadrate projection along the posterior margin of peduncular article 1 of antenna 1. It shares with K. durraween, K. michaelmas and K. wadei a lack of apical robust seta on the inner ramus of uropod 1. It shares with K. durraween and K. wadei an anterodistal projection on peduncular article 2, but in K. maia the projection is triangular and more pronounced. It has an evenly tapered rostrum similar to K. durraween. Kapalana maia has no lateral keel on pereonite 1 or sternal keel on pereonite 3 (both present in K. durraween). The tubes of K. maia are encrusted with fine sediment (encrusted with sand grains and pieces of shell in K. durraween).

Distribution. Australia. Victoria: Bass Strait; Wilsons Promontory. Tasmania: Bass Strait; King Island; Flinders Island; Woodbridge.

*Kapalana michaelmas* sp. nov.

Figs 12–15

**Holotype**, male, 10.3 mm, AM P.75528, off south-east corner of Michaelmas Island, King George Sound, Western Australia, Australia (35°3’S 118°E), sand, 27 m, J. K. Lowry, 17 December 1983, WA 187. **Paratypes**: 1 female, 10.0 mm, AM P.75529; 1 male, 5.7 mm, AM P.75530; 1 male, 5.4 mm, AM P.75531; 1 male, 6.5 mm, AM P.75532; 1 male, 7.5 mm, AM P.75533; 1 male, 8.9 mm, AM P.75534; many specimens, AM P.75535; 1 specimen, AM P.75538; collection data same as holotype.

**Additional material examined.** One female, AM P.75536, near Mistaken Island, Vancouver Peninsula, King George Sound, Western Australia (35°4’S 117°56’E), seagrass, 6 m, R. T. Springthorpe, 13 December 1983, WA 121; 2 females, AM P.75537, near Mistaken Island, Vancouver Peninsula, King George Sound, Western Australia (25°4’S 117°56’E), seagrass, 3 m, J. K. Lowry, 13 December 1983, WA 112; 1 male, 6.2 mm, 1 female, 8.3 mm, 1 male, 20 females, SAM C1755, 6 miles off Semaphore, South Australia (34.837°S 138.484’E), 5 fathoms, H.M. Hale, 12 December 1925; 2 females, SAM C6341, 2 nautical miles south west of Point Avoid, Price Island, Eyre Peninsula, South Australia (35°42’2S 135°19’E), shale gutters and algae, 17 m, L. Hobbs on MRV Ngerin, 28 September 1989; females & juveniles, SAM C6342, West Island, South Australia (35°37’S 138°35’E), 5 m, S. A. Shepherd, 20 June 1989; many specimens, AM P99047, Cape Donington, Spencer Gulf, South Australia, (34° 44’S 135°59’E), rough bottom, 15 m, N. Coleman, 21 December 1970; 1 male, 1 juvenile, AM P99048, reef front, south of Tantabiddy, Ningaloo Reef, Western Australia, (21°54’36”S 113°55’42”E), coral heads, 9 m, N. L. Bruce and M. Blazewicz-Paszkwowycz, 12 June 2008, NIN 10c.

**Type locality.** Off south-east corner of Michaelmas Island, King George Sound, Western Australia, Australia (35°3’S 118°E).

**Etymology.** Named for Michaelmas Island, the type locality.

**Description.** Based on Holotype, male, 10.3 mm, AM P.75528.

**Head.** Rostrum long, length 0.5 × head, forming a basal shoulder, apically acute; lateral cephalic lobe with ventral corner subacute, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin sloping, posterior margin sloping. *Antenna 1* long, length 0.5 × body length; peduncle with scales; peduncular article 1 subequal in length to peduncular article 3, length 1.1 × peduncular article 3, with well-developed subquadrate projection along posterior margin; peduncular article 2 with distal projection; article 2 anterodistal corner without distal projection; flagellum 9-articulate; article 1 short. *Antenna 2* length 0.9 × antenna 1; flagellum 10-articulate.

**Epistome and upper lip** fused, produced, broad base, apically acute. **Mandible** palp article 2 long and slender (more than 2.5 × as long as broad); palp article 3 slender, blade-like.

**Pereon.** Pereonite 1 with lateral keel, without sternal keel. *Pereonites 2–3* without sternal keel. *Pereonite 5* length equal to depth.

*Gnathopod 1* subchelate; coxa not fused to pereonite 1, length 1.2 × depth, without anteroventral lobe; basis length 2.3 × depth; carpus broad, length 1.5 × depth with setose posterior lobe, propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.6 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.8 × breadth; carpus long, length 1.3 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 0.9 × width; propodus slender, curved, length 4.8 × width, without tooth on posterior margin, posterodistal corner smooth, without spines; dactylus length 0.5 × propodus.

*Pereopod 3* coxa not fused to pereonite 3, without anteroventral lobe, length 2.3 × depth; basis, length 2.1 × breadth, with proximal, subquadrate anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; ischiium long, length 2.3 × breadth; merus length equal to breadth, short; without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2 × depth, with anterior lobe separated from an anteroventral lobe; basis length 1.7 × breadth, with simple setae along entire anterior margin; ischiium long, length 2.9 × breadth; merus very long, length 1.5 × breadth. *Pereopod 5* coxa, length 1.3 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe not extending beyond anterior margin of carpus, posterior lobe with 2 plumose setae; propodus with 4 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; merus length 2 × breadth; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; merus length 2.4 × breadth; dactylus short, uncinate, with 2 accessory hooks.

**Pleon.** *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 9-articulate; outer ramus 6-articulate, article 1 evenly swollen. *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus, broad, 3-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; peduncle, length 1.4 × outer ramus; rami with distoventral fan of robust setae;
outer ramus with lateral row of denticles, with 6 medial setae and 18 lateral setae, with large apical robust seta and smaller slender setae; inner ramus, length $0.6 \times$ outer ramus, with 6 medial, and 4 lateral setae, without large apical robust seta. *Uropod 2* uniramous, peduncle, length $2.9 \times$ breadth, $3.7 \times$ length of ramus; ramus small with 7 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length $1.9 \times$ breadth; ramus with 2 curved hooks. *Telson* length $0.6 \times$ breadth, moderately cleft (21 %), each lobe with 38–39 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on female, 10.0 mm, AM P.75529. *Antenna 1* flagellum 10-articulate. Antenna 2 flagellum 7-articulate. *Pereonite 1* without lateral keel. *Gnathopod 1* coxa, length $1.4 \times$ depth; basis, length $2.6 \times$ depth, carpus length $0.7 \times$ depth with setose posterior lobe. *Gnathopod 2* simple; basis, broad, length $1.9 \times$ breadth, carpus length $1.7 \times$ breadth. *Pereopod 5* coxa, length $1.4 \times$ depth. *Oostegites* from gnathopod 2 to pereopod 5.

**Tube.** Tubes of adult males encrusted with fine and coarse organic matter. Tubes of adult females in two parts, the
anterior end encrusted with fine and coarse organic matter, the posterior end encrusted with large sand grains. Tubes of juveniles attached in a ring, circling the tube of adult female.

**Habitat.** Sublittoral (3–27 m depth).

**Remarks.** The shape of gnathopod 2 propodus and carpus changes as males grow, with the propodus becoming curved and slender in large males. In males less than 6 mm in length, gnathopod 2 is subchelate with a small anterodistal and posterodistal tooth. In males longer than 6 mm, gnathopod 2 becomes carpochelate, and the carpus develops an excavate posterior margin.

*Kapalana michaelmas* shares with *K. durraween*, *K. maia* and *K. wadei* a lack of apical robust seta on the inner ramus of uropod 1. The rostrum has a basal shoulder (a character shared with *K. kimbla* and *K. wadei*) but the rostrum is not as long as *K. wadei* (the rostrum is very long in *K. wadei*). Gnathopod 1 coxa is not fused to pereonite 1 in *K. michaelmas* (fused in *K. wadei*). In *K. michaelmas* the posterior lobe of the carpus of pereopod 5 bears 2 plumose setae and *K. wadei* bears 6 plumose setae.

**Distribution.** Australia. Western Australia: King George Sound; Ningaloo Reef. South Australia: off Semaphore; Price Island, Eyre Peninsula; West Island; Cape Donington, Spencer Gulf.
Figure 14. Kapalana michaelmas sp. nov., holotype, male, 10.3 mm, AM P.75528; paratype, female, 10.0 mm, AM P.75529; Michaelmas Island, King George Sound, Western Australia, Australia.

Scales represent 0.1 mm

Kapalana stebbingi sp. nov.

Figs 16–19

Cerapus abditus.—Stebbing, 1910: 616, pl. 5a.

Holotype, male, 8.9 mm, AM P.51210, east of Port Jackson, New South Wales, Australia (33°52’S 151°23’E), mud, 80 m, FRV Kapala, 27 October 1980, stn K-80-20-11. Paratypes: 1 female, ovigerous, 6.4 mm, AM P.51211; 1 male, 6.5 mm, AM P.99058; 1 male, 5.7 mm, AM P.99059; 1 male, 4.9 mm, AM P.99060; many specimens, AM P.99061; all same data as holotype. Many specimens, AM P.99062, south-east of Broken Bay, New South Wales, Australia, (33°36’S 151°30’E), trawl, 71–75 m, FRV Kapala, 10 February 1986; 1 female, AM P.2526; 1 male, 1 female, AM P.2527; 3–4 km off Botany Bay, New South Wales, Australia, (34°05’S 151°15’E), mud, 91–95 m, E.R. Waite on HMCS Thetis, 11 March 1898, stn 37. 1 male, AM P.2528, 9–12 km off Cape Three Points, New South Wales, Australia, (33°32’S 151°32’30”E), trawl, sticky mud and shell, 75–91 m, E.R. Waite on HMCS Thetis, 25 February 1898, stn 13; 1 male, AM P.99064, east of Broken Bay, New South Wales, Australia, (33°35’S 151°41’E), 135 m, FRV Kapala, 10 February 1896, K86-01-02; 2 specimens, AM P.99065, east of Long Reef Point, New South Wales, Australia, (33°46’S 151°43’E), dredge, 176 m, FRV Kapala, 5 December 1977, K77-23-01.

Additional material. Many specimens, AM P.99063, south-east of Broken Bay, New South Wales, Australia, (33°36’S 151°30’E), trawl, 71–75 m, FRV Kapala, 10 February 1986; 1 female, AM P.2526; 1 male, 1 female, AM P.2527; 3–4 km off Botany Bay, New South Wales, Australia, (34°05’S 151°15’E), mud, 91–95 m, E.R. Waite on HMCS Thetis, 11 March 1898, stn 37. 1 male, AM P.2528, 9–12 km off Cape Three Points, New South Wales, Australia, (33°32’S 151°32’30”E), trawl, sticky mud and shell, 75–91 m, E.R. Waite on HMCS Thetis, 25 February 1898, stn 13; 1 male, AM P.99064, east of Broken Bay, New South Wales, Australia, (33°35’S 151°41’E), 135 m, FRV Kapala, 10 February 1896, K86-01-02; 2 specimens, AM P.99065, east of Long Reef Point, New South Wales, Australia, (33°46’S 151°43’E), dredge, 176 m, FRV Kapala, 5 December 1977, K77-23-01.
Type locality. East of Port Jackson, New South Wales, Australia (33°52'S 151°23'E).


Description. Based on holotype male, 8.9 mm, AM P.51210.

Head. Rostrum long, length 0.3 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, ventral margin sloping, posterior margin sloping. **Antenna 1** long, length 0.6 × body length; peduncle with scales; peduncular article 1 shorter than article 3, length 0.6 × peduncular article 3, not produced anterodistally and anteromedially, with strong acute projection along posterior margin, posterodistal corner produced; peduncular article 2 anterodistal corner without distal projection; flagellum 9-articulate; article 1 long. **Antenna 2** length 1.1 × antenna 1; flagellum 7-articulate. 

Epistome and upper lip fused, produced, broad base, apically acute.

**Pereon.** Pereonite 1 with lateral keel, without sternal keel. Pereonites 2–3 without sternal keel. Pereonite 5 length 1.8 × depth.

**Gnathopod 1** simple; coxa fused to pereonite 1, without anteroventral lobe; basis length 2.2 × depth, carpus very broad, length 2.2 × depth with setose posterior lobe, propodus palm extremely acute. **Gnathopod 2** carpocelate; coxa fused to pereonite 2, length 1.3 × depth, without anteroventral lobe or cusp; basis long, slender, length 3 × breadth, basis without anteroproximal group of long slender setae, basis without anteroproximal bulge; carpus very long, length 1.9 × breadth, slender, palm straight, anterodistal tooth small, located near articulation with propodus, posterodistal tooth poorly defined; propodus slender, slightly curved, length 5.5 × width, with proximal tooth on posterior margin, posterodistal corner minutely rugose with 1 tooth; dactylus length 0.5 × propodus.

**Pereopod 3** coxa not fused to pereonite 3, without anteroventral lobe, length 1.7 × depth; basis, length 2.4 × breadth, with proximal, subquadrilateral anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; ischium long, length 3.9 × breadth; merus length 1.1 × breadth; short; without ridges. **Pereopod 4** coxa not fused to pereonite 4, length 2.3 × depth, with anterior lobe separated from an anteroventral lobe; basis length 1.8 × breadth, with plumose setae along entire anterior margin; ischium long, length 2.5 × breadth. **Pereopod 5** coxa, length 1.5 × depth, with patches of small setae, with setae along ventral margin; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 1 simple seta; propodus with 2 setae along posterior margin; dactylus short, uncinate with 1 accessory hook. **Pereopod 6** coxa with setal fringe ventrally, with patch of small setae near posterior margin; basis with patch of small setae near anterior margin; merus length 2.2 × breadth; dactylus short, uncinate, with 1 accessory hook. **Pereopod 7** coxa with posterodorsal lobe, with patch of small setae; merus length 2.5 × breadth; dactylus short, uncinate, with 1 accessory hook.

**Pleon.** Pleopods 1–3 biramous, decreasing in size anteroposteriorly. **Pleopod 1** inner ramus 7-articulate; outer ramus 4-articulate, article 1 with straight medial margin. **Pleopod 2** inner ramus reduced, 1-articulate; outer ramus, broad, 1-articulate. **Pleopod 3** inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. **Uropod 1** biramous; peduncle length 1.4 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, without medial setae, with 8 lateral setae, with large apical robust seta and smaller slender setae; inner
ramus, length 0.6 × outer ramus, without medial setae, with 4 lateral setae. Uropod 2 uniramous, peduncle, length 2.8 × breadth, 4.4 × length of ramus; ramus small with 4 denticles and 1 slender apical seta. Uropod 3 uniramous, peduncle length 1.8 × breadth; ramus with 2 curved hooks. Telson length 0.5 × breadth, moderately cleft (54%), each lobe with 20–23 anteriorly directed hooks in 2 rows.

**Female** (sexually dimorphic characters). Based on paratype female, 6.4 mm, AM P.51211. Antenna 1 flagellum 6-articulate. Pereonite 1 without lateral keel. Gnathopod 1 coxa not fused to pereonite 1, coxa, length 1.6 × depth; carpus broad, length equal to depth with setose posterior lobe. Gnathopod 2 simple; coxa not fused to pereonite 2, length 1.6 × depth; basis short, broad, length 1.8 × breadth, carpus long, length 1.6 × breadth. Pereopod 5 coxa, length 1.5 × depth. Oostegites from gnathopod 2 to pereopod 5.

**Tube**. Encrusted with sand grains and pieces of shell. Tubes of juveniles attached in a ring, circling the tube of adult female.

**Habitat**. Sublittoral and continental shelf (71–200 m depth).

**Remarks**. The shape of gnathopod 2 basis, propodus and carpus changes as males grow, with the propodus becoming slender and the basis carpus becoming much longer than wide in males larger than 7 mm. In males less than 5 mm...
Figure 18. Kapalana stebbingi sp. nov., holotype, male, 8.9 mm, AM P.51210; paratype, male “a”, 4.9 mm, AM P.99060; paratype, male “b”, 5.7 mm, AM P.99059; paratype, male “c”, 6.5 mm, AM P.99058; paratype, female, 6.4 mm, AM P.51211; east of Port Jackson, New South Wales, Australia. Gnathopod 2 males “a”, “b”, “c” insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

Kapalana stebbingi is the only species in the species group with antenna 1 peduncular article 1 with a strong subacute projection along the posterior margin, gnathopod 1 simple, the dactylus of pereopods 5–7 bearing 1 accessory hook, gnathopod 2 with a very long and slender carpus, the posterior margin of the propodus bearing a proximal tooth and a straight palm (all other species have an excavate palm).

Distribution. Australia. New South Wales: off Cape Three Points; off Botany Bay (Stebbing, 1910); east of Port Jackson; east of Long Reef; off Broken Bay. Victoria: south of Point Hicks.

Kapalana wadei sp. nov.

Holotype, male, 10.9 mm, AM P.78347, just beyond beach flats, off Bagnalls Beach, Port Stephens, New South Wales, Australia (32°43′17″S 152°07′17″E), benthic sledge, W. F. Ponder & S. J. Hall, 25 October 1980, NSW 191. Paratypes: 11 males, 2 females, 3 juveniles, AM P.78348; 1 male, AM P.78349; 1 male, 8.3 mm, AM P.78350; 1 male, 11.2 mm, AM P.78351; 1 female, 9.3 mm, AM P.78352; 1 male, 15.5 mm, AM P.78353; all with same data as holotype. Many specimens, AM P.78354, northern cove of Boondelbah Island, Port Stephens, New South Wales, Australia, (32°42′17″S 152°13′28″E), red algae and Kapalana tubes,
**Figure 19.** *Kapalana stebbingi* sp. nov., holotype, male, 8.9 mm, AM P.51210; paratype, female, 6.4 mm, AM P.51211; east of Port Jackson, New South Wales, Australia. Pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

hand collected on scuba, 17.1 m, P. B. Berents, 28 May 1998, NSW 1405; many specimens, AM P.78355, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia (32°42'07"S 152°14'16"E), *Kapalana* tubes on large rocks, hand collected on scuba, 21.7 m, P. B. Berents, 30 May 1998, NSW 1454.

**Additional material examined.** 8 specimens, AM P.78356, Port Kembla, New South Wales, Australia, (34°29'S 150°55'E), low lying reef, 18 m, J. E. Watson; 4 specimens, AM P.78357, Jibbon Head, New South Wales, Australia, (34°04'S 151°10'E), on weed on reef, 23 m, J.E. Watson; 1 female, AM P.78358, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia (32°42'07"S 152°14'16"E), brown-purple multi-siphoned low sponge in sediment and attached to rock, hand collected on scuba, 21.8 m, S. J. Keable, 30 May 1998, NSW 1443; 1 female, AM P.78359, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia, (32°42'07"S 152°14'16"E), orange finger sponge from rock, hand collected on scuba, 21.6 m, S. J. Keable, 30 May 1998, NSW 1444; several specimens, AM P.78360, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia, (32°42'07"S 152°14'16"E), on lacy bryozoan cf. *Triphyllozoon* sp. on boulder, hand collected on scuba, 21.6 m, A. Murray, 30 May 1998, NSW 1446; 2 specimens, AM P.78361, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia, (32°42'07"S 152°14'16"E), on orange feathery bryozoan, hand collected on scuba, 20.1 m, A. Murray, 30 May 1998, NSW 1453; 2 females, AM P.78362, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia, (32°42'07"S 152°14'16"E), on gelatinous ascidians on rocks, hand collected on scuba, 21.6 m, A. Murray, 30 May 1998, NSW 1455; 1 ovigerous female, AM P.78363,
east of Red Head, New South Wales, Australia, (32°03'17"S 152°33'14"E), encrusted rock surface with sediment and worm tubes, airlift, 12.3 m, P. B. Berents, R. T. Johnson, S. J. Keable, A. Murray & R. T. Springthorpe on RV Baragula, 22 March 2003, NSW 2265; 2 males, AM P.78588, Jolong Reef, approximately 700 metres north east of Cape Banks, New South Wales, Australia, (33°59'47"S 151°15'13"E), turfing algae, hand collected on scuba, 21 m, A. Murray on RV Baragula, 10 November 2008, MI NSW 3369; many specimens, AM P.75506, Park Beach Bommie, east of Coffs Harbour, New South Wales, Australia (30°17'42"S 153°12"E), green alga Halimeda sp., hand collected on scuba, R. T. Springthorpe on RV Baragula, 3 May 2005, NSW 2828; 1 specimen, AM P.73743, east of Red Head, New South Wales, Australia (32°03'17"S 152°33'14"E), small sandy tubes from rock, hand collected on scuba, 12 m, Australian Museum Party, RV Baragula, 22 March 2003, NSW 2246; 1 male, AM P.74098, northern cove of Boondelbah Island, Port Stephens, New South Wales, Australia (32°42'17"S 152°13'28"E), red algae and Kapalana tubes, hand collected on scuba, 17.1 m, P. B. Berents, 28 May 1998, NSW 1405; many specimens, AM P.99316, Home Bommie, south east of Sullivan’s Reef, east of Ulladulla, New South Wales, Australia (35°21'40"S 150°29'36"E), brown and red algae and lacy bryozoans scrapings on rock wall, by hand on scuba, 21.5 m, A. Murray on RV Baragula, 13 May 2013, MI NSW 4201.

**Type locality.** Off Bagnalls Beach, Port Stephens, New South Wales, Australia (32°43'17"S 152°07'17"E).

**Etymology.** Named for Dr Denis Wade AM, Former Foundation Professor, Clinical Pharmacology at The University of New South Wales.

**Description.** Based on holotype, male, 10.9 mm, AM P.78347.
Figure 22. *Kapalana wadei* sp. nov., holotype, male, 10.9 mm, AM P.78347; paratype male “b”, 8.3 mm, AM P.78350; paratype, female, 9.3 mm, AM P.78352; off Bagnalls Beach, Port Stephens, New South Wales, Australia. Scales represent 0.1 mm.

**Head.** Rostrum very long, length 0.6 × head, forming a basal shoulder, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin sloping, posterior margin sloping. *Antenna 1* long, length 0.5 × body length; peduncle with scales; peduncular article 1 subequal to article 3, length 1.1 × peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner with distal projection flagellum 10-articulate; article 1 short. *Antenna 2* length 1.1 × antenna 1; flagellum 7-articulate.
Figure 23. *Kapalana wadei* sp. nov., holotype, male, 10.9 mm, AM P.78347; off Bagnalls Beach, Port Stephens, New South Wales, Australia. Scales represent 0.1 mm.

*Epistome and upper lip* fused, produced, broad base, apically acute. *Mandible*, palp article 2 long and slender, 2.5 × as long as broad, subequal in length to article 3; palp article 3 slender, blade-like, length 5.2 × breadth.


*Gnathopod 1* subchelate; coxa fused to pereonite 1, without anteroventral lobe; basis length 2.2 × depth; carpus broad, length 1.4 × depth with setose posterior lobe, propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.9 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.5 × breadth; carpus long, length 1.1 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, long, length 2.1 × width; propodus slender, strongly curved, length 5.1 × width, without tooth on posterior margin, posterodistal corner rugose, without spines; dactylus length 0.4 × propodus.

*Pereopod 3* coxa not fused to pereonite 3, without anteroventral lobe, length 1.8 × depth; basis, length 2.3 × breadth, with proximal rounded anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; length 1.9 × breadth; merus length 1.2 × breadth, short, without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2.3 × depth, with anteroventral lobe; basis, length 2 × breadth, with simple setal group midway along anterior margin; ischium long, length 2.6 × breadth; merus long, length 1.4 × breadth. *Pereopod 5* coxa, length 0.8 × depth, without patches of small setae, with setae along ventral margin; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 6 plumose setae; propodus with 5 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near margins; ischium long, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; dactylus short, uncinate, with 2 accessory hooks.

*Pleon*. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 10-articulate; outer ramus 9-articulate, article 1 evenly swollen. *Pleopod 2* inner
Figure 24. *Kapalana wadei* sp. nov., holotype, male, 10.9 mm, AM P.78347; paratype male “a”, 8.3 mm, AM P.78350; paratype, male “b”, 15.5 mm, AM P.78353; paratype, female, 9.3 mm, AM P.78352; off Bagnalls Beach, Port Stephens, New South Wales, Australia. Gnathopod 2 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.
### Key to species of *Kapalana* g. nov.

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<th>Key</th>
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<td>Rostrum very long, more than half as long as head</td>
<td><em>Kapalana wadei</em> sp. nov.</td>
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<tr>
<td></td>
<td>Rostrum less than half as long as head</td>
<td><em>Kapalana wadei</em> sp. nov.</td>
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<tr>
<td>2</td>
<td>Gnathopod 2 propodus with tooth on posterior margin</td>
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<tr>
<td></td>
<td>Gnathopod 2 propodus without tooth on posterior margin</td>
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<td>3</td>
<td>Gnathopod 2 carpus with row of small spines on posterior margin</td>
<td><em>Kapalana amelga</em> sp. nov.</td>
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<tr>
<td></td>
<td>Gnathopod 2 carpus without row of small spines on posterior margin</td>
<td><em>Kapalana michaelmas</em> sp. nov.</td>
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<td>Antenna 1 peduncular article 2 with medial triangular projection on posterodistal corner</td>
<td><em>Kapalana maia</em> sp. nov.</td>
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<tr>
<td></td>
<td>Antenna 1 peduncular article 2 without medial triangular projection on posterodistal corner</td>
<td><em>Kapalana durraween</em> sp. nov.</td>
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<td>5</td>
<td>Rostrum evenly tapered</td>
<td><em>Kapalana durraween</em> sp. nov.</td>
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<td>Rostrum forming a basal shoulder</td>
<td><em>Kapalana kimbla</em> sp. nov.</td>
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<td>6</td>
<td>Pereopod 5 merus posterior lobe with 2 plumose setae</td>
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<tr>
<td></td>
<td>Pereopod 5 merus posterior lobe with 5 plumose setae</td>
<td><em>Kapalana kimbla</em> sp. nov.</td>
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**Distribution.** Australia. *New South Wales*: Coffs Harbour to Ulladulla.

### Discussion

Within the Cerapodini the unusual process by which juveniles attach their tubes to adult females appears to be unique to *Kapalana*. Extended parental care has been reported in amphipods and may take the form of juveniles remaining in the female marsupium (Shillaker & Moore, 1987; Kobayashi et al., 2002; Thiel, 2003), juveniles on the female body (Aoki, 1999) and juveniles sharing the parental dwelling (Thiel, 2000b, 2003). Myers (1971) reported that the young of another corophiid, *Microdeutopus gryllotalpa* Costa, 1853, constructed tubes on the inside and outside of the parental tube.

Thiel (2003) suggests that the benefits of parental care include provision of a microhabitat for juveniles, assistance with feeding or grooming of juveniles and active defence or guarding. Thiel (1999) noted that when females carry their offspring, a second brood is not usually produced while carrying one brood, but in examples when the female guards the juveniles, a second brood may be produced while caring for the first, as seen in *Kapalana* (Fig. 4).

Although nothing is known about possible interactions between parent and juveniles in *Kapalana*, the fact that up to two generations of juveniles may attach to the mother tube indicates at least passive protection (Shillaker & Moore, 1987; Thiel, 1999, 2000a). It is not known how long juveniles of *Kapalana* remain in the tube attached to the female tube. Thiel (1999) found the duration of extended parental care in tube dwelling species to be variable but may be long lasting (exceeding 20 days).
ACKNOWLEDGMENTS. We thank the late Sharne Wiedland for her beautiful illustrations of whole animals and tubes; Roger Springthorpe for the illustrations of *K. amelgor*; Dr Lauren Hughes for assistance with scanning of figures; Dr Joanne Taylor and Thierry Laperousaz for loans from Museums Victoria and the South Australian Museum respectively, and for donating specimens to the collections of the Australian Museum; Dr Stephen Keable and Collection Management staff at the Australian Museum for assistance with curation of material. We thank Dr Alan Myers for his critical reading of the manuscript. The manuscript was improved as a result of comments by two anonymous referees.

References


