

streaks. Aperture white or light yellowish to orangish brown deep within.

Periostracum pale olive-grey, thin, translucent, smooth.

In form *solomonensis* (Pl. 40, Figs. 6, 7), ground colour white to bluish grey, variably suffused with brownish beige. On last whorl, beige shades usually arranged in 3-4 spiral bands, at base, on both sides of centre and often below shoulder. Basal bands usually fused, often all bands confluent. Spiral rows of brown to blackish brown dots, spots and axial streaks extending from base to shoulder, mostly restricted to 3-4 spiral zones with larger and more prominent markings overlying the beige background bands. Larval whorls and first 2-4 postnuclear sutural ramps brown to beige. Following ramps with white to blackish brown radial markings; marginal brown dots may be present. Aperture violet to bluish violet deep within, with brown to orange-brown collabral edge.

Periostracum matching that of typical form.

A dark coloured form from Solomon Is. (Pl. 40, Figs. 8, 9, 13) differs from form *solomonensis* in having more prominent brown-beige background shades and a dark brown apex. Largely solid, coarse dark brown spiral lines extend from base to subshoulder area. Dark brown bars, flecks, and flames may cover most of the last whorl or may be absent. Radial markings on late sutural ramps larger and confluent.

Shells from Flores (Pl. 40, Figs. 10, 11) with a greyish violet ground colour. Last whorl pattern similar to that of typical *C. sertacinctus* but with prominent spiral rows of brown dots between the 4 spiral bands. Beige background bands absent. Apex white to grey; following sutural ramps with brown radial streaks and flames, without marginal dots. Aperture brown to bluish violet deep within, with a darker collabral edge.

Periostracum grey, thin, translucent, smooth.

In shells from Batangas Bay (Pl. 40, Fig. 12), ground colour white to greyish violet or beige. Last whorl with 3-4 darker beige background bands overlain by brown to red-brown flecks, axial streaks and flames sometimes fusing into solid spiral bands. Intervening zones with a few spiral rows of similarly coloured dots, spots or bars. Apex pale brown to brown; following sutural ramps matching last whorl in colour pattern. Aperture brownish violet to violet deep within, with an orange-brown to brown collabral edge.

Animal of form *solomonensis* beige-grey (Delsaerd, 1993). In dark coloured form from Solomon Is., foot greyish beige, mottled with dark brown on sole; dorsum with a blackish brown pre-marginal band latero-posteriorly. Tentacles white. Siphon brown or mottled grey and brownish beige, with blackish brown markings dorsally or dorso-laterally (Moylan, 1990). In specimens from Flores, animal uniformly pinkish white (Raybaudi & Ormas, 1992).

**Habitat and Habits:** Usually in 2-30 m, on sand; sometimes dredged as deep as 100 m. Specimens from Flores in 0.3-3 m, most common between 0.3-0.5 m, on fine white coral sand (Raybaudi & Ormas, 1992).

**Discussion:** *C. sertacinctus* resembles *C. collisus*, *C. andamanensis*, *C. subulatus*, *C. broderipii*, *C. scalptus*, and *C. stramineus*. *C. collisus* has a generally more conical last whorl (PMD 0.80-0.90), a more angulate shoulder, and a more prominent spiral sculpture on its late sutural ramps. *C. andamanensis* tends to have a conical or conoid-cylindrical rather than ventricosely conical last whorl, its spire outline is concave rather than sigmoid, and its last whorl pattern comprises small scattered markings. *C. subulatus* differs in its narrower last whorl (RD 0.51-0.54), more angulate shoulder, and its slightly concave late sutural ramps with a more prominent spiral sculpture. *C. scalptus* is smaller (to 28 mm), has more prominent spiral sculpture on the late sutural ramps, and the spiral lines on its last whorl are finer than those of dark-coloured *C. sertacinctus* from Solomon Is.

Typical *C. broderipii* can be distinguished by a generally lower spire with a concave rather than sigmoid outline, a generally more angulate shoulder, the absence of beige background shades, and by a last whorl pattern of typically 3 instead of 4 spiral bands. The population from Philippines provisionally assigned to *C. broderipii* and the population from Batangas Bay provisionally assigned to *C. sertacinctus* are closer in shape and colour pattern; they can be separated by the dashed spiral lines on the last whorl of the shells assigned to *C. broderipii* and by their white to beige apex. For comparison between *C. sertacinctus* and *C. stramineus*, see the Discussion of the latter species.

The description of *C. sertacinctus* was based on shells from Guadalcanal, Solomon Is. (Pl. 40, Figs. 4, 5) that we provisionally consider a light colour variant of the more common form recently described as *C. solomonensis* (Pl. 40, Figs. 6, 7). *C. sertacinctus* form *solomonensis* has a relatively wide geographical range from Solomon Is. and E. New Britain to Philippines and India.

Dark coloured shells from Solomon Is. (Pl. 40, Figs. 8, 9, 13) and from Marshall Is. are so similar to typical *C. sertacinctus* and form *solomonensis* in shell characters and animal colour that we regard them as a colour pattern variant of the same species.

The shallow-water population from Flores (Pl. 40, Figs. 10, 11) is provisionally assigned to *C. sertacinctus*, because its shells are similar in colour pattern and unseparable by morphology. However, differences in the colour patterns of shells and animals suggest at least separation as a local race. Although the shells from Batangas Bay (Pl. 40, Fig. 12) are provisionally assigned to *C. sertacinctus*, a conclusive taxonomic placement of this population between *C. broderipii* and *C. sertacinctus* depends on further research.

***Conus stramineus* LAMARCK, 1810**

(Plate 40, Figures 14-21; Map 79)

- 1810 *Conus stramineus* Lamarck, Ann. Mus. Hist. Nat. Paris, **15**: 273, no. 81
- 1833 *Conus alveolus* Sowerby I, Conch. Ill.: Pt. 25, fig. 11
- 1858 *Conus nissus* "Chemnitz" Sowerby II, Thes. Conch., **3**: 33, pl. 19 figs. 470, 471 (non *C. nissus* Dillwyn, 1817, non *C. nissus* Kiener, 1845)
- 1877 *Conus fuscomaculatus* E. A. Smith, Ann. Mag. Nat. Hist., **19**: 224
- 1936 *Conus mulderi* Fulton, Proc. Zool. Soc. London, **22**: 9, pl. 2 fig. 1
- 1992 *Conus stramineus amplus* Röckel & Korn, Acta Conchyl., **3**: 27-28, pl. 2 figs. 21-25 (nom. nov. for *C. nissus* Sowerby II, 1858)

**Types:** *C. stramineus*: Neotype (Kohn, 1981) in MNHN (34 x 16 mm); *C. alveolus*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 25 fig. 11) (35 x 15 mm); *C. nissus* Sowerby II: Lectotype (Röckel, 1987a) figured in Sowerby II (1858: Pl. 19 fig. 471) (30.5 x 16 mm); *C. fuscomaculatus*: Holotype in BMNH (37.5 x 16 mm); *C. mulderi*: Holotype in BMNH (29 x 13.5 mm).

**Type Localities:** *C. stramineus*: "l'Océan Asiatique"; *C. nissus*: "Moluccas, Philippines"; *C. mulderi*: "Mindoro Island, Philippines."

**Range:** *C. s. stramineus*: Indonesia (Moluccas); *C. s. mulderi*: Philippines, Papua New Guinea, and Solomon Is.

**Description:** Medium-sized, moderately solid. Last whorl ventricosely conical, occasionally conical in *C. s. stramineus* (Pl. 40, Figs. 14-17) and conoid-cylindrical in *C. s. mulderi* (Pl. 40, Figs. 18-21), generally narrower in *C. s. stramineus*; outline convex adapically, less so to straight below; left side may be concave just above base. Aperture slightly wider at base than near shoulder in *C. s. stramineus*, more so in *C. s. mulderi*. Shoulder angulate to subangulate, sometimes rounded. Spire usually low in *C. s. stramineus*, of moderate height in *C. s. mulderi*; outline concave. Larval shell of 2.25-2.5 whorls, maximum diameter 0.6-0.8 mm. Teleoconch sutural ramps flat to slightly convex, occasionally slightly concave in late whorls, with 0 increasing to 3-7 spiral grooves; latest ramps may have additional spiral striae. Last whorl with spiral grooves on basal fourth to third, occasionally to centre; ribbons between broad posteriorly, narrower and alternating with wide grooves anteriorly.

***C. stramineus* Shell Morphometry**

	<i>C. s. stramineus</i>	<i>C. s. mulderi</i>
<b>L</b>	34 - 43 mm	33 - 52 mm
<b>RW</b>	0.14 - 0.17 g/mm	0.12 - 0.26 g/mm
<b>RD</b>	0.51 - 0.56	0.53 - 0.63
<b>PMD</b>	0.79 - 0.87	0.74 - 0.85
		(to 0.87 in subadults)
<b>RSH</b>	0.08 - 0.13	0.11 - 0.19

Ground colour white to bluish grey. In *C. s. stramineus*, last whorl with rather regular spiral rows of yellowish or

reddish brown dots, spots and bars that are also mostly aligned axially; markings fuse into discontinuous spiral bands below shoulder and above centre. In *C. s. mulderi*, last whorl pattern similar but with an additional spiral band within basal third, and markings seldom aligned axially. Siphonal fasciole white to pale violet in *C. s. stramineus*, white in *C. s. mulderi*. Larval whorls and a few adjacent postnuclear sutural ramps white to brown. In *C. s. stramineus*, following sutural ramps solid brown or with variably discrete radial streaks and blotches. In *C. s. mulderi*, following sutural ramps with separate reddish to dark brown radial streaks and blotches often extending over shoulder edge. Aperture light to dark or brownish violet; *C. s. mulderi* with an orange-brown collabral band.

Periostracum olive-grey, thin, translucent, smooth (*C. s. mulderi*).

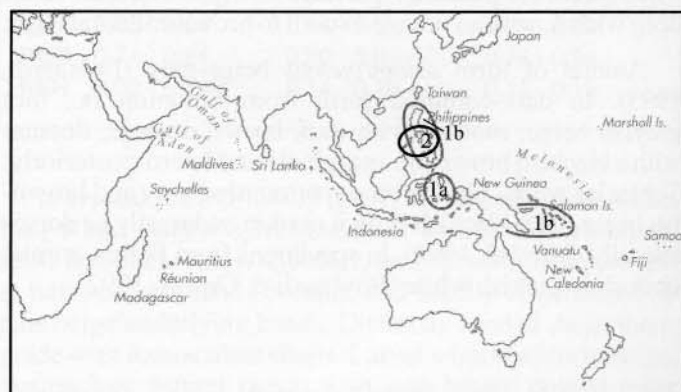
**Habitat and Habits:** Shallow water.

**Discussion:** *C. stramineus* resembles *C. iodostoma*, *C. sertacinctus*, *C. zebra*, and *C. zapatosensis*. *C. iodostoma* differs in having its last whorl more finely patterned, with few to many rows of reddish brown dots and sometimes with wavy axial lines forming an irregular network. Its spiral rows lack the larger dots and bars of *C. stramineus*. *C. sertacinctus* is a somewhat smaller species (to 40 mm); its last whorl has beige background shades and lacks the predominant pattern of regular spiral rows of brown dots, spots and bars characteristic of *C. stramineus*. *C. s. stramineus* can be also distinguished by its usually narrower last whorl (RD 0.51-0.56 vs. 0.53-0.64) and its solid brown postnuclear sutural ramps. For comparison with *C. zapatosensis* and *C. zebra*, see the Discussions of those species.

*C. nissus* Sowerby II was renamed *C. stramineus amplus* by Röckel and Korn (1992), as a geographic subspecies of *C. stramineus* (Röckel, 1987b). However, this subspecies had already been described in 1936 as *C. mulderi*, based on a subadult shell as holotype (Pl. 40, Fig. 21). The differences between *C. s. stramineus* and *C. s. mulderi* do not justify separation at the species level.

*C. alveolus* and *C. fuscomaculatus* (Pl. 40, Fig. 17) are synonyms of *C. s. stramineus*.

Map 79



1a: *C. stramineus stramineus* 1b: *C. stramineus mulderi* 2: *C. zapatosensis*

***Conus zapatosensis* RÖCKEL, 1987**

(Plate 40, Figures 22-25; Map 79)

1987 *Conus zapatosensis* Röckel, Spixiana, **10** (3): 288-293, figs. 8, 12**Type:** Holotype in ZSM (40 x 19 mm).**Type Locality:** "Zapatos Island, Negros, Philippinen."**Range:** Philippines (Zapatos Id., Marinduque, Burias Strait).

**Description:** Medium-sized, moderately solid. Last whorl ventricosely conical to conoid-cylindrical, outline convex; left side constricted just above base. Aperture wider at base than near shoulder. Shoulder angulate to sharply angulate. Spire of low to moderate height, outline concave. Larval shell of 2-2.5 whorls, maximum diameter 0.8-0.9 mm. Teleoconch sutural ramps flat, with 1 increasing to 3-7 pronounced spiral grooves. Last whorl with widely spaced axially striate spiral grooves from base to centre or shoulder; intervening ribbons broadest centrally, divided into pairs or triplets of narrow ribbons at base.

***C. zapatosensis* Shell Morphometry**

<b>L</b>	36 - 48 mm
<b>RW</b>	0.11 - 0.20 g/mm
<b>RD</b>	0.53 - 0.59
<b>PMD</b>	0.76 - 0.84
<b>RSH</b>	0.10 - 0.19

Ground colour cream. Last whorl with 3 groups of 2-5 rows of dark brown to violet-brown spots or bars on spiral ribbons, within basal third, just above centre and at sub-shoulder area. Spirally arrayed or irregularly scattered fine brown dots and axial dashes occur on entire last whorl but vary in number and arrangement. Larval whorls and early postnuclear sutural ramps light brown to almost white. Late sutural ramps with dark brown radial streaks and blotches. Aperture white or light yellow, with a darker collabral band.

**Habitat and Habits:** Reported from 75-120 m.

**Discussion:** *C. zapatosensis* resembles *C. stramineus mulderi* in size, shape and colour pattern. However, shells of the latter have less angulate shoulders, the spiral sculpture of the last whorls is restricted to the basal parts, the ground colour is bluish grey, and the aperture is violet to orange-brown. *C. subulatus* differs from *C. zapatosensis* in having a narrower and usually more conical last whorl (RD 0.51-0.54). Its aperture is violet and lacks the dark collabral band. *C. zapatosensis* is most similar to the dark-coloured shells from Philippines provisionally assigned to *C. blanfordianus*. The latter tend to have slightly broader last whorls (RD 0.56-0.61); their ground colour is white rather than cream, their spiral rows of spots and bars are more uniformly distributed adapically, and the fine brown dots and axial dashes on their last whorls are more sparse. With

regard to these rather slight differences, we cannot unequivocally exclude conspecificity.

***Conus zebra* LAMARCK, 1810**

(Plate 40, Figures 26-33; Map 80)

1810 *Conus zebra* Lamarck, Ann. Mus. Hist. Nat. Paris, **15**: 273, no. 821986 *Conus nahoniaraensis* da Motta, La Conchiglia, **18** (210-211): 20-21, text figs.**Types:** *C. zebra*: Holotype in MNHN (27 x 15 mm); *C. nahoniaraensis*: Holotype in MHNG (32 x 16 mm).**Type Localities:** *C. zebra*: "l'Océan Asiatique"; *C. nahoniaraensis*: "off Honiara, Guadalcanal island, Solomon Sea."**Range:** Indonesia, Papua New Guinea, and Solomon Is.

**Description:** Moderately small, moderately light to moderately solid. Last whorl ventricosely conical, occasionally slightly pyriform in form *nahoniaraensis*; outline variably convex adapically, less so to slightly concave basally. Shoulder subangulate to rounded. Spire of low to moderate height, outline concave or sigmoid. In form *nahoniaraensis*, larval shell of about 2 whorls, maximum diameter about 0.7 mm; typical form with a maximum diameter of about 0.8 mm. Teleoconch sutural ramps flat to slightly convex; later ramps with 3-5 increasing to 5-8 fine spiral grooves; in last 1-2 whorls, spiral sculpture may be weak or have additional spiral striae. Last whorl with widely spaced axially striate spiral grooves on basal third to half, ribbons between narrower or grading to ribs near base.

***C. zebra* Shell Morphometry**

<b>L</b>	25 - 33 mm
<b>RW</b>	0.07 - 0.12 g/mm
<b>RD</b>	0.54 - 0.65
-form <i>nahoniaraensis</i>	0.58 - 0.61
<b>PMD</b>	0.75 - 0.84
<b>RSH</b>	0.10 - 0.17

Ground colour white to cream or grey; bluish or purplish grey in form *nahoniaraensis* (Pl. 40, Figs. 31-33). Last whorl with orangish to blackish brown axial flames from base to shoulder ramp, partially as axial rows of spots toward base. Shells with variably interrupted axial markings intergrade with shells primarily with spiral rows of dots, dashes and bars that tend to fuse into axial streaks and blotches. Form *nahoniaraensis* with axially as well as spirally arrayed separate brown spots that fuse axially. Apex brown; later postnuclear sutural ramps with orangish to blackish brown radial markings. In form *nahoniaraensis*, larval whorls white to light brown, early postnuclear sutural ramps grey to brown, and late sutural ramps with very



sparse radial maculation. Aperture blue or violet, with brown collabral band; colour more prominent in form *nahoniaraensis*.

Periostracum grey, thin, translucent, smooth.

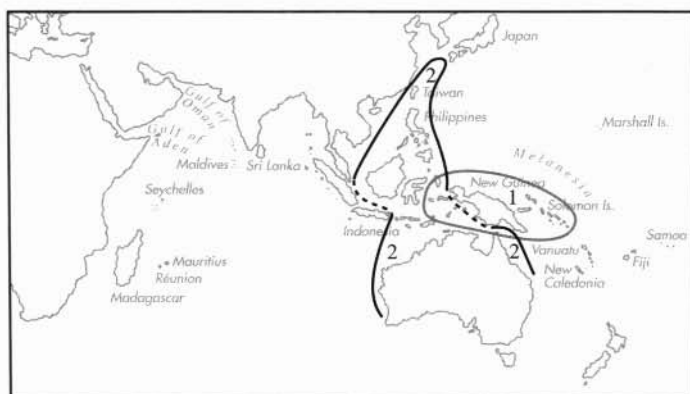
In E. New Britain, animal reported to be brown with white flecks, and with brown transverse stripes on the siphon (Richards, pers. comm., 1989).

**Habitat and Habits:** Intertidal to about 30 m. In E. New Britain, in 1-2 m as well as in about 30 m (Richards, pers. comm., 1989). Form *nahoniaraensis* on sand bottom in 2-18 m (Bailey, pers. comm., 1986).

**Discussion:** *C. zebra* is very similar to *C. stramineus* and *C. subulatus*. *C. stramineus* attains larger size (L 33-52 mm), has a more angulate shoulder in similarly sized shells, and the spiral sculpture on its late sutural ramps is distinctly coarser. Its last whorl pattern has a primarily spiral arrangement and forms spiral bands, while that of *C. zebra* is predominantly axially rather than spirally arranged and has axial flames. *C. subulatus* differs in having a narrower last whorl (RD 0.51-0.54) and a violet aperture without a brown collabral band.

The holotype of *C. zebra* is in poor condition, and the type locality is unknown. However, specimens from the Solomon Is. (Pl. 40, Fig. 27) as well as from Indonesia (Pl. 40, Fig. 30) correspond closely enough with the type (Pl. 40, Fig. 26) to justify their identification as *C. zebra*. Specimens from E. New Britain (Pl. 40, Figs. 28, 29) with an often narrower last whorl (RD 0.54-0.60) and an axially as well as spirally arranged pattern are almost identical in size, weight, sculpture and colouration and intergrade with the typical form in shape and pattern. We therefore consider them conspecific with *C. zebra*. Specimens described as *C. nahoniaraensis* also occur in the Solomon Is., with typical *C. zebra*. They may have a slightly pyriform shape and differ slightly in colour pattern of the last whorl as well as the spire, although some specimens have a zebrine pattern on the last whorl and sutural ramps. As they are not separable from *C. zebra* by shell morphology, we provisionally assign them to this species as a form.

Map 80



1: *C. zebra* 2: *C. spectrum*

# *Conus spectrum* LINNÉ, 1758

(Plate 41, Figures 1-31; Map 80)

- 1758 *Conus spectrum* Linné, Syst. Nat., 10 ed., 1: 717, no. 280
- 1798 *Cucullus carota* Röding, Mus. Bolten., 2: 47, no. 597/93
- 1810 *Conus lacteus* Lamarck, Ann. Mus. Hist. nat. Paris, 15: 274, no. 83
- 1843 *Conus conspersus* Reeve, Proc. Zool. Soc. London, 11: 180; 1844: Conch. Icon., 1, *Conus*: Pl. 47 sp. 262
- 1845 *Conus verreauxii* Kiener, Coq. Vivant., 2: Pl. 60 fig. 5; 1849: 249-250
- 1849 *Conus stillatus* Reeve, Conch. Icon., 1, *Conus* suppl.: Pl. 5 sp. 247
- 1849 *Conus filamentosus* Reeve, Conch. Icon., 1, *Conus* suppl.: Pl. 6 sp. 260
- 1849 *Conus pica* A. Adams & Reeve, Zool. Voy. Samarang, Moll., 18: Pl. 5 figs. 10 a-d
- 1864 *Conus daphne* Boivin, J. Conchyl. (Paris), 12: 35, pl. 1 figs. 7, 8
- 1864 *Conus dolium* Boivin, J. Conchyl. (Paris), 12: 38, pl. 1 figs. 3, 4

**Types:** *C. spectrum*: Lectotype (Kohn, 1963) figured in Rumphius (1705: Pl. 32 fig. S) (39 x 21 mm); *C. carota*: No type exists; *C. lacteus*: Lectotype (Kohn, 1981) in MHNG (30 x 15.5 mm); *C. conspersus*: Holotype figured in Reeve (1844: Pl. 47 sp. 262) (30 x 16 mm); *C. verreauxii*: Original figure 40 x 21 mm; *C. stillatus*: Original figure 36 x 20 mm; *C. filamentosus*: Type in BMNH (28.5 x 13.5 mm); *C. pica*: 3 syntypes in BMNH; *C. daphne*: Holotype figured in Boivin (1864: Pl. 1 figs. 7, 8) (35 x 19 mm); *C. dolium*: Holotype figured in Boivin (1864: Pl. 1 figs. 3, 4) (37 x 22 mm).

**Type Localities:** *C. spectrum*: "Asia"; *C. lacteus*: "Asie"; *C. conspersus*: "Moluccas, Indonesia" (Coomans et al., 1985a); *C. verreauxii*: "Les côtes du cap de Bonne-Espérance"; *C. pica*: "Island of Balambangan, north end of Borneo"; *C. stillatus*: "Moluccas"; *C. daphne*: "océan Indien."

**Range:** Indonesia to Philippines and Ryukyu Is., to Australia and Papua New Guinea.

**Description:** Medium-sized to moderately large and moderately light to solid, relative weight of similarly sized specimens may vary by 50%; form *pica* (Plate 41, Figs. 9-12) moderately small to medium-sized and moderately solid. Last whorl usually ventricosely conical, occasionally conoid-cylindrical or ovate; outline convex adapically, less so to straight below; left side usually concave above prominent siphonal fasciole, seldom so in form *pica*. Aperture wider at base than near shoulder. Shoulder angulate to subangulate. Spire low, outline concave. Larval shell of 2.25-2.75 whorls; maximum diameter 0.8-1.1 mm, 0.8-0.9 mm in form *pica*. Early postnuclear whorls occasionally undulate to weakly tuberculate. Teleoconch sutural ramps almost flat, with 0-2 increasing to 3-5 equal or to 7-8 variably broad spiral grooves; elevations between usually as well separated ribs, grading to spirally striate, closely spaced ribbons in form *pica*. Last whorl with variably spaced spiral ribs and ribbons separated by grooves on basal third to half, sometimes followed by spiral threads to shoulder; in form *pica*, spiral sculpture more uniform, with ribs anteriorly, then a few ribbons, and smooth above.



### **C. spectrum Shell Morphometry**

<b>L</b>	30 - 76 mm
- form <i>pica</i>	30 - 42 mm
<b>RW</b>	0.08 - 0.50 (L 35-69 mm)
- form <i>pica</i>	0.12 - 0.22
<b>RD</b>	0.51 - 0.67
- form <i>pica</i>	0.59 - 0.67
<b>PMD</b>	0.73 - 0.86
<b>RSH</b>	0.03 - 0.12
- form <i>pica</i>	0.07 - 0.11

Ground colour white. Last whorl usually with yellowish orange to dark brown axial streaks, flames and blotches, generally concentrated or fused into 2-3 interrupted or solid spiral bands. White shells intergrade with brown shells with a paler central band; shells with an irregularly arranged pattern intergrade with shells with a regularly reticulate pattern between the spiral bands. Some specimens also with wavy or straight, continuous or discontinuous brown axial lines from base to shoulder or shoulder ramp; some with closely spaced, dotted to solid spiral lines. In form *pica*, pattern consists of separate spots to confluent blotches; widely spaced dotted spiral lines in some shells; traces of axial lines rarely present. Larval whorls white to pale brown, white in form *pica*. Late sutural ramps with narrow to broad and confluent radial markings matching last whorl pattern in colour; shells with an immaculate white spire intergrade with shells with a nearly brown spire. Aperture generally white to bluish white and often slightly translucent.

Periostracum pale olive-grey, thin, translucent, and smooth but darker, thicker and with interlaced axial ridges in form *pica*.

In W. Australia, animal pale cream, maculated with light brown; foot thinly edged with black (Turnbull, pers. comm., 1987). In E. Australia, sole and sides of foot white; dorsum of foot laterally edged with a fine black line that expands into a spot anteriorly; siphon white, with immaculate tip and brown transverse lines proximally (Kohn, unpubl. observ.). In the Timor Sea, dorsum of foot with a narrow black pre-marginal band expanding into a blotch at each corner of both ends (G. Raybaudi Massilia, pers. comm., 1992).

**Habitat and Habits:** Intertidal to about 50 m, mainly on sand. In W. Australia on intertidal and slightly subtidal sand bars to sand bottoms in about 40 m (Turnbull, pers. comm., 1987).

**Discussion:** *C. spectrum* resembles *C. wittigi*, *C. broderipii*, *C. fischoederi*, and *C. blanfordianus*. *C. wittigi* is a smaller species (L 26-42 mm) with an often higher spire (RSH 0.07-0.17), and a reticulate pattern with triangular markings rather than axial markings on the last whorl. *C. broderipii* has a less pronounced spiral sculpture on the late sutural ramps and a violet to purple aperture. The shells from Philippines provisionally assigned to *C. broderipii* differ in a generally higher spire (RSH 0.09-0.16), less angulate shoulder, pale brown spiral background bands, and

a rose, orange or violet aperture. *C. fischoederi* is distinguished from *C. spectrum* by its higher spire (RSH 0.11-0.17) with a less concave outline and more prominent shoulder tubercles in the early postnuclear whorls and by the absence of spiral ribbons basally on the last whorl. Variants of *C. spectrum* from Moluccas (form *conspersus*) and Philippines are particularly similar to *C. fischoederi* in their last whorl pattern with dashed to solid brown spiral lines. However, they differ in their wider apertures and smoother last whorls; in form *conspersus*, the aperture is often suffused with flesh to pale orange and the last whorl pattern lacks tentmarks. *C. blanfordianus* differs mainly in its colour pattern: White with about 15 spiral rows of brown spots and bars.

*C. spectrum* as presented here exhibits considerable conchological variability both within and between populations. It may represent a complex of closely related species, but we are unable to identify consistent differences in shape, sculpture and colour pattern among variants from different parts of its range. We thus favour the hypothesis of a single species.

The representation of the lectotype of *C. spectrum* (Rumphius, 1705: pl. 33 fig. S), probably from Moluccas, is moderately slender, low-spined and ornamented with axial streaks. We consider the following nominal species to be forms of *C. spectrum*:

*C. conspersus*: Type specimens are no longer available. The figure of the holotype (Reeve, 1844: Pl. 47 sp. 262) lacks distinctive characters except for the yellow colour. Reeve himself considered the holotype to be an "indifferent specimen" and figured afterwards (1849: Suppl. pl. 9 sp. 262b) a more distinctive specimen "encircled throughout with fine close-set hair lines and with a warm flesh tint" within the aperture. Similar specimens occur in the Moluccas intergrading with typical *C. spectrum* (Coomans et al., 1985a). We therefore provisionally consider *C. conspersus* a colour form of *C. spectrum*, although the absence of type specimens does not allow unequivocal assignment (Pl. 41, Figs. 19, 20).

*C. daphne*: Shell ventricosely conical to ovate; solid yellow, encircled with fine brown lines on the last whorl and a wider line at the shoulder (Pl. 41, Figs. 22-25). The aperture is yellowish pink, similar to that of *C. conspersus*. Richard (1990) considered *C. daphne* a valid species; we provisionally consider it a local form with a restricted distribution in Indonesia.

*C. dolium*: Last whorl rather broad and ventricose, with large, variably confluent orange-brown areas; its spire is remarkably low (Pl. 41, Fig. 26). This form occurs in Philippines and is very similar to form *pica*.

*C. filamentosus*: Known only from the holotype, which probably represents a subadult specimen (Pl. 41, Figs. 29, 30). It has a yellowish brown last whorl, flecked with white below shoulder and centre, and with spiral grooves up to the shoulder. Its slender shape and rather narrow aperture resemble attributes also found in subadult and adult specimens of other variants. We provisionally attach *C. filamentosus* to *C. spectrum*.

*C. lacteus*: It is usually considered to be conspecific with *C. parius*. The lectotype (Pl. 47, Fig. 27) is white, has widely spaced spiral grooves from the base to the subangulate shoulder and a relatively low spire. *C. parius* differs in its more rounded shoulder and its generally weak spiral sculpture on the late sutural ramps, except for a distinct adaxial groove. A larger specimen of *C. lacteus* also present in the MHNG (coll. Delessert) (Pl. 41, Fig. 28) is more distinct in its resemblance to *C. spectrum* and in its difference from *C. parius*. We thus consider *C. lacteus* a form of *C. spectrum*.

*C. pica*: A distinctive variant very similar to form *dolium* (Pl. 41, Figs. 9-12). Its sympatric occurrence in the Philippines and differences from other variants of *C. spectrum* suggest distinction at the species level. However, as specimens conforming with the description of *C. pica* overlap with *C. spectrum* in all studied shell characters, we provisionally consider them conspecific.

*C. verreauxii*: The identity of the figured shell (Pl. 41, Fig. 21) from Cape of Good Hope is dubious. It resembles *C. conspersus* in the fine brown spiral lines and scattered small brown spots on the last whorl. Reeve was the first to suggest that *C. verreauxii* is identical with *C. conspersus*, although Kiener compared it with *C. anemone*. Whether this hypothesis is correct or *C. verreauxii* represents a valid species, cannot be unequivocally decided, because we lack a type specimen and the original figure shows the dorsal side of the shell only. We provisionally follow Reeve's suggestion and regard *C. verreauxii* as a synonym of *C. spectrum* form *conspersus* (cf. Coomans et al., 1985a).

*C. stillatus*: Last whorl with fine dark brown axial lines (Pl. 41, Figs. 17, 18).

*C. carota* represents a synonym rather than a form of *C. spectrum*.

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### *Conus geographus* LINNÉ, 1758

(Plate 42, Figures 1-4; Plate 76, Figure 50, Plate 81, Third row, right; Map 81)

1758 *Conus geographus* Linné, Syst. Nat., 10 ed., 1: 718, no. 283

**Type:** Lectotype (Kohn, 1963, as "holotype") in LSL (98 x 48 mm).

**Type Locality:** "Indiis."

**Range:** Indo-Pacific except for Hawaii.

**Description:** Moderately large to large, moderately solid to solid; relative weight may vary by 60% in specimens of the same size. Last whorl narrowly cylindrical to cylindrical; outline straight or slightly convex and nearly parallel-sided centrally, slightly concave to convex above and convex (right side) or concave (left side) below. Aperture wider at base than near shoulder. Shoulder angulate to rounded, usually strongly tuberculate. Spire low, outline variably concave to straight. Larval shell of 2.5-3 whorls,

maximum diameter 0.9-1 mm. Postnuclear whorls tuberculate, tubercles strong and pointed upward in late whorls. Teleoconch sutural ramps concave, with 0-2 increasing to 4-5 spiral grooves in early whorls; closely set radial striae and many spiral striae produce a minutely granulose surface in late whorls. Last whorl nearly smooth except for weak spiral ribs or ribbons near base of subadults.

#### *C. geographus* Shell Morphometry

<b>L</b>	65 - 166 mm
<b>RW</b>	0.10 - 0.80 g/mm (L 65-133 mm)
<b>RD</b>	0.49 - 0.56 (adults)
	0.45 - 0.51 (subadults)
<b>PMD</b>	0.62 - 0.75
<b>RSH</b>	0.04 - 0.10

Ground colour white, suffused with bluish grey, violet or pink. Last whorl with fine, often incomplete network of tan to dark reddish brown lines and small often tent-like spots. Pattern tends to fuse into blotches forming 2-3 broad spiral bands, within basal third, above centre and often below shoulder; occasionally, bands contain dotted, dashed or solid dark spiral lines. Larval whorls pink to red. Earliest postnuclear sutural ramps white to pink, usually with brown dots at both or only inner margins. Following sutural ramps with light to dark brown radial blotches that separate into loosely reticulated lines in late whorls. Aperture white.

Periostracum grey to yellowish or reddish brown, thin and variably translucent, with closely spaced axial ridges on sutural ramps and with spiral rows of tufts on last whorl, that are arranged in 9-11 widely spaced groups of 2-3 rows.

Animal with a broad, massive foot. Dorsum of foot white, with a broad cream to pale orange longitudinal band and overlying interlaced brown to black radial streaks and blotches laterally, solid black at posterior end; medially and anteriorly, pinkish tan spots, patches and veins form a network similar to that of the shell. Sole of foot white, mottled with light brown. Rostrum yellow brown, marbled with darker brown dorsally; indented at distal edge. Tentacles white, tipped with light brown. Siphon white, with brown to dark brown transverse stripes on lighter brown flecks; tip white (Pl. 76, Fig. 50, Pl. 81, Third row, right) (Bergh, 1895; Chaberman, pers. comm., 1981; Estival, unpubl. observ.). In subadult animals from the Marshall Is., dorsum of foot greyish white, mottled with black; mottling heavy at posterior end, almost absent at anterior end (Pearson, unpubl. observ.). In the N. Red Sea, animal reddish brown, mottled with black on siphon and marginal zones of the foot's dorsum (Fainzilber et al., 1992).

Radular teeth with an adapical barb opposite a slightly barbed cutting edge; serration of about 125 denticles extends back to centre of tooth; basal knob weak, without a spur (Troschel, 1868; Bergh, 1895; Peile, 1939; Endean & Rudkin, 1965). The tooth depicted by Bandel (1984) for specimens from Port Sudan (Red Sea) has a distinct second

barb rather than a slightly barbed cutting edge and its base appears to have a weak spur.

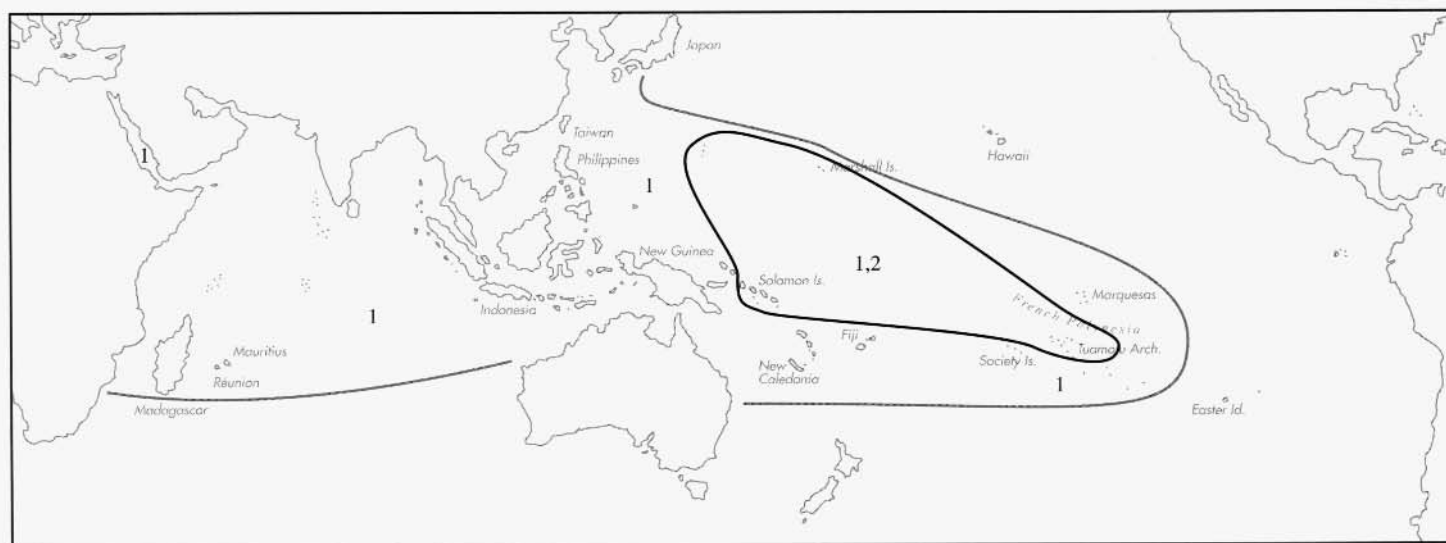
**Habitat and Habits:** Intertidal to about 20 m; on coral reefs, mainly on sand bottoms beneath or among coral heads, also on lagoon pinnacles, in caves and on coral rubble (Kohn, 1961b; Cernohorsky, 1964; Marsh, 1971; Sharabati, 1984; Grosch, pers. comm., 1989; Tirard, pers. comm., 1989; Fainzilber et al., 1992).

*C. geographus* feeds on fishes, sometimes also on molluscs. It captures its prey with its rostrum without stinging it first; after a fish is engulfed, it may be stung. Animals with shells of 80-87 mm may feed on fishes 130-140 mm long; fresh dead fishes may also serve as food. Venom highly toxic to fishes and mammals, known to cause fatalities in humans. Toxicity and high quantity of injected venom make *C. geographus* the most dangerous *Conus* species. It has caused more than 30 human fatalities. (Kohn, 1963, 1983; Johnson & Stablum, 1971; Cruz, Gray & Olivera, 1976, 1978; Cruz, Corpuz & Olivera, 1978; Tsurriel, 1978).

Animals observed to oviposit in isolated coral heads; capsule masses may be made by several females. Capsules deposited in short rows forming an irregular cluster; each row affixed to substratum by confluent basal plates. Observed number of capsules per spawn is 54, observed number of eggs per capsule 14,500-17,800, and observed capsule size 26-28 x 18-21 mm. Egg diameter of about 190  $\mu$ m predicts a minimum pelagic period of about 24 days (Kohn, 1961b; Perron & Kohn, 1985).

**Discussion:** *C. geographus* closely resembles *C. eldredi* and *C. fragilissimus* and is also similar to *C. tulipa* and *C. obscurus*; for comparison, see the Discussions of those species.

Map 81



1: *C. geographus* 2: *C. eldredi*

## *Conus eldredi* MORRISON, 1955

(Plate 42, Figures 5-7; Map 81)

- 1833 *Conus geographus* var. *rosea* "Broderip" Sowerby I, Conch. Ill.: Pt. 32, fig. 33 (non *C. roseus* Fischer, 1807, non *C. roseus* Lamarck, 1810)
- 1843 *Conus intermedius* Reeve, Proc. Zool. Soc. London, 11: 169-170; Conch. Icon., 1, *Conus*: Pl. 23 fig. 129 (non *C. intermedius* Lamarck, 1810)
- 1858 *Conus mappa* Crosse, Rev. Mag. Zool., (2) 10: 200, 205 (nom. nov. for *C. intermedius* Reeve; non *C. mappa* [Lightfoot], 1786)
- 1955 *Conus (Gastridium) eldredi* Morrison, J. Washington Acad. Sci., 45: 32 (nom. nov. for *C. mappa* Crosse)

**Types:** *C. g. rosea* and *C. intermedius*: Original figure 53.5 x 22 mm.

**Type Localities:** *C. g. rosea* and *C. intermedius*: "Annaa."

**Range:** Central Pacific, from Guam to Wake Id. and Marshall Is. as well as to Cook Is. and Tuamotu Archipelago; probably also Solomon Is.

**Description:** Moderately large, moderately light to moderately solid. Last whorl ovate, narrowly ovate, cylindrical or narrowly cylindrical; outline varies from moderately convex to almost straight and parallel-sided centrally; left side concave at basal third. Aperture wider at base than near shoulder. Shoulder angulate to subangulate, tuberculate. Spire low, outline straight to slightly convex. Postnuclear whorls tuberculate. Teleoconch sutural ramps flat, concave in late whorls; late ramps with 4 increasing to 10-12 fine spiral grooves. Last whorl with widely spaced weak spiral ribs at base and shoulder and with widely spaced, irregularly punctate shallow grooves centrally.



### *C. eldredi* Shell Morphometry

L	57 - 65 mm
RW	0.09 - 0.17 g/mm
RD	0.47 - 0.52
PMD	0.49 - 0.70
RSH	0.10 - 0.12

Ground colour white, suffused with pink and violet. Last whorl with a fine but usually incomplete network of light brown to dark reddish brown lines and often triangular spots; interrupted brown spiral lines and streaks may be present; reticulate pattern usually fusing in a discontinuous spiral band at centre and within basal third. Apex white. Late postnuclear sutural ramps with sparse brown radial lines and streaks on a pink ground; marginal tubercles usually white. Aperture white.

**Habitat and Habits:** Shallow water.

**Discussion:** *C. eldredi* is very closely related to *C. geographus*. The latter species attains much larger size and rarely has a pink ground colour; it differs in a lower spire (RSH 0.04-0.10) with a slightly concave outline, in stronger tubercles on the late sutural ramps, and in a smoother surface of the last whorl. The position of maximum diameter is generally closer to the shoulder in *C. geographus* (0.62-0.76) than in *C. eldredi*. Although further study of sympatric occurrences is necessary, we consider that these differences justify separation at species level. For comparison with *C. tulipa* see the Discussion of that species.

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### *Conus fragilissimus* PETUCH, 1979

(Plate 42, Figures 8-10; Map 82)

1979 *Conus fragilissimus* Petuch, Nemouria, 23: 14-16, 18, figs. 22-25

**Type:** Holotype in DMNH (30 x 12 mm).

**Type Locality:** "off south coast of Harmil Is., Dahlak Archipelago, Eritrea Province, Ethiopia."

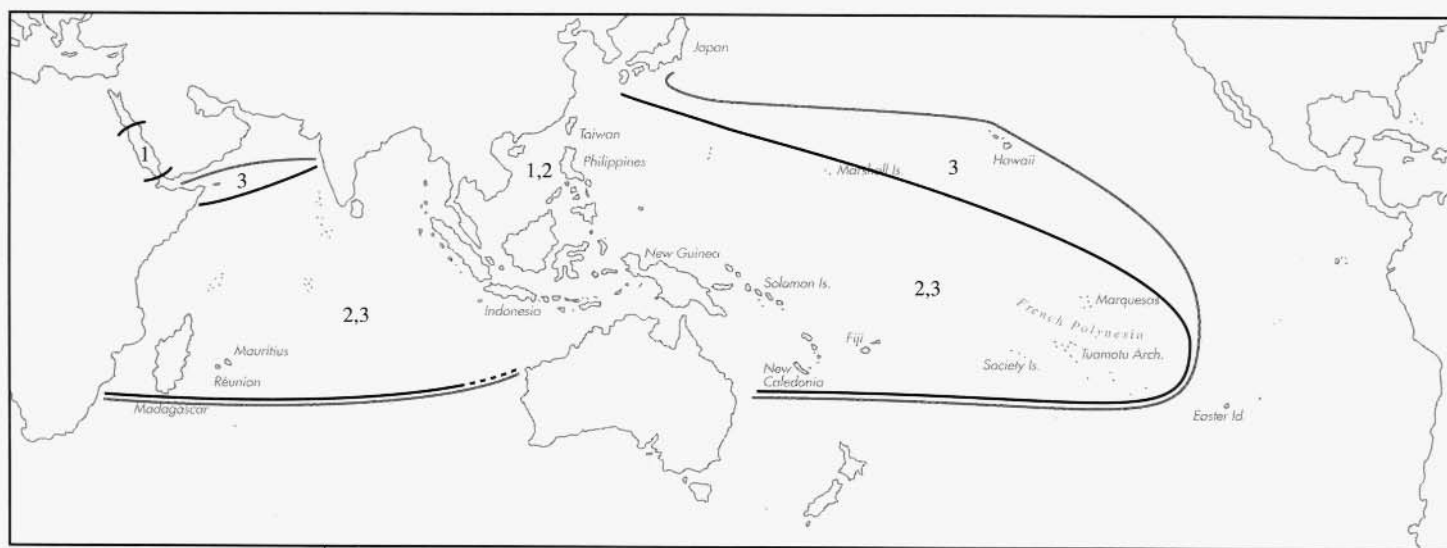
**Range:** Central and S. Red Sea.

**Description:** Moderately small to medium-sized, light to moderately light. Last whorl ovate, outline convex; left side slightly concave at basal third. Aperture wider at base than near shoulder. Shoulder angulate, tuberculate. Spire of low to moderate height, outline concave. Larval shell of about 1.75 whorls, maximum diameter 0.9-1 mm. Postnuclear whorls tuberculate, tubercles weak in early whorls. Teleoconch sutural ramps flat to slightly concave, with 0-1 increasing to 4-6 weak or pronounced spiral grooves. Last whorl with a few weak, widely spaced spiral ribs at base.

### *C. fragilissimus* Shell Morphometry

L	26 - 47 mm
RW	0.02 - 0.09 g/mm
RD	0.50 - 0.55
PMD	0.64 - 0.74
RSH	0.08 - 0.14

Map 82



1: *C. fragilissimus* 2: *C. tulipa* 3: *C. obscurus*

Ground colour white to grey. Last whorl with a fine, incomplete, light brown to dark reddish brown reticulate pattern fusing in variously sized and shaped blotches that leave an interrupted spiral ground-colour band at centre. Spiral rows of brown dots and dashes, often alternating with white dots and dashes, extend from base to shoulder but may be weak. Larval whorls and adjacent 2 postnuclear sutural ramps dark brown. Following sutural ramps with dark brown radial streaks and blotches. Aperture translucent, shaded with violet.

**Habitat and Habits:** In 2-5 m, in mud or coral rubble on coral reefs. *C. fragilissimus* feeds on small benthic fishes (Petuch, 1979).

**Discussion:** *C. fragilissimus* may only be confused with subadult *C. geographus*. Similarly sized specimens of the latter species differ in their red multispiral larval shells, narrower and cylindrical rather than ovate last whorls (RD 0.45-0.51), and in the straighter outline of their spires. Spiral rows of alternating brown and white markings on the last whorl are usually prominent in *C. fragilissimus* but absent in *C. geographus*.

*C. eldredi* can be distinguished from *C. fragilissimus* by its pink ground colour, white apex, generally narrower last whorl (RD 0.47-0.52), and its straight to slightly convex spire outline. *C. eldredi* lacks spiral rows of alternating brown and white markings, while *C. fragilissimus* has no punctate spiral grooves on the last whorl.

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### *Conus tulipa* LINNÉ, 1758

(Plate 42, Figures 11-14; Plate 81, Fourth row, left; Map 82)

- 1758 *Conus tulipa* Linné, Syst. Nat., 10 ed., 1: 717, no. 282  
 1798 *Cucullus purpureus* Röding, Mus. Bolt., 2: 47, no. 602/96  
 1840 *Conus (Tuliparia) nebulosa* Swainson, Treat. Malac.: 311 (non *C. nebulosus* Gmelin, non *C. nebulosus* Hwass in Bruguière)  
 1868 *Conus (Chelyconus) borbonicus* H. Adams, Proc. Zool. Soc. London, 1868: 288-289, pl. 28 fig. 1

**Types:** *C. tulipa*: Lectotype (Kohn, 1963) in LSL (56.5 x 27 mm); *C. nebulosa*: Lectotype (Kohn, 1992) figured in Tableau (1798: Pl. 322 fig. 12) (70 x 33 mm); *C. borbonicus*: Holotype in BMNH (12 x 5 mm).

**Type Localities:** *C. borbonicus*: "Isle of Bourbon."

**Range:** Mozambique to Somalia, to Marshall Is. and French Polynesia.

**Description:** Moderately large to large, moderately solid. Last whorl ovate to cylindrical; outline convex or almost straight and parallel-sided centrally; left side straight to distinctly concave at basal third. Aperture wider at base than near shoulder. Shoulder subangulate. Spire low, outline slightly concave or straight. Larval shell of about 4 whorls, maximum diameter 0.8-0.9 mm. First 4-7 postnuclear whorls tuberculate. Teleoconch sutural ramps usually

somewhat concave, with 1 increasing to 4-9 spiral grooves; latest whorls usually with additional spiral striae, first 3 whorls with a prominent subsutural ridge. Last whorl with a few weak, variably spaced spiral ribs at base.

#### *C. tulipa* Shell Morphometry

L	50 - 95 mm
RW	0.16 - 0.25 g/mm (L 50-80 mm)
RD	0.50 - 0.57
PMD	0.61 - 0.72
RSH	0.09 - 0.11

Ground colour bluish grey, suffused with blue or pink. Last whorl with confluent reddish brown flames and blotches often fusing into an interrupted spiral band on each side of centre. Spiral rows of alternating brown and white dots and dashes from base to shoulder. Larval whorls red, with a brown sutural line. Early postnuclear sutural ramps pink to violet, with regularly spaced brown dots at outer margins, sometimes also at inner margins; usually only first ramp dotted at both margins. Late sutural ramps sparsely maculated with dark reddish brown flecks and radial blotches. Aperture bluish white, translucent toward outer lip.

Periostracum yellowish brown, rather thin, translucent to opaque, with 4-7 widely spaced spiral rows of tufts on last whorl including shoulder; Cernohorsky (1964) reports a smooth periostracum from Fiji.

Dorsum of foot white, heavily mottled with brown radial streaks and blotches, larger and concentrated marginally. Sole of foot white to beige, sparsely mottled with brown flecks that are interspersed by darker longitudinal stripes. Rostrum beige, sparsely mottled with light brown; orifice surrounded by a dense cluster of white cirri. Tentacles white, tipped with brown and with sparse light brown mottling at base. Siphon grey, with transverse rows of brown bars and streaks, confluent at base; tip dark grey but with a lighter distal edge (Marshall Is.) (Pearson, unpubl. observ.). Reports of Quoy and Gaimard (1824) correspond with this description (Pl. 81, Fourth row, left).

Radular teeth with 2 opposite adapical barbs; serration of 15-25 denticles extends from first barb 1/3 the length of the shaft; basal spur obsolete or absent (Bergh, 1895; Shaw, 1915; Peile, 1939; James, 1980; Kohn, unpubl. observ.).

**Habitat and Habits:** Intertidal to about 10 m; usually reported from coral reefs, in Mozambique also in intertidal habitats of the mainland coast; in sand patches beneath rocks and coral boulders, on coral rubble among sea-weed, and on rocky flats exposed to wave action (Meese, 1969; Huish, 1978; Estival, 1982; Richards, pers. comm., 1989; Grosch, pers. comm., 1989).

*C. tulipa* feeds on fishes and molluscs. Fishes are either engulfed after stinging them or without stinging them first. The venom is highly toxic to fishes and small mammals (Endean & Rudkin, 1965).

In Seychelles, R. C. Wood observed females ovipositing below loose corals in depressions near the reef edge (Kohn 1961b). Pearson (unpubl. observ.) observed *C. tulipa* mating and ovipositing in the aquarium; capsules are axially elongate and have a slightly corrugated surface.

**Discussion:** *C. tulipa* is easily distinguished from *C. geographus*, *C. eldredi*, and *C. fragilissimus* by its non-tuberculate late postnuclear whorls and pale blue ground colour. For comparison with *C. obscurus*, see the Discussion of that species.

*C. borbonicus* is a juvenile shell.

## 186

### *Conus obscurus* SOWERBY I, 1833

(Plate 42, Figures 15-18; Pl. 76, Figure 51; Plate 81, Fourth row, right; Map 82)

1833 *Conus obscurus* Sowerby I, Conch. Ill.: Pt. 29, fig. 26

1943 *Conus halitropus* Bartsch & Rehder, Proc. Biol. Soc. Washington, 56: 88

**Types:** *C. obscurus*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 29, fig. 26) (38 x 17 mm); *C. halitropus*: Holotype in USNM (32.5 x 14 mm).

**Type Localities:** *C. obscurus*: "coast of Arabia"; *C. halitropus*: "at Honolulu."

**Range:** S. and E. Africa to Hawaii and French Polynesia except for Red Sea.

**Description:** Moderately small to medium-sized, light to moderately light. Last whorl cylindrical to narrowly cylindrical; outline almost straight; left side slightly concave at basal fourth to third. Aperture wider at base than near shoulder. Shoulder angulate. Spire usually of moderate height, outline straight or slightly concave. Larval shell of 3.75-4 whorls, maximum diameter about 1 mm. First 2-4 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 1 increasing to 4-6 major spiral grooves, sometimes to 8 finer grooves; sculpture usually weak on latest ramps. Last whorl with a few weak spiral ribs at base.

#### *C. obscurus* Shell Morphometry

L	25 - 44 mm
RW	0.02 - 0.06 g/mm (L 25-35 mm)
RD	0.46 - 0.52
PMD	0.58 - 0.74
RSH	0.11 - 0.16

Last whorl greyish blue to violet. Variably prominent spiral rows of alternating brown and grey dots and dashes from base to shoulder. Brown flames, clouds and blotches usually concentrated in spiral bands below shoulder, just above centre and within basal third. Larval whorls red to orange. Early postnuclear sutural ramps grey, often dotted with dark brown at both margins in first whorl and with brown radial lines and streaks in following whorls. Late sutural ramps bluish grey with confluent brown radial blotches, often completely overlaid with brown. Aperture translucent or with thin white enamel.

Periostracum yellow, very thin, translucent, smooth (Kohn, 1959a; Cernohorsky, 1964).

Dorsum of foot white to pink, heavily mottled with tan to reddish brown; pattern consists of discrete spots and longitudinal bars medially; white elements fuse marginally. Sole of foot pink, mottled with light brown. Rostrum pink, with closely spaced brown axial streaks, or solid brown. Tentacles white, may be mottled with brown. Siphon white to pink, with closely spaced reddish brown transverse stripes on underlying brown blotches, or solid brown; tip white, edged with pink or yellow (Pl. 76, Fig. 51; Pl. 81, Fourth row, right) (Kohn & Weaver, 1962; Chaberman, pers. comm., 1981; Pearson unpubl. observ.).

Radular teeth with 2 small adapical barbs in line and an opposite third long barb with a variably pointed posterior tip; serration and basal spur absent (James, 1980; Kohn, unpubl. observ.).

**Habitat and Habits:** Intertidal to more than 40 m, more common subtidally; usually reported from coral reefs. On various reef substrata (in caves among coral heads, on coral rubble among sea-weed, and on patches of sand) as well as on intertidal rocky flats exposed to wave action (Kohn, 1959a; Kohn & Weaver, 1962; Richards, pers. comm., 1989; Grosch, pers. comm., 1989).

*C. obscurus* feeds on fishes; known human injuries resemble bee stings (Kohn, 1963).

In Hawaii, egg diameter of 147 µm predicts a pelagic period of about 28 days (Perron & Kohn, 1985).

**Discussion:** *C. tulipa* is similar in pattern and also lacks shoulder tubercles in the late postnuclear whorls. However, it attains larger size (to 95 mm), has a generally broader and often ovate last whorl (RD 0.50-0.57), a subangulate shoulder, and more tuberculate early postnuclear whorls (4-7). *C. obscurus* lacks a brown sutural line on the larval shell and prominent marginal dots on the early postnuclear sutural ramps (except first whorl), while *C. tulipa* does not have the late sutural ramps overlaid with brown. *C. geographus*, *C. eldredi*, and *C. fragilissimus* can be distinguished from *C. obscurus* by their white ground colour and tuberculate late postnuclear whorls.

*C. halitropus* refers to a pattern variant of *C. obscurus* without dotted and dashed spiral lines on the last whorl.



**Conus cuvieri CROSSE, 1858**

(Plate 42, Figures 19-22; Map 83)

- 1838 *Conus cervus* Sowerby I, Conch. Ill.: Pt. 147, fig. 94 (non *C. cervus* Lamarck, 1822)
- 1843 *Conus deshayesii* Reeve, Proc. Zool. Soc. London, 11: 168-169; Conch. Icon., 1, *Conus*: Pl. 5 sp. 28 (non *C. deshayesii* Bellardi & Michelotti, 1840)
- 1858 *Conus cuvieri* Crosse, Rev. Mag. Zool., (2) 10: 123 (nom. nov. for *C. deshayesii* Reeve)
- 1893 *Chelyconus exdeshayesii* Sacco, Memorie Accad. Sci. Torino, (2) 44 (13): 73 (nom. nov. for *C. deshayesii* Reeve)

**Types:** *C. cervus*: Lectotype (Kohn, 1992) in IRSN (51 x 27.5 mm); *C. cuvieri*: Lectotype (Coomans et al., 1985a, b) is based on the same shell.

**Type Locality:** *C. cuvieri*: "Swan River"; corrected in "Djibouti in the Gulf of Aden" (Coomans et al., 1985a).

**Range:** S. Red Sea and Gulf of Aden.

**Description:** Moderately small to medium-sized, moderately light. Last whorl ovate to ventricosely conical, outline convex; left side straight or slightly concave toward base. Aperture broad at base. Shoulder angulate. Spire usually low; outline concave, often with apex projecting from an otherwise almost flat spire. Larval shell of 2-2.25 whorls, maximum diameter about 1 mm. Teleoconch sutural ramps flat to slightly concave, with 0-1 increasing to 5-6 weak spiral grooves. Last whorl with weak spiral ribs at base.

***C. cuvieri* Shell Morphometry**

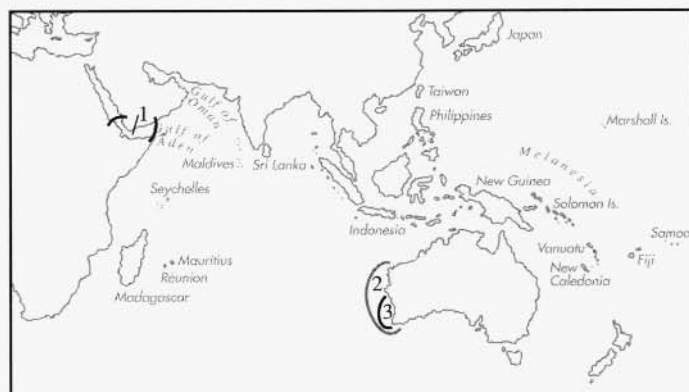
<b>L</b>	32 - 49 mm
<b>RW</b>	0.06 - 0.09 g/mm (L 32-44 mm)
<b>RD</b>	0.57 - 0.66
<b>PMD</b>	0.68 - 0.77
<b>RSH</b>	0.07 - 0.13

Ground colour pale grey. Last whorl with olive to brown axial lines, streaks and blotches, often fusing into a broad interrupted or continuous spiral band on each side of centre. Numerous closely spaced spiral rows of irregularly alternating brown and white dots and dashes extend from base to shoulder. Larval whorls and adjacent 2.5 postnuclear sutural ramps dark brown. Late sutural ramps with light to blackish brown radial streaks. Aperture translucent.

**Habitat and Habits:** In shallow calm water amongst fine rubble (Sharabati, 1984).

**Discussion:** *C. cuvieri* differs from *C. fragilissimus* and *C. obscurus* by its broader last whorl (RD 0.57-0.66) and by the absence of shoulder tubercles from its early and late postnuclear whorls. The sympatric *C. fragilissimus* has a primarily reticulate pattern, while *C. obscurus* has a generally higher spire with a rather straight outline (RSH 0.11-0.16) and a cylindrical rather than ovate last whorl.

Map 83



1: *C. cuvieri* 2: *C. cocceus* 3: *C. gabelishi*

**Conus cocceus REEVE, 1843**

(Plate 42, Figures 23-25; Map 83)

- 1843 *Conus cocceus* Reeve, Proc. Zool. Soc. London, 11: 174; 1844: Conch. Icon., 1, *Conus*: Pl. 42 sp. 228
- 1845 *Conus decrepitus* Kiener, Coq. Vivant., 2: Pl. 99 fig. 4; 1849: 263-264

**Types:** *C. cocceus*: Lectotype (Coomans et al., 1985a) in BMNH (31 x 16 mm); *C. decrepitus*: Original figure 40 x 20 mm.

**Type Localities:** *C. cocceus*: "New Holland"; corrected in "Geographe Bay, West Australia" (Coomans et al., 1985a); *C. decrepitus*: "l'Océan Austral, les côtes de la Nouvelle Hollande."

**Range:** W. Australia from Albany area to N. W. Cape.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl ventricosely conical or ovate; outline convex adapically, less so toward base; left side straight to slightly concave or constricted near base. Shoulder rounded. Spire of moderate height, outline convex. Larval shell of 1.75-2 whorls, maximum diameter 1.2-1.5 mm. Teleoconch sutural ramps flat to moderately convex, with 2 increasing to 5-8 spiral grooves. Last whorl with fine and closely spaced spiral ribs; ribs may be obsolete adapically.

***C. cocceus* Shell Morphometry**

<b>L</b>	25 - 54 mm
<b>RW</b>	0.07 - 0.26 g/mm
<b>RD</b>	0.60 - 0.71
<b>PMD</b>	0.71 - 0.85
<b>RSH</b>	0.13 - 0.22

Ground colour white or pinkish grey. Last whorl with spiral rows of alternating white and yellow to orangish brown dots, dashes, spots or bars and with confluent yellow to orangish brown flames and clouds that may be concen-

trated in 2-3 spiral bands. Larval whorls white, violet or pale brown. Postnuclear sutural ramps with yellow to orangish brown radial markings. Pattern elements often weak or absent both on spire and last whorl. Aperture white to light pink.

Periostracum pale brown, thin, translucent, smooth.

Animal reported to be pale cream (Turnbull, pers. comm., 1987).

**Habitat and Habits:** Intertidal to 100 m; a sand-dwelling species also living on limestone platforms, beneath rocks or among granite boulders intertidally and in sand pockets subtidally. In southern W. Australia, *C. cocceus* co-occurs with *C. dorreensis*.

**Discussion:** *C. cocceus* is most similar to *C. catus*. *C. catus* is often broader (RD to 0.78) and its sculpture varies from smooth with only a few weak basal spiral ribs, to strong, broad ribs from base to shoulder. It does not have the fine, closely spaced spiral ribs characteristic of *C. cocceus*. *C. catus* also has tubercles on the early postnuclear whorls and its larval shell is half as broad as that of *C. cocceus*. *C. cocceus* sometimes resembles *C. gabelishi*, *C. anemone* and *C. clarus*; for comparison, see the Discussions of those species.

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### *Conus gabelishi* DA MOTTA & NINOMIYA, 1982

(Plate 42, Figures 26-28, Map 83)

1982 *Conus gabelishi* da Motta & Ninomiya, Publ. Ocas. Soc. Portuguesa Malac., 1: 14-15, figs. 13a-c

**Type:** Holotype in NSMT (35.5 x 19.5 mm).

**Type Locality:** "in the Great Australian Bight, in the Esperance/Albany area, West Australia."

**Range:** W. Australia from the Albany area to Jurien Bay.

**Description:** Usually moderately small and moderately light. Last whorl usually conical, sometimes ventricosely conical or broadly conical to broadly and ventricosely conical; outline convex at adapical fourth to third, almost straight below; left side constricted above base. Shoulder broadly carinate. Spire of low to moderate height, outline nearly straight. Larval shell of 1.5-1.75 whorls, maximum diameter 1.1-1.2 mm. Teleoconch sutural ramps convex, with 0-2 increasing to 4 major spiral grooves; 1-2 intervening ribs often located high on sutural ramps. Last whorl with weak to distinct, well separated spiral grooves at base; ribbons between grade to ribs at anterior end.

Ground colour white. Last whorl with well separated spiral rows of alternating white and orange bars and with fusing orange clouds and spiral bands. Pattern may cover entire last whorl evenly or leave a spiral ground-colour band below centre and somewhat above base. Larval whorls

white. Postnuclear sutural ramps with orange radial markings. Aperture translucent to white.

#### *C. gabelishi* Shell Morphometry

<b>L</b>	23 - 38 mm
<b>RW</b>	0.06 - 0.11 g/mm
<b>RD</b>	0.64 - 0.71
<b>PMD</b>	0.84 - 0.88
<b>RSH</b>	0.09 - 0.16

Periostracum thin and translucent.

**Habitat and Habits:** In 120-230 m.

**Discussion:** *C. gabelishi* may be similar in pattern to *C. cocceus*. The latter species can be distinguished by its more ventricose or ovate last whorl (PMD 0.71-0.85), generally higher and convex spire (RSH 0.13-0.22), and its less distinct shoulder.

## 190

### *Conus julii* LIÉNARD, 1870

(Plate 43, Figures 1-6, Map 84)

1870 *Conus julii* Liénard, J. Conchyl. (Paris), 18: 304-305; 1871: *ibid.*, 19: 71, pl. 1 fig. 6

**Type:** Holotype in MNHN (37 x 18.5 mm).

**Type Locality:** "in insula Mauritiu."

**Range:** Réunion and Mauritius.

**Description:** Medium-sized to moderately large, moderately solid to solid. Last whorl ovate to ventricosely conical; outline almost straight at adapical fourth, then convex and rather angulate at position of maximum diameter, almost straight below centre. Aperture broad at base, narrow near shoulder. Shoulder angulate to subangulate. Spire low, outline slightly concave, straight or sigmoid. Larval shell of 3-3.5 whorls, maximum diameter 0.8-0.9 mm. About first 3.5 postnuclear whorls tuberculate. Teleoconch sutural ramps slightly concave, with 0 increasing to 1-2 spiral grooves in early whorls, grading to 10 weak spiral grooves or numerous often obsolete spiral striae in latest whorls. Last whorl with prominent widely spaced spiral ribs on basal fourth to third.

#### *C. julii* Shell Morphometry

<b>L</b>	44 - 62 mm
<b>RW</b>	0.23 - 0.43 g/mm (L 44-57 mm)
<b>RD</b>	0.53 - 0.60
<b>PMD</b>	0.69 - 0.78
<b>RSH</b>	0.07 - 0.11

Ground colour white, sometimes with sparse pinkish violet shadows. Last whorl with orange to reddish or dark brown wavy axial lines, concentrated or fusing into blotches and forming spiral bands below shoulder, just above centre and within basal third. Larval whorls white. Postnuclear sutural ramps with orange, violet, or brown radial streaks and blotches; the latter may contain darker radial lines. Aperture pink to orange behind a white collabral zone.

Periostracum pale olive, thin, translucent, smooth.

**Habitat and Habits:** In 25-100 m.

**Discussion:** *C. julii* is quite distinct from its congeners, except some shells of *C. floccatus* may be rather similar; for comparison, see the Discussion of the latter species.

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### *Conus adamsonii* BRODERIP, 1836

(Plate 43, Figures 7-10; Map 84)

1825 *Conus cingulatus* Sowerby I, Cat. Shells Tankerville, Appendix: 34, no. 2467 (non *C. cingulatus* Lamarck, 1810, non *C. cingulatus* Schlotheim, 1820)

1836 *Conus adamsonii* Broderip, Proc. Zool. Soc. London, 4: 44

1839 *Conus rhododendron* Jay, Cat. Shell Coll. Jay, 3 ed.: 121, pl. 7 figs. 2, 3

**Types:** *C. cingulatus*: Holotype figured in Sowerby I (1834: Pt. 152, fig. 108) (50.5 x 28 mm); *C. adamsonii*: Lectotype (Kohn, 1992) in NMWC (45 x 26 mm); *C. rhododendron*: Holotype figured in Jay (1839: Pl. 7 figs. 2, 3) (51 x 27 mm).

**Type Localities:** *C. adamsonii*: "American Samoa" (Coomans et al., 1979); *C. rhododendron*: "Australasia."

**Range:** S. Pacific from Coral Sea to French Polynesia.

**Description:** Medium-sized, moderately solid to solid; size varies with location. Last whorl ventricosely conical or

conoid-cylindrical to ovate; outline variably convex apically, less so (right side) or slightly concave (left side) toward base. Aperture wider at base than near shoulder. Shoulder subangulate to angulate. Spire low, outline straight to concave. First 5-6 postnuclear whorls tuberculate. Teleoconch sutural ramps concave, with a prominent subsutural ridge and 1 increasing to 3-6 spiral grooves. Last whorl with 7-13 well separated punctate spiral grooves on abapical third and 4-9 grooves below shoulder; intervening ribbons grade to ribs basally and sometimes at shoulder.

#### *C. adamsonii* Shell Morphometry

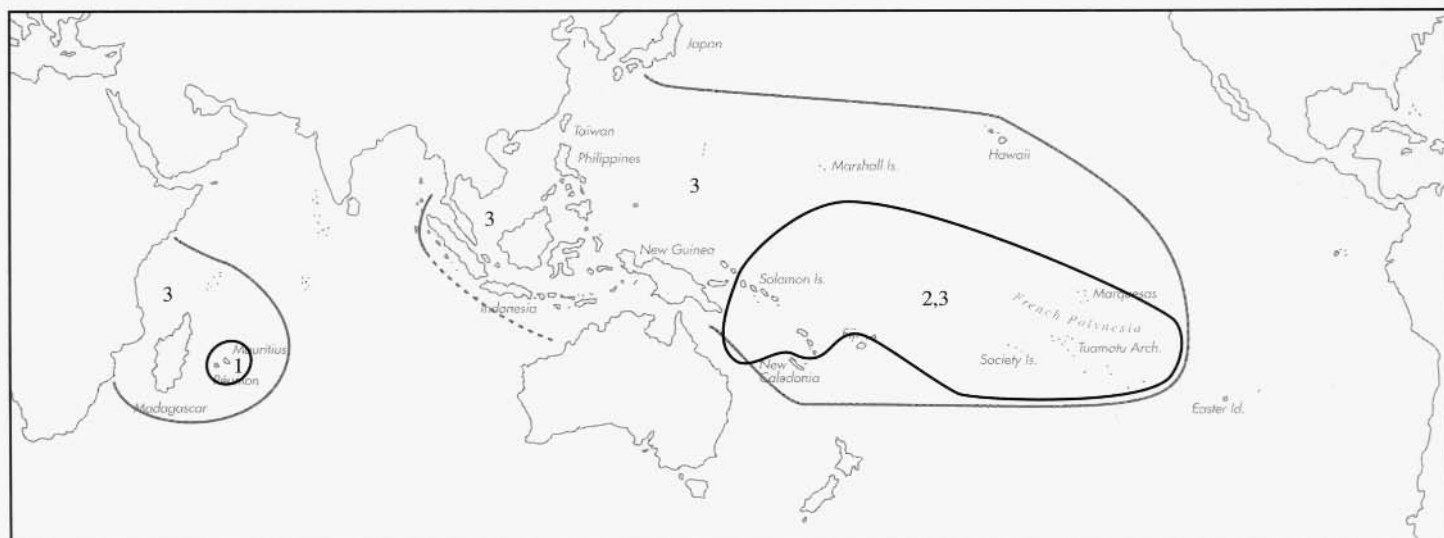
<b>L</b>	35 - 56 mm
<b>RW</b>	0.22 - 0.50 g/mm (L 35-44 mm)
<b>RD</b>	0.58 - 0.68
<b>PMD</b>	0.72 - 0.83
<b>RSH</b>	0.03 - 0.08

Ground colour white, partially suffused with pink to purple. Last whorl with 3 rather broad spiral bands of confluent violet or brown nebulous flecks and tent-like spots, below shoulder, just above centre, and within abapical third, alternating with 3-4 rather narrow spiral zones of very small brown to dark reddish or purplish brown triangular spots. Colour bands contain prominent to obsolete spiral rows of irregularly alternating white and brown dots and dashes. Larval whorls purple. Late postnuclear sutural ramps with purple or brown radial streaks and blotches, and with brown dots on subsutural ridge. Aperture yellow to orange within.

Periostracum almost colourless, thin, translucent, smooth (Hart, 1991).

Body pattern similar to that of the shell but in lighter violet (Richards, pers. comm., 1988); animal cream with

Map 84



1: *C. julii* 2: *C. adamsonii* 3: *C. bullatus*



light violet lines, with a dark purplish brown ring around siphon (Hamann, pers. comm., 1989).

**Habitat and Habits:** Intertidal to 60 m on seaward sides of coral reefs and in lagoons, on large stretches or small pockets of sand (Hart, 1992).

**Discussion:** *C. adamsonii* is so distinctive that it cannot be confused with any of its congeners.

## 192

### *Conus bullatus* LINNÉ, 1758

(Plate 43, Figures 11-16; Map 84)

- 1758 *Conus bullatus* Linné, Syst. Nat., 10 ed., 1: 717, no. 281  
1791 *Conus nubecula* Gmelin, Syst. Nat., 13 ed., 1: 3396, no. 66  
1798 *Cucullus parvus* Röding, Mus. Bolten., 2: 46, no. 585/84  
1798 *Cucullus laganum* Röding, Mus. Bolten., 2: 51, no. 648/134  
1937 *Conus bullatus* var. *articulata* "Lamarck" Dautzenberg, Mém. Mus. Roy. Hist. Nat. Belgique, 2 (18): 55 (non *C. articulatus* Sowerby III, 1873)  
1977 *Textilia bullatus* forma *pongo* Shikama & Oishi, in Shikama, Sci. Rep. Yokohama Natl. Univ., (2) 24: 21-22, pl.4 figs. 5a, b, pl. 5 fig. 5

**Types:** *C. bullatus*: Neotype (Kohn, 1963) in ZIUU (59 x 30 mm); *C. nubecula*: Lectotype (Kohn, 1966) figured in Seba (1758: Pl. 42 fig. 14) (60 x 31 mm); *C. parvus*: Objective synonym of *C. nubecula*; *C. laganum*: Lectotype (Kohn, 1975) figured in Knorr (1771: Pl. 11 fig. 4) (42 x 23 mm); *C. b. var. articulata*: Lectotype (Coomans et al., 1981) figured in Tableau (1798: Pl. 339 fig. 6) (57 x 27 mm); *T. b. forma pongo*: One of the figured specimens in KPM (64 x 28 mm).

**Type Localities:** *C. bullatus*: "island of Amboina, Indonesia" (Coomans et al., 1982); *T. b. forma pongo*: "East China Sea."

**Range:** From Mozambique and Zanzibar to Marquesas and Hawaii (form *pongo* E. Africa to W. Thailand).

**Description:** Medium-sized to large, moderately solid to solid. Last whorl ovate to narrowly ovate; outline convex, less so or straight at adapical fourth and toward base; left side may be concave near base; sometimes sides nearly parallel centrally. Aperture distinctly wider at base than near shoulder. Shoulder subangulate to angulate or slightly carinate. Spire low, outline either concave, with apex projecting from an otherwise almost flat spire, or straight. Larval shell of 3-3.5 whorls, maximum diameter 0.9-1 mm. First 3-6 postnuclear whorls tuberculate, late whorls sometimes slightly carinate. Teleoconch sutural ramps flat, concave in late whorls, with 1 increasing to 2-4 spiral grooves that are weak in latest whorls. Last whorl with a few weak narrow spiral grooves at base.

Ground colour white, variably suffused with orange to violet. Last whorl with spiral rows of orangish to reddish brown dots, dashes, bars and spots that alternate irregularly

with white dots and often with triangular spots in some rows. Areas between usually with an incomplete to regular network of less prominent, orangish to reddish brown tent-like spots. Similarly coloured blotches also form interrupted spiral bands, within abapical third, above centre and sometimes below shoulder. Fine reddish brown axial lines may extend from shoulder to base. Form *pongo* (Pl. 43, Figs. 14-16) usually lacks reticulated triangular spots but has more prominent fine white axial lines; specimens may be irregularly clouded with orangish to reddish brown. Larval whorls and adjacent 2 postnuclear sutural ramps light red. Late sutural ramps with orangish to reddish brown radial streaks and blotches, often fusing in latest whorls. In common form, aperture beige marginally, yellow-orange deep within; in form *pongo*, aperture orange-brown marginally, dark red-brown deeper within.

#### *C. bullatus* Shell Morphometry

L	45 - 82 mm
RW	0.17 - 0.52 g/mm (L 45-68 mm)
RD	0.47 - 0.60
PMD	0.60 - 0.74
RSH	0.02 - 0.10

Periostracum very thin, translucent.

Animal white; dorsum of foot with reddish to dark brown lines and blackish brown lateral blotches; tentacles tipped with dark brown; siphon heavily mottled with dark brown dorso-laterally, immaculate at anterior end (Estival, pers. observ.). A red animal is reported from Papua New Guinea (Richards, pers. comm., 1988).

**Habitat and Habits:** Intertidal to about 240 m, most common from slightly subtidal to 50 m; on muddy sand, coral rubble and gravel, often beneath dead coral rocks, outside and inside the reef. Form *pongo* reported from slightly subtidal to about 20 m.

Common form of *C. bullatus* known to feed on fishes and molluscs after nightfall and to be preyed upon by skates and stingrays as well as molluscivorous Conidae (McDowall, 1974).

**Discussion:** *C. bullatus* cannot be confused with any of its congeners. *C. julii* differs in having a narrower aperture and more ventricosely conical last whorl (PMD 0.69-0.78) with orange to brown wavy axial lines rather than complex spiral rows of orange to brown markings.

*C. bullatus* form *pongo* (Pl. 43, Figs. 14-16) is recorded from Indian Ocean localities, while its occurrence in the W. Pacific (reports from E. China Sea and Admiralty Is.) has to be verified. It co-occurs with the common form of *C. bullatus* in Zanzibar.

***Conus floccatus* SOWERBY II, 1841**(Plate 43, Figures 17-20; Plate 82, First row;  
Map 85)

- 1841 *Conus floccatus* Sowerby II, Conch. Ill.: Index, fig. 112 (as nom. nov. for "*C. dux* Lamarck")
- 1845 *Conus magdalenae* Kiener, Coq. Vivant., 2: Pl. 69 fig. 4; 1849-1850: 293
- 1865 *Conus circumsignatus* Crosse, J. Conchyl. (Paris), 13: 311, pl. 10 fig. 4

**Types:** *C. floccatus*: Original figure in Sowerby (1833-1841: Pt. 153/154, fig. 112) (63 x 29 mm); *C. magdalenae*: Holotype in MHNG (52 x 25.5 mm); *C. circumsignatus*: Holotype in BMNH (30 x 16 mm).

**Type Localities:** *C. floccatus*: "Luzon, Philippines" (Sowerby II, 1858).

**Range:** Indonesia and Philippines to Marshall Is.; Solomon Is., Queensland, New Caledonia, Vanuatu, and Samoa.

**Description:** Medium-sized to moderately large or large (New Caledonia), moderately solid to solid. Last whorl conoid-cylindrical, conical, ventricosely conical, ovate or cylindrical; outline varies from almost evenly convex to straight except for convex adapical fourth. Aperture wider at base than near shoulder. Shoulder subangulate to angulate, usually angulate in New Caledonian shells (Pl. 43, Fig. 19). Spire of low to moderate height, outline slightly concave, straight, sigmoid or variably domed. Early postnuclear whorls tuberculate but usually eroded. Teleoconch sutural ramps slightly concave, with a prominent subsutural ridge and 2 increasing to 5 weak spiral grooves, often obsolete or replaced by numerous spiral striae in latest whorls. Last whorl with closely to widely spaced, prominent to weak spiral ribs on basal third.

***C. floccatus* Shell Morphometry**

<b>L</b>	45 - 86 mm
<b>RW</b>	0.20 - 0.75 g/mm (L 45-80 mm)
<b>RD</b>	0.48 - 0.61
<b>PMD</b>	0.72 - 0.86
<b>RSH</b>	0.07 - 0.15

Ground colour white, suffused or clouded with pale pink, grey, blue, violet, or yellow. Last whorl with sparse to numerous brown blotches, flecks, spots, flames, axial streaks and axial lines, usually concentrated or fusing into 2 spiral bands, above and below centre; shells with varied markings of all sorts intergrade with shells with sparse markings of only one type. Spiral rows of alternating white and brown dots, dashes and spots extend from base to shoulder but vary considerably; spiral rows sometimes lack white markings and are sometimes absent. Larval whorls white. Postnuclear sutural ramps with separate to fused,

pale to dark brown radial blotches, streaks and lines often producing dark dots at outer margins. Aperture white or yellow deep within.

Periostracum pale brownish olive, thin, translucent, smooth.

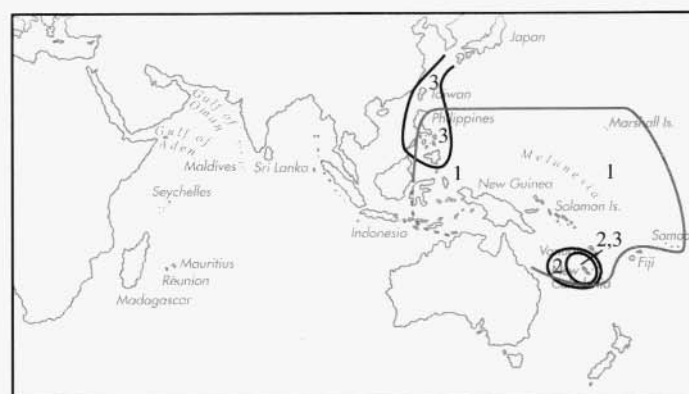
In the Marshall Is., animal of white ground colour. Dorsum of foot mottled with brown, less so medially; anterior end nearly white at corners, with a triangular black blotch centrally; lateral and posterior marginal zones with brown to black radial blotches, well separated longitudinally on extended foot. Sole of foot sparsely mottled with light brown, ends almost immaculate, sometimes shaded with pink. Rostrum with dark brown and black longitudinal lines and streaks except for immaculate white tip. Siphon tipped with orange-red, then with a broad brown band; posterior half with brown markings confluent at base (Pearson, unpubl. observ.) (Pl. 82, First row).

**Habitat and Habits:** In 1-80 m; from lagoon pinnacles to the outer side of barrier reefs, in sand pockets and caves, beneath rocks and on diverse reef substrate; in W. Samoa, in surf-zone under stones (Bayer, pers. comm., 1993). Reported to feed on small fishes and molluscs (Tirard, pers. comm., 1989).

**Discussion:** Specimens of *C. floccatus* with a colour pattern dominated by dark axial lines recall *C. julii*, but their last whorls are heavily clouded with various shades of violet and have prominent spiral rows of dark and white markings. Some shells of *C. floccatus* resemble *C. circumscissus*. The latter species attains larger size (L 55-100 mm), its pattern has prominent spiral bands of varying number but no dark axial lines on the last whorl, and its aperture lacks yellow colour. For comparison with *C. richeri* and *C. gubernator*, see the Discussions of those species.

*C. magdalenae* (Pl. 43, Fig. 20) refers to the yellow colour form of *C. floccatus*, and *C. circumsignatus* seems to be based on a subadult shell of the same shape and similar colour with prominent dark blotches and spiral rows on its last whorl.

Map 85

1: *C. floccatus* 2: *C. richeri* 3: *C. dusaveli*

***Conus richeri* RICHARD & MOOLENBEEK,  
1988**

(Plate 43, Figures 21-23; Map 85)

1988 *Conus richeri* Richard & Moolenbeek, *Venus*, **47** (4): 233-235, pl. 1 figs. 1-5, 10

**Type:** Holotype in MNHN (48 x 22.5 mm).

**Type Locality:** "New Caledonia, Lagon nord, 19°04'S - 163°30'E."

**Range:** New Caledonia and Chesterfield Is.

**Description:** Medium-sized, moderately solid to solid. Last whorl ventricosely conical; outline slightly convex. Shoulder angulate to carinate. Spire of moderate height to high, outline concave. Larval shell of about 3 whorls, maximum diameter about 0.8 mm. First 5-6 postnuclear whorls tuberculate. Teleoconch sutural ramps flat, concave in last whorls, with 2 increasing to 5 spiral grooves gradually disappearing on last ramps. Last whorl smooth except for a few spiral ribs near base.

***C. richeri* Shell Morphometry**

<b>L</b>	36-54 mm
<b>RW</b>	0.14 - 0.40 g/mm
<b>RD</b>	0.51 - 0.62
<b>PMD</b>	0.76 - 0.84
<b>RSH</b>	0.16 - 0.26

Ground colour white. Last whorl with 10-20 spiral rows of orange to reddish brown blotches alternating with white. Larval whorls and adjacent 2 teleoconch sutural ramps white. Following ramps with brown radial blotches. Aperture white.

Periostracum light brown, thin, translucent.

**Habitat and Habits:** In 70-415 m.

**Discussion:** *C. richeri* resembles *C. timorensis* and *C. floccatus*. *C. timorensis* is lighter (RW 0.07-0.22) and its last whorl is more cylindrical in outline. *C. floccatus* differs mainly in its last whorl colour pattern dominated by brown blotches, flecks, flames and axial streaks; these features are not present in *C. richeri*. *C. floccatus* also has a lower spire (RSH 0.07- 0.15) and a less angulate shoulder.

***Conus dusaveli* (H. ADAMS, 1872)**

(Plate 43, Figures 24-28; Map 85)

1872 *Lepticonus* (*Phasmoconus*) *dusaveli* H. Adams, *Proc. Zool. Soc. London*, **1872**: 12, pl. 3 fig. 17

1977 *Textilia dusaveli benten* Shikama & Oishi, in Shikama, *Sci. Rep. Yokohama Natl. Univ.*, **2** (24): 21, pl. 4 figs. 4a, b; pl. 5 fig. 9

**Types:** *L. dusaveli*: Holotype in NMWC (50.5 x 19.5 mm); *T. d. benten*: Holotype in KPM (79 x 29.5 mm).

**Type Localities:** *L. dusaveli*: "Mauritius", "from the stomach of a fish"; *T. d. benten*: "off Senkaku Island, East China Sea."

**Range:** Ryukyu Is. to Philippines; New Caledonia.

**Description:** Moderately large to large, usually solid. Last whorl narrowly conoid-cylindrical to narrowly ovate; outline convex adapically, less so or straight below. Aperture wider at base than near shoulder. Shoulder subangulate to indistinct. Spire of low to moderate height, outline straight to convex. Larval shell of about 3.5 whorls, maximum diameter 1.1 mm. About first 4 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 1 increasing to 4-7 spiral grooves. Last whorl with widely spaced weak spiral grooves at base.

***C. dusaveli* Shell Morphometry**

<b>L</b>	67 - 93 mm
<b>RW</b>	0.27 - 0.54 g/mm (L 67-80 mm)
<b>RD</b>	0.45 - 0.50
<b>PMD</b>	0.73 - 0.78
<b>RSH</b>	0.08 - 0.14

Ground colour white. Last whorl usually overlaid with yellow to orangish brown except for siphonal fasciole and often also area along outer lip of larger adults. Brown bars or blotches fuse into 3 continuous or interrupted spiral bands, at shoulder, above centre and within abapical third. Widely spaced spiral rows of bluish brown to brown dots, dashes and bars extend from base to shoulder, articulated with white and either prominent or obscure within the spiral colour bands. Larval whorls and 3-4 adjacent teleoconch sutural ramps pink. Late ramps with brown radial lines, streaks and blotches, often confluent in latest whorls. Aperture yellow deep within, sometimes completely white (Walls, [1979]).

**Habitat and Habits:** In 50-288 m, on or in sand; New Caledonian specimens were dredged in 200-288 m.

**Discussion:** *C. dusaveli* cannot be confused with any of its congeners. It is probably most similar to *C. bullatus*, which usually has a broader (RD 0.47-0.60) and more ovate (PMD 0.60-0.74) last whorl, and its colour pattern lacks spiral bands of alternating bluish brown and white markings.



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***Conus cervus* LAMARCK, 1822**

(Plate 44, Figures 1-4; Map 86)

1822 *Conus cervus* Lamarck, Hist. Nat. Anim. s. Vert., 7: 510-511, no. 151**Type:** Holotype in MHNG (94 x 43 mm).**Type Locality:** "Moluccas" (Coomans et al., 1983).**Range:** Philippines, Moluccas and New Caledonia; probably Marshall Is.

**Description:** Large and solid. Last whorl ovate to narrowly ovate; outline straight at adapical fourth, then convex, straight to slightly concave toward base. Aperture somewhat wider at base than near shoulder. Shoulder angulate. Spire low, outline slightly concave to slightly convex. Larval shell projecting, of about 3.5 whorls; maximum diameter 1-1.1 mm. About first 3 postnuclear whorls tuberculate. Teleoconch sutural ramps flat, slightly concave in latest whorls, with 0-1 increasing to 6-10 spiral grooves. Last whorl with a few very weak spiral ribs at base or completely smooth.

***C. cervus* Shell Morphometry**

<b>L</b>	90 - 116 mm
<b>RW</b>	0.30 - 0.80 g/mm (L 90-113 mm)
<b>RD</b>	0.49 - 0.53
<b>PMD</b>	0.68 - 0.74
<b>RSH</b>	0.04 - 0.10

Last whorl clouded with light brown except for numerous white dots, triangles and flecks; brown pattern fused into 3 darker spiral bands, below shoulder, above centre and within abapical third. Widely spaced spiral rows of irregularly alternating white and darker brown markings extend from base to shoulder. Siphonal fasciole white or suffused with pale brown. Larval whorls and 1.5-2.5 teleoconch sutural ramps light red. Following ramps light brown, radially mottled with white. Aperture white.

**Habitat and Habits:** In 180-400 m.

**Discussion:** *C. cervus* cannot be mistaken for any of its congeners; *C. vicweei* is similar in shape but quite different in colour pattern, as noted in the Discussion of that species.

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***Conus vicweei* OLD, 1973**

(Plate 44, Figures 5-7; Map 86)

1973 *Conus (Textilia) vicweei* Old, Veliger, 16 (1): 58-60, figs. 1-3, 5**Type:** Holotype in AMNH (66 x 31 mm).**Type Locality:** "off Northwest Coast of Sumatra, Indonesia".**Range:** Andaman Sea from Burma to Strait of Malacca.

**Description:** Moderately large to large, moderately solid to solid. Last whorl usually narrowly ovate; outline convex, grading to straight at adapical fourth and below centre. Aperture wider at base than near shoulder. Shoulder angulate. Spire low, outline slightly concave, straight or slightly sigmoid. First 3-5 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 0-1 increasing to 6-11 spiral grooves. Last whorl with a few weak spiral grooves at base.

***C. vicweei* Shell Morphometry**

<b>L</b>	65 - 91 mm
<b>RW</b>	0.20 - 0.53 g/mm
<b>RD</b>	0.46 - 0.51
<b>PMD</b>	0.71 - 0.85
<b>RSH</b>	0.05 - 0.10

Last whorl brown or violet brown, with variably numerous white to cream arrow- or zigzag-shaped lines, concentrated in spiral bands within adapical and abapical thirds and at base. Pattern may be reduced along outer lip and on ventral side. Apex white. Following sutural ramps with light brown radial blotches, confluent in latest whorls. Aperture white.

Periostracum thin and translucent.

Animal light yellow, with some short black lines on the lateral sides of the foot (Roussy, pers. comm., 1990).

**Habitat and Habits:** In 70-200 m.

**Discussion:** *C. vicweei* is similar to *C. cervus* in colour and shape, but *C. cervus* lacks white zigzag lines and *C. vicweei* lacks spiral rows of alternating brown and white markings.

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***Conus barthelemyi* BERNARDI, 1861**

(Plate 44, Figures 8-12; Map 86)

1861 *Conus barthelemyi* Bernardi, J. Conchyl. (Paris), 9: 285-286; 1862 ibid., 10: 46-47, pl. 1 fig. 121977 *Conus (Rhizoconus) paradiseus* Shikama, Sci. Rep. Yokohama Natl. Univ., 24: 20, pl. 4 figs. 2a, b, pl. 5 fig. 6

**Types:** *C. barthelemyi*: Holotype in NMWC (70 x 37 mm); *C. paradiseus*: Holotype in KPM (58 x 31 mm).

**Type Localities:** *C. barthelemyi*: "les six îles, archip. Chagos" (1861); "les îles de l'Archipel Chagos ou Diego Garcia (mer des Indes)" (1862); *C. paradiseus*: "Indian Ocean."

**Range:** Mascarenes, Comores, Seychelles, Chagos, and Maldives; probably also Sri Lanka; Christmas Is. and Cocos (Keeling) Is. (S. E. Indian Ocean).

**Description:** Medium-sized to large, moderately solid to solid; Maldive shells smaller. Last whorl ventricosely conical to conical; outline convex at adapical fourth, straight below, occasionally slightly concave centrally; shells from Christmas Is. and Cocos (Keeling) Is. narrower than those from other areas (Singleton, pers. comm., 1993). Siphonal fasciole prominent in larger shells. Shoulder broadly carinate to carinate. Spire low, of moderate height in Maldive specimens (Pl. 44, Fig. 11); outline usually sigmoid, sometimes nearly straight. Larval shell projecting, maximum diameter 0.7-0.8 mm. First 4-7 postnuclear whorls tuberculate, late whorls broadly carinate. Teleoconch sutural ramps almost flat, grading to deeply concave in late whorls, with 2 increasing to 4-9 spiral grooves that are often weak on latest ramps; prominent subsutural ridge as strong as or stronger than shoulder carina. Last whorl with weak to distinct, variably spaced spiral ribs and ribbons on basal fourth and with distinct to obsolete spiral striae to shoulder.

#### *C. barthelemyi* Shell Morphometry

<b>L</b>	42 - 84 mm
<b>RW</b>	0.23 - 0.73 g/mm (L 42-80 mm)
<b>RD</b>	0.55 - 0.65
<b>PMD</b>	0.82 - 0.91
<b>RSH</b>	0.06 - 0.12 (typical form)
	0.11 - 0.14 (Maldives)

Ground colour white. Last whorl with variably broad, orangish to reddish or violet brown spiral bands usually leaving interrupted to solid narrow white bands centrally and at base. Spiral rows of blackish brown dots, spots, bars,

and blotches from base to shoulder; number and arrangement of rows and markings within rows highly variable. Shells with immaculate last whorls almost completely overlaid with blending shades of orange to violet brown intergrade with shells that have their last whorls prominently mottled with white and black. In Maldives, last whorl lighter orange-pink. Siphonal fasciole white to pale orange. Larval whorls white. First 2-4 teleoconch sutural ramps immaculate white or cream; following ramps with light brown to black radial blotches usually extending over outer margin. Aperture white to bluish white.

Periostracum brown to olive-brown, rather thick, slightly translucent to opaque, with closely spaced fine axial and wrinkled spiral ridges.

Animal mottled light and dark brownish pink (Couacaud, pers. comm., 1988).

**Habitat and Habits:** In 10-30 m, on sand and rock substrata.

**Discussion:** *C. barthelemyi* is very similar to and perhaps conspecific with *C. gauguini*; it may also be confused with *C. gubernator* from the Mascarenes and Amirantes. For comparison, see the Discussions of the latter species.

## 199

### *Conus gauguini* RICHARD & SALVAT, 1973

(Plate 44, Figures 13-17; Map 86)

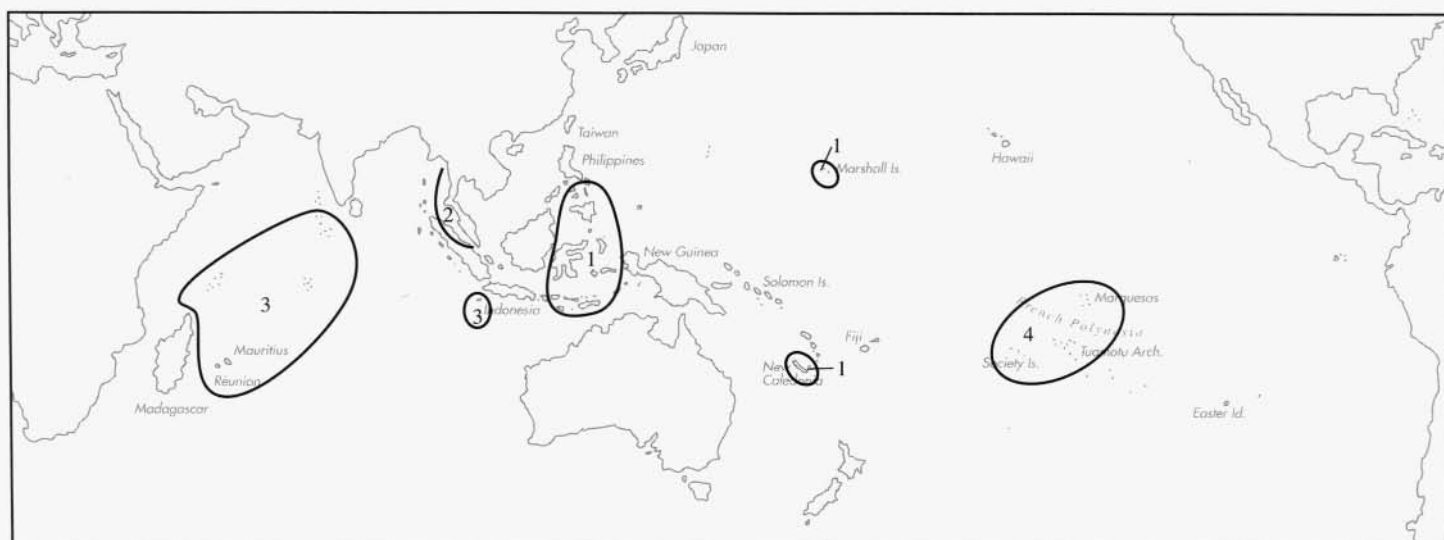
1973 *Conus gauguini* Richard & Salvat, Cahiers du Pacifique, 17: 25, figs. 1-3

**Type:** Holotype in MNHN (87 x 40.5 mm).

**Type Locality:** "Iles Marquises."

**Range:** Marquesas, Tahiti.

Map 86



1: *C. cervus* 2: *C. vicweei* 3: *C. barthelemyi* 4: *C. gauguini*

**Description:** Moderately large to large, solid to moderately heavy. Last whorl ventricosely conical to conical; outline convex at adapical fourth to third, straight below, occasionally slightly concave centrally. Siphonal fasciole indistinct to prominent. Shoulder sharply carinate. Spire usually low, outline straight but early postnuclear whorls often slightly domed. Larval shell projecting, maximum diameter 0.7-0.8 mm. First 4-7 postnuclear whorls tuberculate, late whorls carinate. Teleoconch sutural ramps almost flat, grading to deeply concave in later whorls, with 2 increasing to 6-10 distinct spiral grooves; prominent subsutural ridge as strong as shoulder carina. Last whorl with variably spaced, rather fine spiral ribs on basal third.

#### *C. gauguini* Shell Morphometry

<b>L</b>	60 - 87 mm
<b>RW</b>	0.60 - 0.75 g/mm (L 60-71 mm)
<b>RD</b>	0.57 - 0.66
<b>PMD</b>	0.81 - 0.87
<b>RSH</b>	0.07 - 0.13

Ground colour white. Last whorl with pinkish or brownish violet spiral bands and axial clouds, leaving 1-3 interrupted to solid white bands, just below centre, and sometimes within adapical third, and at base. Sparse spirally arranged black spots, flecks, and blotches may occur, sometimes also forming rows of alternating black and white dots and dashes (Pl. 44, Fig. 16). Siphonal fasciole white to violet. Larval whorls and a few adjacent postnuclear sutural ramps immaculate white. Following ramps mainly suffused with pinkish to bluish violet adaxially, margins white; brown to black radial blotches either extending across ramps or reduced to spots and flecks at both margins. Aperture white to bluish white.

Periostracum brown, rather thick.

**Habitat and Habits:** In 20-50 m on coral reefs.

**Discussion:** *C. gauguini* can be confused with *C. barthelemyi* from the W. and Central Indian Ocean; the two are separated more by distance than by morphology. The latter species has weaker spiral sculpture on its late sutural ramps, and its shoulder is not sharply carinate. In *C. gauguini*, the surface of the last whorl is often smoother adapically (distinct spiral striae are absent) and has fine spiral ribs instead of ribs and ribbons at base. The last whorl pattern of *C. barthelemyi* is orangish to reddish brown rather than violet, and its sutural ramps have radial blotches rather than marginal markings. Because of their widely separated geographic ranges, we tentatively distinguish *C. gauguini* and *C. barthelemyi* as species rather than at the subspecies level.

## 200

### *Conus striatus* LINNÉ, 1758

(Plate 44, Figures 18-25; Plate 45, Figures 1-3; Plate 82, Second row; Map 87)

- 1758 *Conus striatus* Linné, Syst. Nat., 10 ed., 1: 716, no. 277
- 1786 *Conus leoninus* [Lightfoot], Cat. Portland Mus.: 72, no. 1620
- 1858 *Conus floridus* Sowerby II, Thes. Conch., 3: 47, frontispiece fig. 558
- 1978 *Conus chusaki* da Motta, Centre Thai Nat. Study, 6 (figs.), 8 (text figs.), Addenda
- 1985 *Conus subfloridus* da Motta, La Conchiglia, 17 (190-191): 27-28, figs. 4a-d

**Types:** *C. striatus*: Lectotype (Kohn, 1963) in LSL (62 x 31 mm); *C. leoninus*: Lectotype (Kohn, 1964) figured in Knorr (1768: Pl. 12 fig. 5) (62 x 31.5 mm); *C. floridus*: 2 Syntypes in BMNH (77 x 44; 69 x 32 mm); *C. chusaki*: Holotype in MNHG (65 x 30 mm); *C. subfloridus*: Holotype in MNHG (76 x 35.5 mm).

**Type Localities:** *C. striatus*: "Hitoe"; *C. chusaki*: "shorelines of Raya Island, Phuket"; *C. subfloridus*: "Gulf of Mannar between India and Sri Lanka."

**Range:** South Africa to Red Sea, Hawaii, and French Polynesia; form *floridus*: W. Thailand and Andaman Is.; form *subfloridus*: Gulf of Mannar, Coromandel Coast and W. Thailand.

**Description:** Medium-sized to large, solid to heavy; forms *floridus* and *subfloridus* usually moderately large and solid. Last whorl narrowly conoid-cylindrical to conoid-cylindrical, narrowly cylindrical to cylindrical, or ventricosely conical to ovate; outline from almost evenly convex to almost straight and nearly parallel-sided centrally, generally straight just below shoulder. In form *floridus*, last whorl usually ovate. Aperture wider at base than near shoulder. Shoulder sharply angulate to sharply carinate. Spire of low to moderate height; outline concave to slightly convex or slightly sigmoid, stepped, less so in form *subfloridus*. Larval shell of about 3.5 whorls, maximum diameter 0.7-0.8 mm. First 3-5 postnuclear whorls tuberculate, following whorls angulate to sharply angulate, usually only last 1-2 whorls carinate. Teleoconch sutural ramps flat, slightly concave to concave in latest whorls, with 0-1 increasing to 3-7 spiral grooves; spiral sculpture generally weaker on latest ramps, very weak in form *subfloridus*. Last whorl with closely spaced, generally fine spiral ribs on basal third, finer and obsolete above, occasionally persisting to shoulder; siphonal fasciole with distinct spiral ribs except for very weak ribs in form *subfloridus*.

Typical form (Pl. 44, Figs. 18-23) with white ground colour, often suffused with shades of grey, blue, pink and violet. Last whorl with brown to black flecks, blotches, flames and axial streaks containing solid, dashed or dotted darker spiral lines and usually concentrated in 2 interrupted



to solid spiral bands, above and below centre. Almost immaculate white shells intergrade with heavily patterned shells; striate colour markings often fuse into broad coalescing spiral bands or form a coarse network.

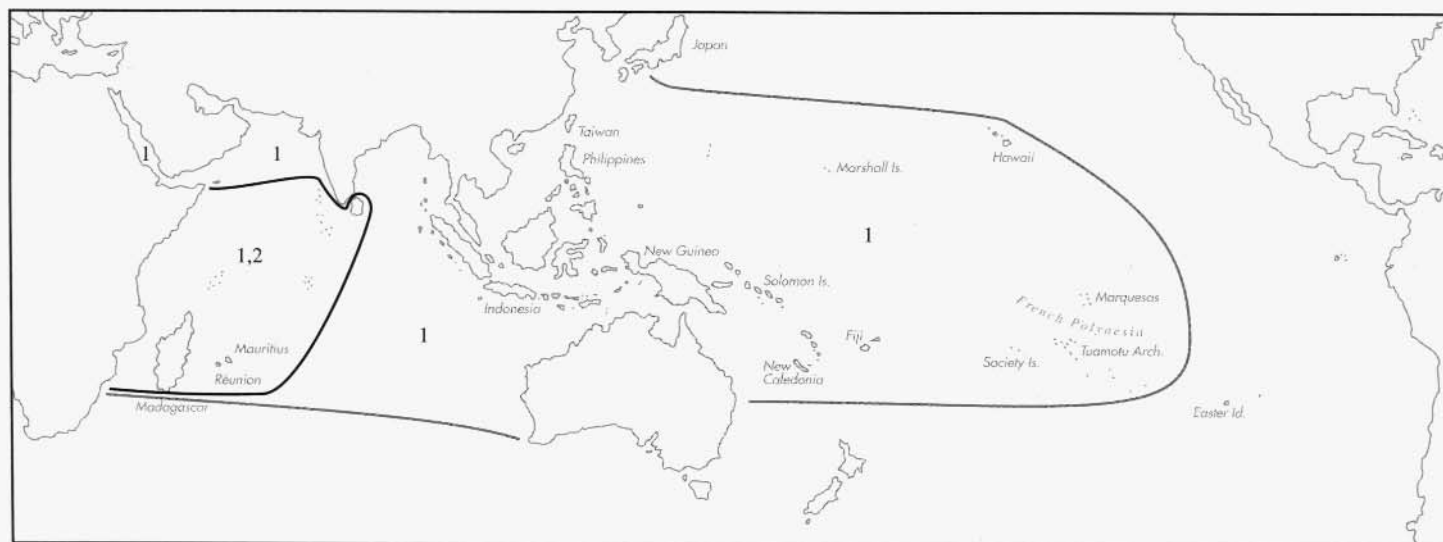
#### ***C. striatus* Shell Morphometry**

<b>L</b>	55 - 129 mm
- form <i>floridus</i>	57 - 82 mm
- form <i>subfloridus</i>	60 - 88 mm
<b>RW</b>	0.24 - 1.10 g/mm (L 55-111 mm)
- form <i>floridus</i>	0.30 - 0.60 g/mm (L 57-76 mm)
- form <i>subfloridus</i>	0.24 - 0.71 g/mm (L 60-86 mm)
<b>RD</b>	0.47 - 0.62
- form <i>floridus</i>	0.52 - 0.59
- form <i>subfloridus</i>	0.47 - 0.55
<b>PMD</b>	0.70 - 0.82
- form <i>floridus</i>	0.69 - 0.76
- form <i>subfloridus</i>	0.71 - 0.79
<b>RSH</b>	0.00 - 0.14
- form <i>floridus</i>	0.09 - 0.15
- form <i>subfloridus</i>	0.06 - 0.13

Form *floridus* (Pl. 44, Figs. 24, 25) with white ground colour. Last whorl clouded or spirally banded with shades of pink, orange, brown, or violet. Spirally aligned brown markings occur on each side of centre, are less prominent below shoulder, and vary in number, size and shape; maculation generally sparser than in typical form. Brown spiral lines extending from siphonal fasciole to shoulder, more prominent within background clouds and bands, coarse and very dark within brown markings; spiral lines sometimes partially restricted to these markings but even in otherwise immaculate shells traceable within some ground-colour zones.

Form *subfloridus* (Pl. 45, Figs. 1-3) with white ground colour, variably suffused with pale purple to bluish violet.

Map 87



1: *C. striatus* 2: *C. gubernator*

Last whorl with spirally aligned yellowish to dark reddish brown spots, blotches and axial streaks within basal third, adapical third, and sometimes below shoulder. Brown markings often contain darker brown spiral lines and sometimes also wavy darker brown axial lines. Pattern usually sparse, occasionally absent.

In typical form, siphonal fasciole white to cream, with variably spaced very fine brown axial lines; form *subfloridus* without these lines, form *floridus* with dotted and dashed lines on white ground. Larval whorls and about first postnuclear sutural ramp orange; in Hawaii, larval whorls pale pink before metamorphosis (Perron, 1981a); in form *subfloridus*, larval whorls and about first 3 postnuclear sutural ramps pale brown to pink. Following sutural ramps with yellowish to blackish brown radial lines, streaks and blotches, the latter often containing darker axial lines. Aperture white to bluish white, occasionally cream deep within; white to beige in form *subfloridus*; in form *floridus*, orange deep within.

Periostracum yellow to olive or red-brown, thin, translucent, and smooth or with fringes at shoulder; in subadults, periostracum pale yellow. Periostracum of form *floridus* almost identical to that of typical form with fringed shoulder; periostracum of form *subfloridus* also very similar but smooth at shoulder, sometimes opaque (Kohn, 1978a, as "*C. gubernator*").

Adult animals from Marshall Is., New Caledonia, Papua New Guinea, and Red Sea are very similar in colour pattern (Pearson, unpubl. observ., Estival, unpubl. observ., de Couet, unpubl. observ.; Richards, pers. comm., 1989; Fainzilber et al., 1992). Dorsum of foot white, with interlaced brown flecks, radial streaks and blotches that may be mottled with darker brown and be darker on lateral marginal zones; lateral pattern varies from well-separated radial markings to nearly solid brown; anterior corners and median zone almost immaculate. Sole of foot white to cream, mottled with brown. Rostrum white to beige, mottled and axially striped with brown except for distal zone. Tentacles

white. Siphon white, immaculate at tip, then mottled and transversely striped with brown and/or grey to black dorso-laterally. In the Marshall Is., large subadult specimens of nearly identical shell pattern may have a body colouration similar to that of the adults or have a white foot except for brown lateral edges, while the siphon is typically patterned. Small subadult animals from Marshall Is. are white or grey to orange, often darker at anterior ends of foot, rostrum and siphon and with scattered brown to black dots (Pl. 82, Second row). In animals from Indonesia, foot orange, lightly mottled with dark brown; siphon tipped with vermilion (Kohn, unpubl. observ.). Foot, rostrum and siphon of Hawaiian specimens usually mottled tan and brown, while specimens with immaculate white shells have pale pink bodies (Kohn, 1959a; Edmonds, 1972). Philippine animals reported to have a pale yellow proboscis and the foot black dorsally and red-brown ventrally (Bergh, 1895). Form *floridus* reported to have a pink animal (da Motta, 1978).

Radular teeth long; adapical part with a short anterior barb opposite a long posterior barb with recurved tip, and with a short additional barb between and nearly perpendicular to the others; serration and basal spur absent (Bergh, 1895; Kohn, 1956; Marsh, 1977; James, 1980). The tooth depicted by Bandel (1984; p. 163) in Fig. 320 is that of an adult specimen, while that in Fig. 322 appears to be from a subadult specimen with the barbs not yet completely developed.

**Habitat and Habits:** Typical form in 1-25 m, usually in sand on coral reef, often beneath rocks and dead coral slabs (Kohn, 1959a, b, 1960; Kohn & Nybakken, 1975; Perron, 1981b; Sharabati, 1984; Reichelt & Kohn, 1985; Tirard, pers. comm., 1989). Form *floridus* reported from sand bottoms in 20-40 m, form *subfloridus* from about 50 m.

*C. striatus* known to feed on fishes, reported occasionally to consume molluscs; it has been observed both to ignore recently killed fishes (Kohn, 1956) and attack them the same way as living prey (Pearson, unpubl. observ.). Venom toxic to fishes, molluscs, small mammals and crabs, not affecting polychaetes (Kohn, Saunders & Wiener, 1960; Endean & Rudkin, 1965). *C. textile* and *Pleuroploca filamentosa* Röding observed to prey on *C. striatus*.

Oviposition of the typical form beneath dead coral slabs and rocks; capsules of about 25x16 mm deposited in parallel rows. Egg diameter of 235-255 µm predicts a minimum pelagic period of 20-19 days; in Hawaii, diameter is 250 µm and a pelagic period of 21 days (in vitro) has been observed (Perron, 1981a, b; Perron & Kohn, 1985).

**Discussion:** *C. striatus* is most similar to *C. gubernator*; for the distinctions, see the Discussion of that species.

*C. floridus* (syn. *C. chusaki*) and *C. subfloridus* are sometimes regarded as conspecific with each other but separate from *C. striatus* (Richard, 1990), while other authors consider *C. floridus* to represent only a slight variant of *C. striatus* (E.A. Smith, 1884). We provisionally consider both to be ecological variants of *C. striatus* from deeper subtidal habitats. In W. Thailand, where all three occur sympatrically, they are very similar in shell shape, sculpture and colour pattern.

## 201

### *Conus gubernator* HWASS in BRUGUIÈRE, 1792

(Plate 45, Figures 4-21; Map 87)

- 1792 *Conus gubernator* Hwass in Bruguière, Encycl. Méth., 1: 727-728, no. 121
- 1810 *Conus terminus* Lamarck, Ann. Mus. Hist. Nat. Paris, 1810: 426, no. 141
- 1799 *Conus leehmani* da Motta & Röckel, La Conchiglia, 11 (122-123): 17-18, text figs.
- 1990 *Conus veillardii* da Motta, La Conchiglia, 22 (253-255): 44-46, text figs.

**Types:** *C. gubernator*: Lectotype (Kohn, 1968) in MHNG (76 x 34 mm); *C. terminus*: Holotype figured in Kiener (1845: Pl. 48 fig. 1d) (83 x 32 mm); *C. leehmani*: Holotype in MHNG (65.5 x 34 mm); *C. veillardii*: Holotype in MHNG (52.5 x 25.5 mm).

**Type Localities:** *C. gubernator*: "l'Océan asiatique"; *C. terminus*: "l'Océan asiatique"; *C. leehmani*: "Maldives Is., Indian Ocean"; *C. veillardii*: "Glorieuses Islands, 11.30 S 47.20 E, western Indian Ocean."

**Range:** Natal and Madagascar to Somalia, Mascarenes, and Seychelles to Chagos and to Maldives and Laccadives.

**Description:** Medium-sized to large, moderately solid to moderately heavy. Last whorl conical to ventricosely conical in form *leehmani*, also narrowly conical and narrowly conoid-cylindrical to conoid-cylindrical in typical form and intermediate shells; outline slightly to sometimes strongly convex at adapical fourth to third, straight below; adapical fourth often bulbous and central area slightly concave in form *leehmani* and intermediate shells. Siphonal fasciole and siphonal notch ranging from indistinct to prominent. Shoulder angulate to usually carinate. Spire of low to moderate height; outline slightly convex or slightly sigmoid to concave, concave to deeply concave in form *leehmani*. Larval shell of 2.5-2.75 whorls (form *leehmani*); maximum diameter about 0.8 mm in form *leehmani*, 0.8-1.2 mm in typical form. First 4-8 postnuclear whorls tuberculate. Teleoconch sutural ramps flat in early whorls, concave to deeply concave in late whorls, with 0-1 increasing to 5-10 spiral grooves; spiral sculpture weak to obsolete on latest ramps. Last whorl with several shallow spiral grooves on basal fourth to third and variably broad ribbons between; fine spiral threads extending from shoulder to base, occasionally coarser on basal ribbons.

#### *C. gubernator* Shell Morphometry

L	50 - 106 mm
RW	0.27 - 0.95 g/mm (L 50-93 mm)
RD	0.46 - 0.55 (Mozambique, Tanzania, Madagascar, Somalia)
	0.48 - 0.57 (Amirantes, Seychelles, Mascarenes, Sri Lanka)
	0.55 - 0.64 (Maldives, Laccadives)
PMD	0.78 - 0.90
RSH	0.04 - 0.15

Typical form (Pl. 45, Figs. 4-18): Ground colour white, often suffused with violet and less commonly with grey or brown. Last whorl with separate or confluent tan, reddish or blackish brown axial markings. Each marking may have two different shades of brown; surface often with underlying yellowish brown to violet background pattern. Violet tints more pronounced in specimens from Mozambique, Madagascar and Aldabra Is. than in shells from more northern localities. Axial markings variable in size and shape, ranging from irregular flecks to large, often zigzag flames. Pattern elements evenly distributed across last whorl or clustered in spiral rows on both sides of centre; rows may partially fuse into solid bands. Shells lacking surface pattern elements intergrade with shells with a heavily blotched and banded last whorl. Siphonal fasciole white, occasionally tinged with yellowish brown. Larval whorls and first 1-4 postnuclear sutural ramps white to orange, or light pink. Following sutural ramps with yellowish to reddish or dark brown radial blotches, streaks or lines. Aperture white to bluish white; occasionally bright orange deep within.

Periostracum yellow-olive to dark brown, thin to moderately thick and translucent to opaque, with fine closely set axial ridges. Colour and structure do not vary with locality or growth stage.

Form *leehmani* (Pl. 45, Figs. 20, 21): Ground colour white to cream. Last whorl with a yellowish brown spiral band on each side of centre; an additional spiral band may be present below shoulder. Spiral colour bands separate or connected by a variable number of identically coloured axial streaks to broad bands. Dark or reddish brown spots or axial streaks or blotches mostly over spiral bands; markings usually sparse and irregularly spaced, occasionally absent. Siphonal fasciole white or tinged with yellow. Larval and first 1-4 postnuclear sutural ramps orange. Following sutural ramps with reddish brown radial blotches. Aperture white, pale orange deep within in some specimens.

Periostracum yellowish brown, thin and translucent, smooth in subadults but with densely set axial ridges in adults.

Radular teeth with 3 strong barbs adapically, with a recurved tip in backward-pointing posterior barb; neither a serration nor a basal spur present (Nybakken, 1990).

**Habitat and Habits:** In Mozambique, in the low intertidal zone in sheltered or semi-sheltered habitats, on muddy sand and sand with *Thalassodendron* (Grosch, pers. comm., 1989); in Natal, in depths below 30 m; in the Mascarenes, in 40-60 m; in the Chagos Archipelago, in 0.3-3 m (Samu, 1980); in the Maldives, in 2-6 m.

Radular tooth morphology predicts piscivory in *C. gubernator* (see *C. striatus*). Radular tooth morphology predicts piscivory in *C. gubernator* (see *C. striatus*).

**Discussion:** *C. gubernator* is most similar to *C. striatus*, with which it broadly co-occurs. *C. striatus* is distinguished by more cylindrical or ovate last whorl (PMD 0.69- 0.82) and its larval shell of about 3.5 (vs. 2.75) whorls. Its typical form and form *floridus* differ also in the prominent spiral lines on the last whorl. *C. magus* may also be similar to

typical *C. gubernator*. It differs in its angulate to subangulate shoulder and its more prominent spiral sculpture on the late sutural ramps; spiral rows of dots and dashes on the last whorl are absent in *C. gubernator*.

Conchological similarities in size, sculpture of last whorl and spire as well as colour pattern suggest that *C. gubernator* and the form originally described as *C. leehmani* are conspecific. The latter occurs mainly in the Maldives and Laccadive Archipelagoes and occasionally in Mozambique. Specimens from Chagos, Seychelles, Amirantes, and Mascarenes (Pl. 45, Figs. 15-19) are intermediate in shell morphology, colour pattern, and apex colouration between typical *C. gubernator* and form *leehmani*.

The species originally described as *C. veillardii* (Pl. 45, Fig. 6) differs from *C. gubernator* only in its smaller adult size. Colour pattern of the last whorl, aperture colour and sculpture of the shell agree with *C. gubernator* and we regard *C. veillardii* as a local variant. Shells of smaller adult size but otherwise not separable from typical *C. gubernator* are known also from the nearby Aldabra Is.

## 202

### *Conus australis* HOLTEN, 1802

(Plate 46, Figures 1-11; Map 88)

- 1802 *Conus australis* Holten, Enum. Syst. Conch.: 39, no. 87
- 1810 *Conus australis* Lamarck, Ann. Mus. Hist. Nat. Paris, 15: 439, no. 179 (non *C. australis* Schröter, 1803)
- 1823 *Conus gracilis* Sowerby I, Genera Rec. and Foss. Shells, 2 (16): Pl. 267 fig. 4
- 1823 *Conus duplicatus* Sowerby I, Genera Rec. and Foss. Shells, 2 (16): Pl. 267 fig. 5
- 1963 *Asprella alabasteroides* Shikama, Sci. Rep. Yokohama Natl. Univ. (II), 10: 65, pl. 1 figs. 9a, b
- 1982 *Conus cebuganus* da Motta & Martin, Carfel Philippine Shell News, 4 (3): 1, 3, fig. 1
- 1992 *Conus gabryae* Korn & Röckel, Acta Conchyl., 3: 13-16, pl. 2 figs. 11-20

**Types:** *C. australis* Holten and *C. australis* Lamarck: Lectotypes (Kohn, 1981) figured in Chemnitz (1795: Pl. 183 figs. 1774, 1775) (60 x 24 mm); *C. duplicatus*: Holotype figured in Sowerby I (1823: Pl. 267 fig. 5) (68 x 30 mm); *C. gracilis*: Holotype figured in Sowerby I (1823: Pl. 267 fig. 4) (77 x 27 mm); *C. alabasteroides*: Holotype in KPM (57 x 21 mm); *C. cebuganus*: Holotype in MHNG (36 x 14.5 mm); *C. gabryae*: Holotype in SMNS (62.5 x 26 mm).

**Type Localities:** *C. australis* Holten: "Taiwan" (Coomans et al. 1981); *C. australis* Lamarck: "Botany Bay, Australie"; *C. duplicatus*: "Solomon Is." (Coomans et al., 1985b); *C. alabasteroides*: "Tatsugahama. Wakayama Pref."; *C. cebuganus*: "Visayan Sea, between Malapascua Is. and Bantayan Is. and northward"; *C. gabryae*: "Russell Is., Solomon Archipelago."

**Range:** *C. a. australis*: Japan to Philippines and Vietnam; India and W. Thailand, probably also Fiji; *C. a. gabryae*: Solomon Is.



**Description:** *C. a. australis* (Pl. 46, Figs. 1-8) moderately large to large, moderately solid to solid. Last whorl narrowly conoid-cylindrical to ventricosely conical, to conical in subadults; outline variably convex adapically, less so to straight below. Shoulder subangulate to sometimes angulate. Spire of moderate height, outline slightly concave to slightly sigmoid. Larval shell of about 3.25 whorls, maximum diameter 0.8-0.9 mm. First 2-7 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 0 increasing to 3-8 spiral grooves. Last whorl usually encircled with variably spaced, variably granulate ribs sometimes grouped in pairs or replaced by ribbons; intervening grooves narrow to wide and axially striate.

*C. a. gabryae* (Pl. 46, Figs. 9-11) smaller. Last whorl ventricosely conical to ovate, also narrowly conoid-cylindrical in subadults. Shoulder angulate. First 3-5 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to concave, with 1 increasing to 3-4 spiral grooves. Last whorl with granulate ribbons or pairs of granulate ribs from base to shoulder; shells with strongly granulate prominent spiral elevations intergrade with shells with a preponderance of axially striate incisions. Otherwise, *C. a. gabryae* matching *C. a. australis* in shell morphology.

#### *C. australis* Shell Morphometry

	<i>C. a. australis</i>	<i>C. a. gabryae</i>
<b>L</b>	64 - 105 mm	55 - 78 mm
<b>RW</b>	0.20 - 0.53 g/mm (L 64-84 mm)	0.30- 0.48 g/mm
<b>RD</b>	0.44 - 0.52	0.48 - 0.55
- subadults	to 0.56	
<b>PMD</b>	0.76 - 0.85	0.72 - 0.80
- subadults	to 0.87	
<b>RSH</b>	0.14 - 0.21	0.13 - 0.21

*C. a. australis*: Ground colour white, often suffused with pale yellow or brown. Last whorl with brown spirally or axially aligned dots or flecks, axial streaks, flames and dashes. Pattern elements merging into 3 interrupted to solid brown spiral bands, below shoulder and above and below centre. Larval whorls white. First 1.5-3 postnuclear sutural ramps immaculate. Following sutural ramps with brown radial blotches and streaks. Aperture white, sometimes violet deep within.

Periostracum brownish olive, thin, slightly translucent, smooth.

*C. a. gabryae*: Colour pattern as in *C. a. australis*, except last whorl often with elongate axial lines, mostly brown. Aperture white.

Periostracum dark brown.

Radular teeth with an adapical barb opposite a blade; serration twice as long as blade, ending in a cusp at centre of shaft; central waist and basal spur present (Rolán, pers. comm., 1993).

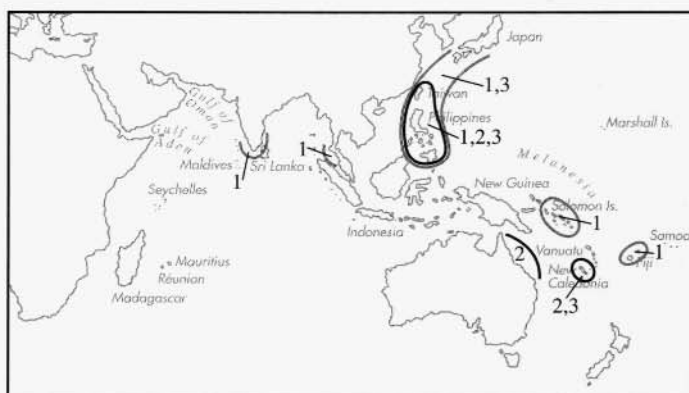
**Habitat and Habits:** *C. a. australis* in 35-240 m. Original material of *C. cebuganus* was dredged in "sandy-mud bottom .. in depths of 20-40 fathoms." *C. a. gabryae* in 120-180 m.

**Discussion:** For comparison with *C. laterculatus*, *C. kuroharai*, *C. armadillo*, *C. leobrerai*, and *C. ranonganus* see the Discussions of those species.

We provisionally recognize *C. a. gabryae* as a subspecies restricted to the Solomon Is. It differs from *C. a. australis* mainly in having a more ventricose to ovate last whorl, and some specimens have colour patterns not known in *C. a. australis*. In 1989, L. Raybaudi Massilia described the subspecies *C. a. gabryae* under the name "*Conus (Asprella) armadillo gabryae*". However, this name is not available under ICZN Art. 7A, and redescription was required (Korn & Röckel, 1992).

*C. alabasteroides* (Pl. 46, Fig. 7) and *C. cebuganus* (Pl. 46, Fig. 8) are based on subadult specimens of *C. a. australis* and are synonyms. *C. duplicatus* matches deep subtidal shells from the Philippines (Pl. 46, Fig. 5) in shape and sculpture (Röckel, 1987b). We therefore consider it an ecological form of *C. a. australis*, characterized by strong, paired ribs on the last whorl, weak spiral colour bands, predominant short axial lines and dashes, and a rather straight last whorl outline.

Map 88



1: *C. australis* 2: *C. armadillo* 3: *C. kuroharai*

## 203

### *Conus armadillo* SHIKAMA, 1971

(Plate 46, Figures 12-15; Map 88)

1971 *Conus (Asprella) armadillo* Shikama, Sci. Rep. Yokohama Natl. Univ. (II), 18: 34-35, fig. 2

**Type:** Holotype in KPM (73 x 32.5 mm).

**Type Locality:** "Taiwan."

**Range:** Taiwan, Philippines, Loyalty Is., and Queensland (S. E. of Samurez Reef).

**Description:** Moderately large and solid. Last whorl ventricosely conical, outline convex at adapical fourth to

half, less so to straight below. Shoulder subangulate to angulate. Spire of moderate height, outline concave. Larval shell of more than 3 whorls, maximum diameter 0.8-0.9 mm. First 3-8 postnuclear whorls tuberculate. Teleoconch sutural ramps almost flat, with 0-1 increasing to 3-5 spiral grooves. Last whorl with widely spaced spiral grooves; intervening ribbons often with a central groove.

#### ***C. armadillo* Shell Morphometry**

<b>L</b>	60 - 79 mm
<b>RW</b>	0.30 - 0.41 g/mm (L 60-72 mm)
<b>RD</b>	0.51 - 0.57
<b>PMD</b>	0.77 - 0.84
<b>RSH</b>	0.15 - 0.23

Ground colour white. Ribbons with closely spaced solid or furcate axial brown dashes; paler brown background flecks often forming a broad spiral band on each side of centre. Larval whorls white. First 2-3 postnuclear sutural ramps immaculate. Following sutural ramps matching last whorl in colour pattern; radial lines continuous from shoulder to subshoulder area. Aperture white.

**Habitat and Habits:** In 100-390 m.

**Discussion:** For comparison of *C. armadillo* with *C. kuroharai*, see the Discussion of the latter species.

*C. armadillo* appears to vary little within and between geographic regions. It is very similar to *C. australis*: *C. australis gabryae* differs in a more ovate last whorl (PMD 0.72-0.80), with a more prominent sculpture of spiral ribs and ribbons, and a less regular colour pattern with long, rather continuous axial lines and streaks. *C. australis australis* is generally larger (L to 105 mm), has an usually narrower last whorl (RD 0.44-0.52) with a more prominent spiral sculpture of ribs and ribbons, and its late sutural ramps bear more spiral grooves. The aperture of *C. a. australis* is sometimes light violet and its last whorl colour pattern is more variable and less regular. Coomans et al. (1981, 1985b) and Richard (1990) regarded *C. armadillo* as a valid species closely related to *C. australis*, but Walls ([1979]) considered the oldest name for *C. armadillo* to be *C. duplicatus* Sowerby I. However, the original figure of *C. duplicatus* shows a shell with a rather straight-sided last whorl and a less regular last whorl pattern including longer axial brown lines; it probably refers to a deep subtidal form of *C. australis*.

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### ***Conus kuroharai* (HABE, 1965)**

(Plate 46, Figures 16-19; Map 88)

1965 *Asprella kuroharai* Habe, Venus **24** (1): 46-48, pl. 4 figs. 3, 4

**Type:** Holotype in NSMT (59 x 27.5 mm).

**Type Locality:** "Off Okinoshima, Kochi Pref., Shikoku."

**Range:** Japan to Philippines; Loyalty Is.

**Description:** Medium-sized to moderately large, moderately solid to solid. Last whorl conical to ventricosely conical or conoid-cylindrical; outline somewhat convex at adapical third, straight below. Shoulder angulate to subangulate. Spire of low to moderate height, outline deeply concave to slightly sigmoid. Larval shell of more than 3 whorls, maximum diameter about 0.9 mm. First 6-8 postnuclear whorls tuberculate. Teleoconch sutural ramps flat, with 1 increasing to 3-4 spiral grooves. Last whorl with spiral ribbons from base to shoulder; toward base, posterior edge of ribbons more prominent and often weakly granulose.

#### ***C. kuroharai* Shell Morphometry**

<b>L</b>	41 - 66 mm
<b>RW</b>	0.19 - 0.48 g/mm
<b>RD</b>	0.50 - 0.56
<b>PMD</b>	0.82 - 0.87
<b>RSH</b>	0.07 - 0.18

Ground colour white. Last whorl with light brown to violet brown clouds, forming an interrupted spiral band on each side of centre, and a less prominent band below shoulder; with narrow, wavy brown or reddish brown axial lines from base to shoulder, extending across the shoulder ramp. Larval whorls white. About first 5 postnuclear sutural ramps immaculate; following sutural ramps with brown to reddish brown radial lines often underlain by paler brown radial blotches. Aperture white.

**Habitat and Habits:** In 100-390 m.

**Discussion:** *C. kuroharai* is similar to *C. armadillo* and *C. australis*. *C. armadillo* differs in its rather ventricose last whorl (PMD 0.77-0.84) with more convex sides, its generally higher spire (RSH 0.15-0.23), and in its last whorl pattern of spiral rows of short, simple to furcate axial dashes, mainly on spiral ribbons. *C. australis* is larger and lacks continuous axial lines as the predominant pattern of *C. kuroharai*. *C. australis australis* has a narrower last whorl (RD 0.44-0.52) and a different spiral sculpture of narrow, variably granulate ribs. *C. australis gabryae* differs also in its more ovate last whorl (PMD 0.72-0.80) with more convex sides.

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### ***Conus laterculatus* SOWERBY III, 1870**

(Plate 46, Figures 20, 21; Map 89)

1870 *Conus laterculatus* Sowerby III, Proc. Zool. Soc. London, **1870**: 255, pl. 22 fig. 3

**Type:** Type in BMNH (42 x 17 mm)

**Type Locality:** Not given.

**Range:** Philippines and Borneo.

**Description:** Medium-sized to moderately large, moderately solid. Last whorl narrowly conoid-cylindrical to narrowly conical, rarely conical to ventricosely conical; outline slightly convex on adapical third, straight below. Basal part of columella often deflected to left. Shoulder angulate to sharply angulate. Spire of low to moderate height, outline slightly concave to straight. Larval shell multispiral, maximum diameter about 0.8 mm. First 3-4 teleoconch spire whorls weakly tuberculate. Teleoconch sutural ramps flat to slightly concave, with 1 increasing to 4-5 spiral grooves. Last whorl with axially striate spiral grooves from base to shoulder and variably broad ribbons between; toward base, grooves wider and partially with a spiral thread, intervening ribbons sometimes weakly granulose; below shoulder, ribbons narrow or grading to ribs.

***C. laterculatus* Shell Morphometry**

<b>L</b>	41 - 64 mm
<b>RW</b>	0.11 - 0.25 g/mm
<b>RD</b>	0.42 - 0.51
<b>PMD</b>	0.80 - 0.88
<b>RSH</b>	0.10 - 0.16

Ground colour white, often suffused with beige or violet. Last whorl with brown dots, dashes and flecks on the spiral ribbons, concentrated in an interrupted spiral band above and below centre. Larval whorls greyish white. Teleoconch spire with curved radial brown streaks and blotches. Aperture bluish violet, demarcated by a darker collabral band from a white marginal zone.

Periostracum olive-grey, thin, translucent, smooth.

**Habitat and Habits:** In 50-240 m.

**Discussion:** *C. laterculatus* is very similar to *C. australis australis*, which differs in its larger size (L to 105 mm), its generally higher spire (RSH 0.14-0.21), less angulate shoulder, and more prominent and granulose spiral elevations on the last whorl. *C. laterculatus* generally lacks the axial streaks and flames characteristic of the last whorl of *C. australis*, and the aperture of *C. laterculatus* is darker. For distinctions from *C. sculpturatus*, see the Discussion of the latter species.

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***Conus alabaster* REEVE, 1849**

(Plate 46, Figures 22-24; Map 89)

1849 *Conus alabaster* Reeve, Conch. Icon., 1, *Conus* suppl.: Pl. 6 sp. 257

**Type:** Neotype (Coomans et al., 1979b) in BMNH (27 x 13.5 mm).

**Type Locality:** "China Sea."

**Range:** W. Indonesia, S. Sulu Sea.

**Description:** Moderately small to medium-sized, usually moderately solid. Last whorl ventricosely conical to conical; outline variably convex adapically, less so to straight below; left side constricted at base or concave basally. Siphonal fasciole may be prominent and basal part of columella deflected to left. Shoulder sharply angulate to slightly carinate. Spire of low to moderate height; outline deeply concave, rather flat in latest whorls. Larval shell of about 2 whorls, maximum diameter 0.7-0.9 mm. First 3-6 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 0-1 increasing to 5-6 spiral grooves. Last whorl with rather widely spaced, narrow and sometimes finely granulose major spiral ribs; interspaces with axial threads crossing spiral threads and sometimes 1-2 additional minor spiral ribs.

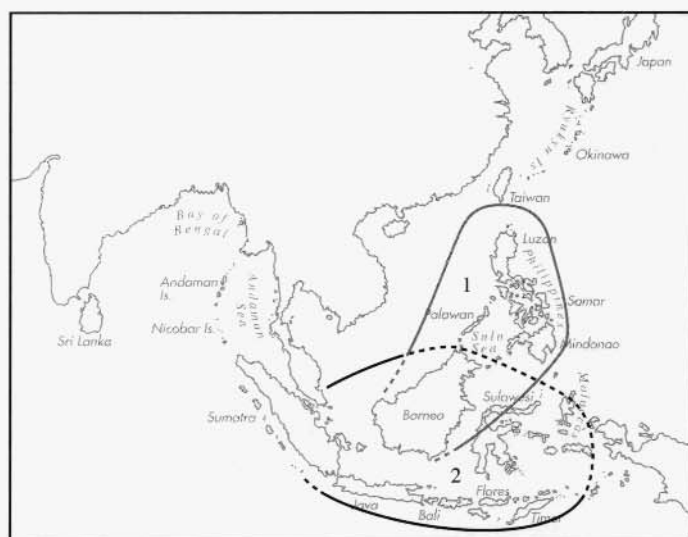
***C. alabaster* Shell Morphometry**

<b>L</b>	27 - 41 mm
<b>RW</b>	0.09 - 0.15 g/mm
<b>RD</b>	0.52 - 0.58
<b>PMD</b>	0.82 - 0.87
<b>RSH</b>	0.10 - 0.14

Ground colour white. Last whorl immaculate, sometimes with sparse light brown axial lines or streaks adapically. Larval whorls white. Teleoconch spire immaculate, sometimes with small light brown radial markings. Aperture white.

**Habitat and Habits:** In 20-50 m.

Map 89



1: *C. laterculatus* 2: *C. alabaster*



**Discussion:** *C. alabaster* is most similar to *C. mucronatus*, *C. asiaticus*, and *C. sculpturatus*; for the distinctions, see the Discussions of those species.

## 207

### *Conus mucronatus* REEVE, 1843

(Plate 46, Figures 25-28; Plate 76, Figure 52; Plate 82, Third row, left; Map 90)

1843 *Conus mucronatus* Reeve, Proc. Zool. Soc. London, **11**: 172-173; Conch. Icon., **1**, *Conus*: Pl. 37 sp. 204

**Type:** 3 syntypes in BMNH (31.5 x 14; 31 x 13.5; 30.5 x 12.5 mm).

**Type Locality:** "Island of Burias, Siquijor, Penay, etc., Philippines."

**Range:** Philippines to New Guinea, Solomon Is., Queensland, and Vanuatu.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl conical to ventricosely conical; outline convex adapically, almost straight below; left side slightly concave at base. Basal part of columella sometimes deflected to left. Shoulder sharply angulate. Spire of moderate height, slightly stepped, outline concave. Larval shell of about 3 whorls, maximum diameter about 0.7 mm. First 2-4 postnuclear whorls tuberculate. Teleoconch sutural ramps almost flat, with 0-1 increasing to 5-9 spiral grooves. In specimens from Philippines, New Guinea and Solomon Is. (Pl. 46, Figs. 25-27), last whorl with variably spaced, axially striate to punctate spiral grooves below centre, occasionally to shoulder, separated by ribs at anterior end and by ribbons above; grooves may contain spiral threads and ribbons may be partially subdivided in 2-3 narrower elevations. Specimens from Vanuatu (Pl. 46, Fig. 28) with a more prominent spiral sculpture from base to shoulder.

#### *C. mucronatus* Shell Morphometry

L	33 - 50 mm
RW	0.08 - 0.18 g/mm (L 34-42mm)
RD	0.52 - 0.62
PMD	0.82 - 0.90
RSH	0.13 - 0.22

Ground colour white. Last whorl with evenly spaced yellowish to reddish brown dotted, dashed or solid spiral lines. Axial streaks or blotches occasionally form a spiral band above centre and traces of bands at shoulder and near base. Larval whorls white. Early postnuclear sutural ramps white to brownish beige, often immaculate; following sutural ramps with brown radial streaks. Shells heavily patterned on last whorl and spire intergrade with completely white shells. Aperture white.

Periostracum olive-brown, translucent to nearly opaque, rather smooth.

Dorsum of foot mottled white and light grey, grading to brownish yellow anteriorly, sometimes flecked with brown; lighter median zone set off from darker latero-posterior margin by a thin brown line; a white spot beneath the operculum. Sole of foot light grey. Rostrum pale brown. Tentacles white, with a white or black tip. Siphon greyish white, dorso-laterally mottled or flecked with brown (Chaberman, pers. comm., 1981; Richards, 1988) (Pl. 76, Fig. 52; Pl. 82, Third row, left). We consider the assignment of the 2 specimens studied by Bergh (1895) to *C. mucronatus* to be doubtful until the structure of the radular teeth is verified by future studies.

**Habitat and Habits:** Usually in 3-50 m, more common below 20 m. In Philippines, in 120-400m (Guillot de Suduiraut, pers. comm., 1992). Populations from upper subtidal mostly on muddy sand (Chaberman, pers. comm., 1981; Richards, 1988; pers. comm., 1989).

**Discussion:** *C. mucronatus* may be confused with *C. sculptus*, *C. alabaster*, *C. asiaticus*, *C. leobrerai*, and *C. sculpturatus*. *C. sculptus* is a smaller species (to 28 mm), its shoulder is subangulate to rounded, the spiral lines on its last whorl are finer and often dashed, and its early postnuclear whorls are not tuberculate. *C. alabaster* differs in having a lower spire (RSH 0.10-0.14) that is rather flat in the latest whorls, and in more prominent spiral sculpture on the last whorl, consisting of narrow ribs rather than broad ribbons; its surface is usually immaculate white, sometimes with small radial markings. For comparison with *C. asiaticus*, *C. leobrerai*, and *C. sculpturatus*, see the Discussions of those species.

## 208

### *Conus asiaticus* DA MOTTA, 1985

(Plate 46, Figures 29-31; Map 90)

1985 *Conus asiaticus* da Motta, La Conchiglia, **17** (192-193): 25, figs.

1993 *Conus lovellreevei* G. Raybaudi Massilia, Gloria Maris, **32**: 3-6, pl. 1 figs. 4, 5

**Types:** *C. asiaticus*: Holotype in MHNG (41.5 x 19 mm); *C. lovellreevei*: Holotype in BMNH (42.5 x 19.5 mm).

**Type Localities:** *C. asiaticus*: "off Tai-chung, Strait of Taiwan, East China Sea"; *C. lovellreevei*: "off Madras, India."

**Range:** *C. a. asiaticus*: Japan to Philippines and Vietnam; Queensland; *C. a. lovellreevei*: S. E. India.

**Description:** Usually medium-sized, moderately solid. Last whorl ventricosely conical, sometimes also conical in *C. a. asiaticus* (Pl. 46, Figs. 29, 30) and slightly ovate in *C. a. lovellreevei* (Pl. 46, Fig. 31); outline convex adapically, less so below; left side slightly to distinctly concave near base. Siphonal fasciole sometimes very prominent and basal part of columella deflected to left in *C. a. asiaticus*. Shoulder angulate to carinate. Spire of moderate height,

outline concave. Larval shell of 2-2.5 whorls, maximum diameter 0.7-0.8 mm. First 3-6 postnuclear whorls tuberculate in *C. a. asiaticus*, first 1-6 in *C. a. lovellreevei*. Teleoconch sutural ramps nearly flat, with 0-1 increasing to 6-10 spiral grooves in *C. a. asiaticus* and 5-8 grooves in *C. a. lovellreevei*. Last whorl with strong, widely spaced major spiral ribs and ribbons, sometimes weakly granulose in *C. a. lovellreevei* and often strongly granulose in *C. a. asiaticus*; interspaces with distinct axial striae crossing spiral threads and 1-3 additional minor spiral ribs and/or ribbons.

#### ***C. asiaticus* Shell Morphometry**

	<i>C. a. asiaticus</i>	<i>C. a. lovellreevei</i>
<b>L</b>	39 - 52 mm	34 - 43 mm
<b>RW</b>	0.13 - 0.21 g/mm	0.10 - 0.15 g/mm
<b>RD</b>	0.53 - 0.58	0.54 - 0.59
<b>PMD</b>	0.75 - 0.87	0.73 - 0.83
<b>RSH</b>	0.15 - 0.20	0.16 - 0.20

Ground colour white. In *C. a. asiaticus*, last whorl suffused or sparsely to heavily overlaid with light brown axial streaks and blotches, mostly concentrated in adapical half and arranged in 1-2 spiral bands. In *C. a. lovellreevei*, last whorl usually adapically with sparse brown dots and axial streaks arranged in 1-2 spiral bands. Larval whorls white to beige in *C. a. asiaticus*, white to brownish beige in *C. a. lovellreevei*. Early postnuclear sutural ramps white to brownish beige in *C. a. asiaticus*, darker in *C. a. lovellreevei*. Late ramps with brown radial streaks and blotches, paler in *C. a. asiaticus*. Aperture white.

Periostracum grey to brownish grey, thin, translucent, smooth.

**Habitat and Habits:** In 25-60 m.

Map 90

**Discussion:** *C. asiaticus* is similar to *C. mucronatus*, *C. alabaster*, *C. pagodus*, *C. sculpturatus*, and the typical form of *C. sulcatus*. *C. mucronatus* differs in its last whorl pattern with prominent brown spiral lines, its weaker spiral sculpture on the adapical part of the last whorl, and its generally more conical and straight-sided last whorl. *C. alabaster* has a lower spire (RSH 0.10-0.14) with a more concave outline that is rather flat in the latest whorls; the spiral elevations on the last whorl are narrower and the colour pattern lacks brown axial streaks. For comparison with *C. sulcatus*, *C. pagodus*, and *C. sculpturatus*, see the Discussions of those species.

Because of their disjunct geographical ranges, the slight differences in shell morphology between *C. asiaticus* and *C. lovellreevei* justify separation at the subspecies level.

## **209**

### ***Conus sculpturatus* RÖCKEL & DA MOTTA, 1986**

(Plate 47, Figures 1-3; Map 90)

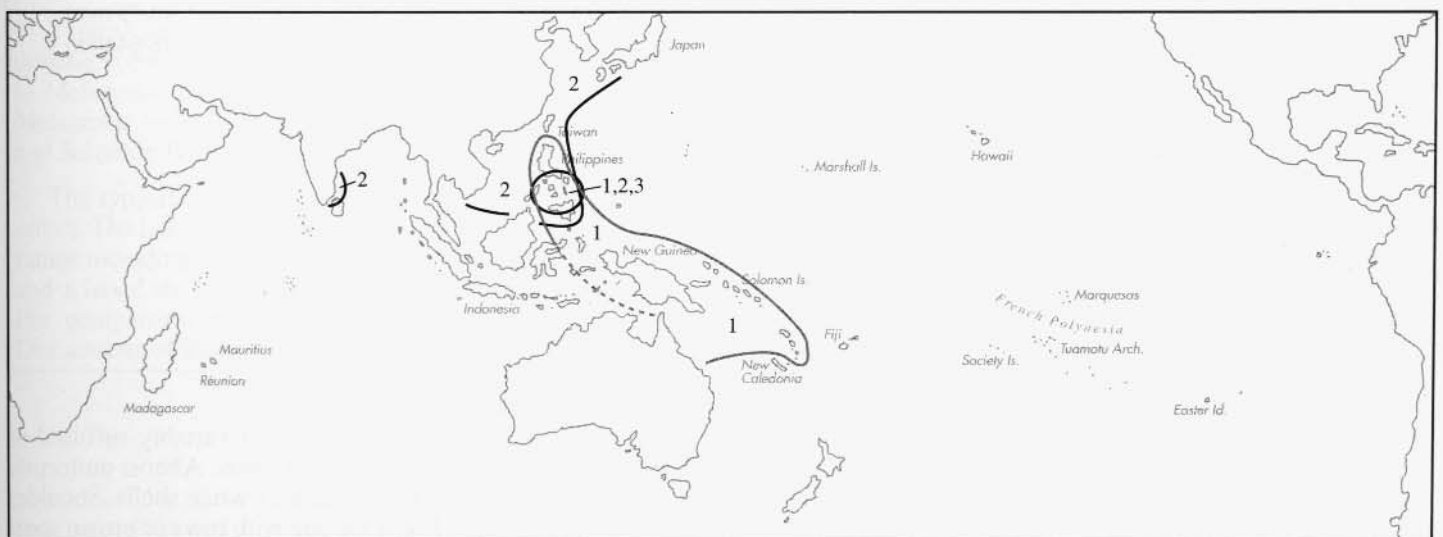
1986 *Conus sculpturatus* Röckel & da Motta, *Heldia*, **1** (4): 133-135, pl. 19 figs. 1, 3, 8

**Type:** Holotype in SMF (42.5 x 20 mm).

**Type Locality:** "Tayabas Bay, Insel Samar, Philippinen."

**Range:** Samar and Marinduque, Philippines.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl conical to narrowly conical, sometimes narrowly conoid-cylindrical to ventricosely conical; outline variably convex, straight (right side) and concave (left side) basally. Shoulder carinate. Spire usually of moderate height, outline concave. Larval shell of 2.5-3 whorls, maximum diameter about



1: *C. mucronatus* 2: *C. asiaticus* 3: *C. sculpturatus*

0.8 mm. First 2-3 postnuclear whorls weakly tuberculate. Teleoconch sutural ramps flat to slightly concave, with 1 increasing to 6-8 spiral grooves. Last whorl with strong spiral ribs and pairs of ribs, often weakly granulose; intervening grooves with axial threads crossed by weak spiral striae or threads.

#### *C. sculpturatus* Shell Morphometry

<b>L</b>	32 - 44 mm
<b>RW</b>	0.08 - 0.12 g/mm
<b>RD</b>	0.48 - 0.52
<b>PMD</b>	0.78 - 0.90
<b>RSH</b>	0.12 - 0.17

Ground colour white. Last whorl with irregularly arranged brown dashes and dots on spiral ribs and in grooves between, often fusing in axial streaks or blotches, and in 2 interrupted spiral bands. Larval whorls white, sometimes grading to light beige. Early postnuclear sutural ramps immaculate beige; following ramps white, with brown radial streaks and blotches. Aperture white.

**Habitat and Habits:** No information.

**Discussion:** *C. sculpturatus* resembles *C. alabaster*, which differs in its broader last whorl (RD 0.52-0.58), larger number (3-6) of tuberculate early whorls, rather flat late sutural ramps, and in its white to sparsely maculated last whorl and spire. *C. asiaticus* also has a broader last whorl (RD 0.53-0.59), more (3-6) tuberculate early whorls and a less prominent colour pattern. *C. mucronatus* also differs in having a broader last whorl (RD 0.52-0.62); it has a sharply angulate rather than carinate shoulder, generally weaker spiral sculpture on the adapical part of the last whorl and prominent brown spiral lines on the last whorl. *C. laterculatus* can be distinguished by its angulate to sharply angulate rather than carinate shoulder, straighter spire outline and smaller number of spiral grooves (4-5) on the late sutural ramps; its last whorl is sculptured with ribbons rather than ribs and has straight rather than concave left side basally; its aperture is bluish-violet.

## 210

### *Conus sulcatus* HWASS in BRUGUIÈRE, 1792

(Plate 47, Figures 4-16; Map 91)

- 1792 *Conus sulcatus* Hwass in Bruguière, Encycl. Méth., 1: 618, no. 14 (redescribed by Reeve, 1843: Pl. 18 sp. 99)
- 1802 *Conus costatus* Holten, Enum. Syst. Conch.: 38, no. 483 (non *C. costatus* Gmelin, 1791)
- 1810 *Conus asper* Lamarck, Ann. Mus. Hist. Nat. Paris, 15: 39, no. 44
- 1858 *Conus undulatus* Sowerby II, Thes. Conch., 3: 34, pl. 4 (190) fig. 63 (non *C. undulatus* Solander, 1786)
- 1881 *Conus bocki* Sowerby III, Proc. Zool. Soc. London, 1881: 636-637, pl. 56 fig. 7

1982 *Conus bretteinghami* Coomans, Moolenbeek & Wils, Basteria, 46 (1-4): 39 (nom. nov. for *C. undulatus* Sowerby II)

1982 *Conus samiae* da Motta, Publ. Ocas. Portuguesa Malac., 1: 12-13, pl. 2 figs. 11a, b

**Types:** *C. sulcatus*: No type (Kohn, 1968); original figure of Reeve (1843: Pl. 18 sp. 99) 73 x 39 mm; *C. costatus* and *C. asper*: Lectotypes (Kohn, 1981) figured in Chemnitz (1795: Pl. 181 figs. 1745-1747) (60 x 31 mm); *C. bretteinghami*: Holotype in BMNH (43 x 21 mm); *C. bocki*: Holotype in NMWC (58 x 32.5 mm); *C. samiae*: Holotype in MHNG (57.5 x 34 mm).

**Type Localities:** *C. sulcatus*: "mers des Indes orientales"; *C. asper*: "les mers de la Chine"; *C. bretteinghami*: "island of Marinduque, Philippines" (Coomans et al., 1982); *C. bocki*: "Amboyna"; *C. samiae*: "Balut Island, off Mindanao, Philippines."

**Range:** Japan to Philippines and Melanesia to Fiji; India to Indonesia.

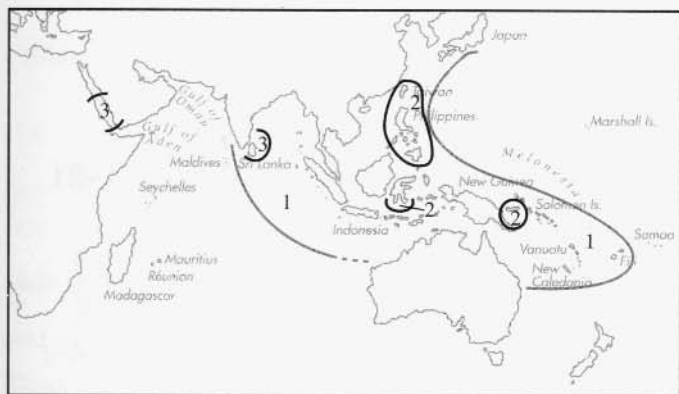
**Description:** Medium-sized to large, moderately solid to solid, lightest in form *bretteinghami*. Last whorl conical to ventricosely conical, broadest in form *samiae*; outline almost straight, left side sometimes concave near base. Form *samiae* with more convex sides than other forms. Shoulder angulate, strongly tuberculate to weakly undulate with about 10-14 broad tubercles or bulges. Spire of low to moderate height, outline concave to almost straight. Larval shell of 3 or more whorls, maximum diameter 0.8-1 mm. Teleoconch spire whorls tuberculate to undulate. Teleoconch sutural ramps concave, with 1-2 increasing to 5-12 spiral grooves; in form *samiae* increasing to 4-7 grooves. In typical form and in form *samiae*, last whorl sculptured with broad, often pustulose spiral ribs and/or ribbons; grooves between axially striate and often containing 1-3 spiral threads. Forms *bocki* and *bretteinghami* usually nearly smooth or weakly sculptured.

#### *C. sulcatus* Shell Morphometry

<b>L</b>	48 - 89 mm
<b>RW</b>	
- typical form	0.27 - 0.84 g/mm (L 48-84 mm)
- f. <i>bretteinghami</i>	0.19 - 0.38 g/mm (L 49-71 mm)
- f. <i>bocki</i>	0.19 - 0.75 g/mm (L 48-79 mm)
- f. <i>samiae</i>	0.30 - 0.42 g/mm (L 48-64 mm)
<b>RD</b>	
- typical form	0.54 - 0.64
- f. <i>bretteinghami</i>	0.51 - 0.62
- f. <i>bocki</i>	0.56 - 0.68
- f. <i>samiae</i>	0.61 - 0.70
<b>PMD</b>	0.81 - 0.92
- f. <i>samiae</i>	0.80 - 0.93
<b>RSH</b>	0.07 - 0.18
- f. <i>samiae</i>	0.11 - 0.21

Ground colour white. Last whorl variably suffused or streaked with yellowish to dark brown. Almost uniformly brown shells intergrade with largely white shells. Shoulder edge usually white. Form *samiae* with rows of brown spots on spiral elevations of last whorl, fusing or concentrating





1: *C. sulcatus* 2: *C. rolandi* 3: *C. grangeri*

into 2-3 spiral bands. Larval whorls and adjacent postnuclear sutural ramps immaculate, following sutural ramps maculated with brown radial markings, ranging from mainly brown to mainly white. Aperture white.

Periostracum greyish to brownish olive, moderately thick, slightly translucent to opaque, with fine spiral and axial ridges bearing fine hairs.

**Habitats and Habits:** In 20 to 240 m.

**Discussion:** Old (1973) and Coomans et al. (1982) considered 3 allopatric subspecies: *C. s. sulcatus* from Taiwan, with strongly sculptured last whorl, but rather weakly tuberculate shoulder, and white to blurred- brown in colour (Pl. 47, Figs. 4-6). *C. s. bretteghami* from Philippines and possibly also New Guinea, with narrower last whorl, the upper half smooth, almost solid brown and undulate to weakly tuberculate shoulder (Pl. 47, Figs. 7-9). *C. s. bocki* from W. Thailand, throughout Indonesia and the Solomon Is., with a broad last whorl, strongly tuberculate shoulder, variable in sculpture of last whorl, and brown (Pl. 47, Figs. 10-13). Although local populations seem to be uniform in their conchological appearance, these three variants all intergrade with one another, and all occur sympatrically. We thus consider them forms rather than subspecies.

Typical form: Japan to Philippines, Vietnam and Indonesia; form *bretteghami*: India, W. Thailand, Philippines to Melanesia; form *bocki*: W. Thailand, Philippines and Melanesia; form *samiae* (Pl. 47, Figs. 14-16): Philippines and Solomon Is., intergrading with form *bocki*.

The typical form of *C. sulcatus* may resemble *C. asiaticus*. The latter species is smaller, has smooth late sutural ramps including shoulder, a higher spire (RSH 0.15-0.20), and a larval shell of 2-2.5 whorls (vs. 3 or more whorls). For comparison with *C. rolandi* and *C. helgae*, see the Discussions of those species.

## 211

### *Conus rolandi* RÖCKEL, 1986

(Plate 47, Figures 17-19; Map 91)

1986 *Conus rolandi* Röckel, Spixiana, 9 (3): 233-238, text figs. 1, 2

**Type:** Holotype in ZSM (49 x 30 mm).

**Type Locality:** "Tayabas Bay, Seegebiet zwischen SW-Luzon und Marinduque, Philippinen."

**Range:** Taiwan to Philippines; Papua New Guinea; recently reported from Makassar (Indonesia).

**Description:** Medium-sized to moderately large, moderately solid to solid. Last whorl ventricosely conical to pyriform; outline convex at apical half to two-thirds, straight to slightly concave (right side) or concave (left side) below. Shoulder angulate, with 15-20 distinct to weak tubercles. Spire of low to moderate height, outline concave or sigmoid. Larval shell of 3 or more whorls, maximum diameter about 0.9 mm. Teleoconch spire whorls tuberculate. Teleoconch sutural ramps slightly concave, with 0-2 increasing to 4-7 spiral grooves. Last whorl with strong, often granulose spiral ribs or ribbons; grooves between axially striate and some containing 1-2 spiral threads.

#### *C. rolandi* Shell Morphometry

L	46 - 70 mm
RW	0.17 - 0.54 g/mm
RD	0.56 - 0.68
PMD	0.75 - 0.85
RSH	0.11 - 0.21

Ground colour white. Last whorl with spiral rows of separate to fused brown dots, spots, and bars on ribs and ribbons, concentrated in 2 incomplete spiral bands, below shoulder and above centre. Larval whorls and first 2-3 postnuclear sutural ramps usually beige to brown. Following ramps with sparse brown spots. Aperture white.

Periostracum greyish brown, thin, translucent, smooth.

Radular teeth about 0.015 of shell length, with an apical barb opposite a blade; serration comprising about 27 denticles (Röckel, 1986).

**Habitat and Habits:** In 60-400 m.

**Discussion:** Although *C. rolandi* was described in 1986, Dayrit recognized the species already in 1966, but misidentified it as *C. granifer* Reeve. Subsequently most authors considered it to be conspecific with *C. grangeri* (e.g. Walls, [1979]); for distinctions see the Discussion of the latter species.

*C. sulcatus* typical form and form *samiae* differ from *C. rolandi* in their often less ventricose last whorls (PMD 0.80-0.93) that have almost straight rather than convex outlines apically and are not pyriform; their shoulders have less (10-14) but broader tubercles or bulges, and their perio-

traca are thicker, less translucent or opaque, and not smooth. All forms of *C. sulcatus*, except form *samiae*, can be distinguished from *C. rolani* by the absence of brown dots, spots, and bars from their last whorls.

## 212

### *Conus grangeri* SOWERBY III, 1900

(Plate 47, Figures 20-26; Map 91)

- 1900 *Conus grangeri* Sowerby III, Ann. Mag. Nat. Hist. (7) 5: 441, pl. 11 fig. 5  
1904 *Conus planiliratus* var. *batheon* Sturany, Denkschrift k. Ak. Wiss. Wien, Exp. Pola, 23: 227, pl. 4 figs. 6a-c, 7a, b

**Types:** *C. grangeri*: Type in BMNH (44.5 x 22 mm); *C. p. var. batheon*: 5 syntypes in NMW (36 x 18.5; 40 x 20; 41 x 22; 44.5 x 21; 38.5 x 22 mm).

**Type Localities:** *C. p. var. batheon*: "Im Rothen Meer" - "Von den Stationen 127, 128, 143, 145".

**Range:** S. Red Sea and Sri Lanka.

**Description:** Moderately small to moderately large, moderately solid to solid. Last whorl conical to ventricosely conical; outline convex at apical third, straight below; left side sigmoid. Shoulder angulate. Spire of low to moderate height, outline concave to straight. Larval shell of about 2 whorls, maximum diameter about 0.95 mm. About first 4 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 1 increasing to 5-7 spiral grooves. Last whorl with single or paired granulose spiral ribs on basal half. Within adapical half, most ribs replaced by ribbons. In large specimens, sculpture obsolete adapically.

Ground colour white. Last whorl with yellow to brown axial flames and spirally aligned bars forming a variably distinct spiral band on each side of centre; an additional subshoulder band may be present. Larval whorls white. Postnuclear sutural ramps with radial streaks and blotches matching pattern of last whorl in colour. Aperture white.

#### *C. grangeri* Shell Morphometry

L	31 - 58 mm
RW	0.11 - 0.37 g/mm
RD	0.56 - 0.68
PMD	0.80 - 0.87
RSH	0.12 - 0.23

Periostracum brownish grey, thin, translucent, smooth.

**Habitat and Habits:** In the Red Sea, on silt or sand in 210-800 m (Sturany, 1904).

**Discussion:** *C. grangeri* is most similar to *C. rolani*. The latter species is distinguished by its tuberculate late postnu-

clear whorls, more larval whorls and strong sculpture on the last whorl, even in large specimens.

## 213

### *Conus sulcicastaneus* KOSUGE, 1981

(Plate 48, Figures 1-3; Map 92)

- 1980 *Conus vicdani* Kosuge, Bull. Inst. Malac. Tokyo, 1 (4): 62-63, pl. 18 figs. 1-5 (non *C. sugimotonis vicdani* Lan, 1978)  
1981 *Conus sulcicastaneus* Kosuge, Bull. Inst. Malac. Tokyo, 1 (6): 99 (nom. nov. for *C. vicdani* Kosuge)

**Type:** Holotype in IMT (48 x 24 mm).

**Type Locality:** "Balut Island, Davao, Philippines."

**Range:** Philippines and Marshall Is.

**Description:** Medium-sized to moderately large, moderately solid to solid. Last whorl conical or ventricosely conical; outline almost straight, left side usually constricted above base. Aperture wider at base than near shoulder. Siphonal canal sometimes deflected to left. Shoulder strongly tuberculate. Spire of moderate height, outline straight to convex. Larval shell multispiral, maximum diameter about 0.8 mm. Postnuclear whorls tuberculate. Teleoconch sutural ramps slightly concave with 3 increasing to 4-7 spiral grooves in late whorls. Last whorl with rather broad, axially striate pronounced spiral grooves and prominent ribs and ribbons between.

#### *C. sulcicastaneus* Shell Morphometry

L	44 - 63 mm
RW	0.25 - 0.38 g/mm (L 44-54 mm)
RD	0.57 - 0.63
PMD	0.81 - 0.98
RSH	0.09 - 0.20

Ground colour white. Last whorl with rows of brown spots, bars or dashes on spiral elevations, sometimes fusing into a spiral band on each side of centre. Larval whorls white. Postnuclear sutural ramps with brown radial blotches; outer margins with brown spots between mainly white tubercles. Aperture white.

Periostracum blackish brown, thick, velvety and opaque, on last whorl often restricted to spiral ribbons.

**Habitat and Habits:** In 150-240 m.

**Discussion:** *C. sulcicastaneus* is similar to *C. moluccensis* and *C. sulcatus* form *samiae*. The latter has a concave rather than convex spire outline and a broader last whorl (RD 0.61-0.70), with variably spaced, usually granulose spiral ribs bearing narrower dotted and dashed lines than in *C. sulcicastaneus*. For comparison with *C. moluccensis*, see the Discussion of that species.

***Conus moluccensis* KÜSTER, 1838**

(Plate 48, Figures 4-11; Plate 82, Third row, right; Map 92)

- 1838 *Conus moluccensis* Küster, Syst. Conch. Cab. Martini Chemnitz, 4 (2), 1, *Conus*: 121, pl. 23 figs. 4, 5  
 1843 *Conus stainforthii* Reeve, Conch. Icon., 1, *Conus*: Pl. 1 sp. 1a, b  
 1974 *Conus merletti* Mayissian, Coqu. Nouvelle-Calédonie et Melanésie: 46, pl. 17 figs. 4, 5  
 1975 *Conus marielae* Rehder & Wilson, Smithsonian Contrib. Zool., 203: 14, frontispiece, 10-11, text fig. 10

**Types:** *C. moluccensis*: Lectotype (Kohn, 1992) figured in Küster (1838: Pl. 23 figs. 4, 5) (42 x 23 mm); *C. stainforthii*: Holotype figured in Reeve (1843: Pl. 1 sp. 1a, b) (43 x 21 mm). *C. merletti*: Original figures about 50 mm acc. Mayissian; *C. marielae*: Holotype in USNM (40.5 x 25 mm).

**Type Localities:** *C. moluccensis*: "an den molukkischen Inseln"; *C. merletti*: "N. C."; *C. marielae*: "off Baie Motu-Hee, Nuku Hiva, Marquesas."

**Range:** *C. m. moluccensis*: Japan and Okinawa to Philippines and Indonesia; Queensland and Melanesia (Papua New Guinea, Solomon Is., New Caledonia, Fiji); Réunion, Chagos, and Maldives; *C. m. marielae*: restricted to Marquesas, Tuamotu Archipelago, and Marshall Is.

**Description:** Medium-sized to moderately large, moderately solid. Last whorl conical to ventricosely conical or conoid-cylindrical; outline slightly convex to convex below shoulder, almost straight below; left side may be constricted near base. Columella often deflected to left at siphonal fasciole. Shoulder with 11-17 small to large pointed tubercles. Spire low in *C. m. moluccensis* (Pl. 48, Figs. 4-9), of low to moderate height in *C. m. marielae* (Pl. 48, Figs. 10, 11); slightly stepped; outline straight to concave, sometimes sigmoid. Larval shell of 3.5 or more whorls, maximum diameter 0.7-0.9 mm. Postnuclear

whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 0-1 increasing to 3-8 spiral grooves; spiral sculpture may be obsolete on last 2 ramps.

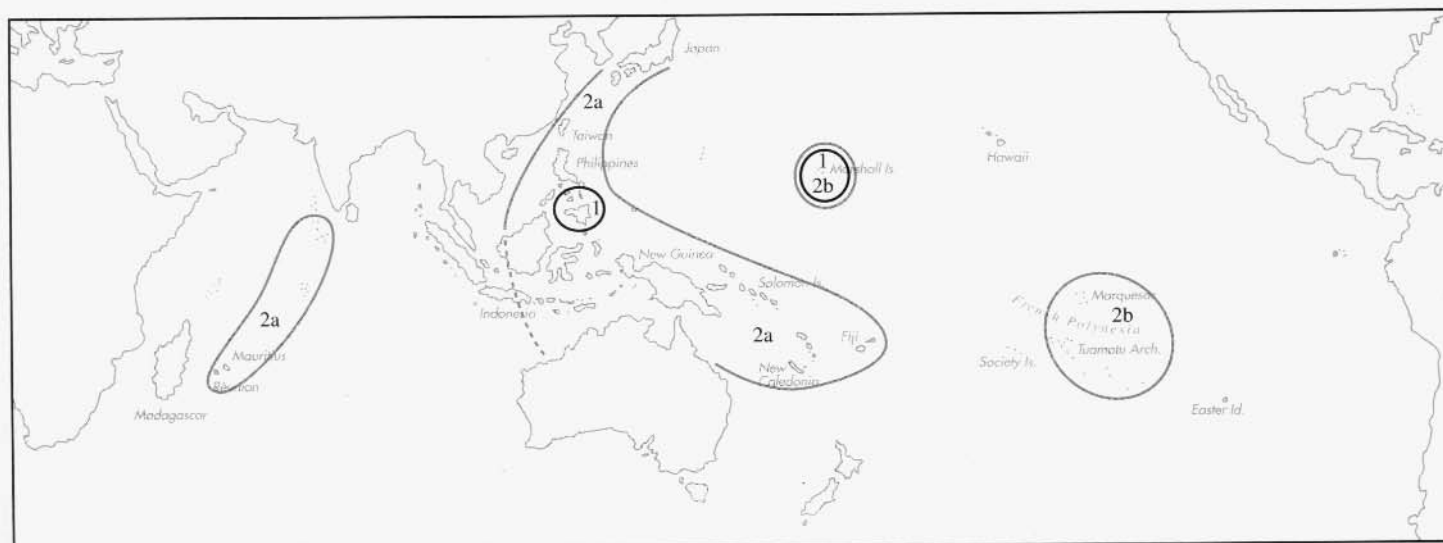
In typical form of *C. m. moluccensis*, last whorl with granulose spiral ribs at base followed adapically by wide ribbons; ribbons weaker toward shoulder and may be obsolete within adapical third. Form *stainforthii* (Pl. 48, Figs. 6, 7) with variably spaced granulose spiral ribs from base to shoulder; grooves between with an adapical spiral thread. In *C. m. marielae*, last whorl sculptured with spiral ribs or ribbons, mostly arranged in unequal pairs.

***C. moluccensis* Shell Morphometry**

<b>L</b>	40 - 60 mm
<b>RW</b>	0.17 - 0.32 g/mm (L 40-52 mm)
<b>RD</b>	0.51 - 0.61
<b>PMD</b>	0.81 - 0.88
<b>RSH</b>	
- <i>C. m. moluccensis</i>	0.06 - 0.12
- <i>C. m. marielae</i>	0.10 - 0.18

Ground colour white, often variably suffused with cream or pink. Colour pattern of last whorl variable in *C. m. moluccensis*: Last whorl typically with orange to red or reddish brown axial flames and blotches, often fusing into 2-3 spiral bands, on both sides of centre and below shoulder; occasionally with traces of spirally aligned dots. In form *stainforthii*, smaller orangish to blackish brown flecks and axial blotches forming 3 spiral bands below shoulder, above centre, and on basal third. Rows of brown dots and dashes on spiral ribs and ribbons. *C. m. marielae* with rows of red to orange bars, spots and dashes on ribs and ribbons of last whorl; similarly coloured axial markings located below shoulder and on both sides of centre, occasionally fusing

Map 92

1: *C. sulcicastaneus* 2a: *C. moluccensis moluccensis* 2b: *C. moluccensis marielae*



into 2-3 spiral bands. Larval whorls and first 1-4 postnuclear sutural ramps white. In typical *C. m. moluccensis*, following sutural ramps sparsely maculated with radial blotches matching last whorl pattern in colour. In form *stainforthii*, following sutural ramps with light to dark brown radial streaks and blotches. In *C. m. marielae*, teleoconch spire similar to that of typical *C. m. moluccensis* or suffused with rose or light red brown. Aperture white.

Periostracum brown, thin, translucent, smooth.

In typical *C. m. moluccensis*, dorsum of foot white sparsely maculated with brown; brown markings darker and densely set on anterior part, also darker and prominent near posterior end. Sole of foot white with sparse brown. Rostrum white, mottled with brown dorsally. Tentacles white. Siphon white, sparsely maculated with light to dark brown dorso-laterally (Estival, 1981, unpubl. observ.). Form *stainforthii* with a similar colouration but with more brown on dorsum of foot and siphon (Walls, [1979]); Richards, pers. comm., 1989). In *C. m. marielae*, the animal is white, speckled with blackish brown, dark colouration concentrating at anterior edge of foot and tip of siphon and covering dorsal side of rostrum (Rehder & Wilson, 1975) (Pl. 82, Third row, right).

**Habitat and Habits:** In 20-240 m, in or on sand bottom but also reported from coral rubble. In New Caledonia, *C. m. moluccensis* in sand pockets at the foot of the barrier reef front in 40-80 m. The animals are active at night and feed on molluscs (e.g. *Cypraea* species; Tirard, pers. comm., 1989). In East New Britain, form *stainforthii* on coarse sand at the foot of reef in 25-40 m, co-occurring with *C. proximus* below 36 m (Richards, pers. comm., 1989). *C. m. marielae* in 38-92 m on or in sand or sand and coral and shell rubble (French Polynesia), in small caves and ledges at depths greater than 30 m on the ocean side of reef (Kwajalein, Marshall Is.; Johnson, 1992).

**Discussion:** *C. moluccensis* is most similar to *C. proximus* and *C. sulcocastaneus*. *C. sulcocastaneus* has less acute shoulder tubercles, a more regular, more prominent and less granulose sculpture of the last whorl, its periostracum is rather thick and opaque, and its colour pattern lacks orange to red shades. For comparison with *C. proximus*, see the Discussion of that species.

The original figure of *C. moluccensis* given by Küster shows the comparatively smooth red variant from New Caledonia or Okinawa. The name *C. stainforthii* applies to a heavily sculptured variant from Philippines, Papua New Guinea and Solomon Is; we consider it a form of *C. m. moluccensis*. In Philippines, most populations of *C. m. moluccensis* are somewhat intermediate in sculpture and colour pattern between the typical form and form *stainforthii*. All these are so similar in their conchological features that they must be regarded as conspecific.

*C. merletti* is a junior synonym of typical *C. moluccensis*.

Morphological differences between *C. moluccensis* and *C. marielae* do not justify separation at the species level. The character states that Rehder and Wilson attributed to *C.*

*marielae* but not to *C. moluccensis* - scarlet rather than brown colour markings, more tubercles (12-15) on the shoulder and no granules on the spiral elevations - are all known to occur in *C. m. moluccensis*. Moreover specimens of *C. m. marielae* with granulose ribs on the last whorl are known. Because of their allopatric distribution (*C. m. moluccensis*: Indian Ocean and W. Pacific; *C. m. marielae*: French Polynesia and Marshall Is.), we favour subspecific rank for these taxa.

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### *Conus proximus* SOWERBY II, 1859

(Plate 48, Figures 12-18; Plate 76, Figure 53; Plate 82, Fourth row, left; Map 93)

- 1854 *Conus pulcher* A. Adams, Proc. Zool. Soc. London, **1853**: 117 (non *C. pulcher* [Lightfoot], 1786)  
1859 *Conus proximus* Sowerby II, Proc. Zool. Soc. London, **1859**: 429, pl. 49 fig. 1  
1990 *Conus proximus cebuensis* Wils, Gloria Maris, **29** (2): 25-27, text figs.

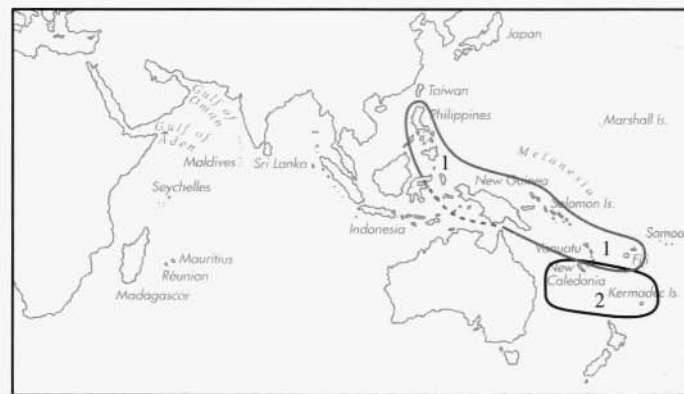
**Types:** *C. pulcher*: Type in BMNH (22 x 10 mm). *C. proximus*: Type in BMNH (31 x 15 mm); *C. p. cebuensis*: Holotype in IRSN (37 x 19 mm).

**Type Localities:** *C. pulcher*: "New Caledonia"; *C. p. cebuensis*: "Punta Engano, Mactan Is., Cebu, Philippines."

**Range:** Philippines to Vanuatu and Fiji.

**Description:** Moderately small to medium-sized, conical to conoid-cylindrical; outline slightly convex, columella slightly deflected to left at siphonal fasciole. Shoulder angulate to subangulate, with about 12-17 tubercles. Spire of low to moderate height, outline concave. Larval shell with about 2 whorls, maximum diameter 0.8-0.9 mm. Postnuclear whorls tuberculate. Teleoconch sutural ramps flat, with 0 increasing to 3-4 spiral grooves, sometimes with a few additional striae. Last whorl with widely to closely spaced, often granulose spiral ribs or ribbons either extending from base to shoulder or restricted to basal part; grooves between punctate or axially striate.

Map 93



1: *C. proximus* 2: *C. plinthis*

Ground colour white to light brown. Last whorl heavily clouded with yellowish to orangish brown; colour markings irregularly arranged or forming indistinct spiral bands on both sides of centre. Spiral rows of brown or orange dots and dashes extend from base to shoulder, varying from numerous to absent. Postnuclear sutural ramps with radial streaks matching last whorl pattern in colour, often as pronounced spots between tubercles. Aperture white to pale blue or violet.

Periostracum thin, translucent, smooth.

#### *C. proximus* Shell Morphometry

L	25 - 45 mm
RW	0.10 - 0.24 g/mm
RD	0.53 - 0.63
PMD	0.82 - 0.92
RSH	0.08 - 0.21

Dorsum of foot white to cream, often darker marginally and anteriorly, radially mottled with brown on central and posterior parts; anterior part with light to dark brown spots concentrated centrally; a dotted to dashed dark brown pre-marginal line may be present. Sole of foot white, edged with cream. Rostrum brownish yellow, streaked with brown. Tentacles white, tipped with brown. Siphon white to cream, transversely mottled with brown, lighter and with less brown distally (Chaberman, pers. comm., 1981)(Pl. 76, Fig. 53; Pl. 82, Fourth row, left).

**Habitat and Habits:** In 25-240 m; intertidal occurrence (Cernohorsky, 1978) remains doubtful. In E. New Britain, below 36 m on coarse sand at the foot of reef (Richards, pers. comm., 1989). At Hansa Bay, in coarse sand off reefs in 40-60 m (Chaberman, pers. comm., 1981). In Solomon Is., in 25-50 m.

**Discussion:** *C. moluccensis* is very similar in shell characters and in the colouration of the animal. It differs from *C. proximus* mainly in its multispiral (3.5 or more vs. 2 whorls) larval shell and in its larger size (to 60 mm).

In Philippines, the typical form occurs sympatrically with heavily sculptured shells (form *cebuensis*; Pl. 48, Figs. 12, 13) and shells with rather smooth last whorl (Pl. 48, Fig. 18). These forms intergrade in shell morphology and shell pattern.

**Type:** Holotype in MNHN (44 x 24 mm).

**Type Locality:** "New Caledonia, Lagon Sud, 22° 44' S - 167° 09' E."

**Range:** New Caledonia, Norfolk Is., Kermadecs Is., and Northern Three Kings Rise (28° 40' S, 173° E).

**Description:** Usually moderately small to medium sized, light to moderately solid. Last whorl conical, outline straight, slightly convex at adapical fourth. Shoulder angulate. Spire of low to moderate height, outline concave. Larval shell of about 3.25 whorls, maximum diameter about 1.1 mm. First 3-4 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 0-4 increasing to 5-7 spiral grooves. Last whorl with a few weak spiral ribs and grooves at base.

#### *C. plinthis* Shell Morphometry

L	20 - 61 mm
RW	0.05 - 0.26 g/mm (L 20 - 54mm)
RD	0.58 - 0.65
PMD	0.86 - 0.94
RSH	0.02 - 0.15

Ground colour white. Last whorl with about 9 broad brown spiral lines from base to adapical third or fourth, widely spaced basally and rather closely spaced adapically. Posterior lines within a variably broad light to reddish brown spiral band above centre. Widely but unevenly spaced brown axial lines and streaks connecting the brown spiral lines and extending from the adapical band to the shoulder ramp. Larval whorls and first 2-3 postnuclear sutural ramps white to beige. Following sutural ramps with brown radial lines. Aperture white.

Periostracum light brown, thin, translucent.

**Habitat and Habits:** In New Caledonian waters, in 225-440 m; in 135-154 m at Raoul Id., Kermadec Is. The deepest record, 844 m, is from Northern Three Kings Rise.

**Discussion:** *C. plinthis* is similar to *C. capitaneus*, sympatric with *C. plinthis* in the New Caledonian area. It differs from *C. plinthis* in its broader last whorl (RD 0.60-0.71), the presence of two brown spiral bands, and in the absence of brown spiral lines on the last whorl.

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### *Conus plinthis* RICHARD & MOOLENBEEK, 1988

(Plate 48, Figures 19-22; Map 93)

1988 *Conus plinthis* Richard & Moolenbeek, Venus, 47 (4): 235-237, pl. 1 figs. 6-9, 11

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### *Conus luteus* SOWERBY I, 1833

(Plate 49, Figures 1-7; Map 94)

1833 *Conus luteus* Sowerby I, Conch. Ill.: Pt. 25, figs. 8, 8\*

1992 *Conus luteus richardsae* Korn & Röckel, Acta Conchyl., 3: 16-19, pl. 3 figs. 1-7

**Types:** *C. luteus* Sowerby I: Lectotype (Kohn, 1992) in BMNH (38 x 15 mm); *C. l. richardsae*: Holotype in NMC (36.5 x 14 mm).

**Type Localities:** *C. l. luteus*: "Anaa"; *C. l. richardsae*: "Bohol, Philippines."

**Range:** *C. l. luteus*: French Polynesia to Marshall Is.; *C. l. richardsae*: Philippines; probably New Caledonia.

**Description:** Moderately small to medium-sized, light to moderately light. Last whorl narrowly conoid-cylindrical to conoid-cylindrical or narrowly conical to conical; narrower in *C. l. richardsae*; outline almost straight to slightly convex; left side may be concave basally. Shoulder subangulate to rounded, more angulate in *C. l. richardsae*. Spire of moderate height; outline convex to domed. In *C. l. richardsae*, larval shell of 3-3.5 whorls, maximum diameter about 0.95 mm; maximum diameter 1-1.1 mm in *C. l. luteus*. In *C. l. luteus*, first 1-2.5 postnuclear whorls weakly tuberculate, first 0.5-4 whorls in *C. l. richardsae*. Teleoconch sutural ramps almost flat, with 2 increasing to 3-4 spiral grooves in *C. l. richardsae*, to 4-6 grooves in *C. l. luteus*; spiral sculpture may be very weak in latest whorls. Last whorl with a few weak spiral ribs near base.

#### *C. luteus* Shell Morphometry

<b>L</b>	28 - 54 mm
<b>RW</b>	0.03 - 0.10 g/mm
<b>RD</b>	
- <i>C. l. luteus</i>	0.48 - 0.53
- <i>C. l. richardsae</i>	0.42 - 0.48
- ? <i>C. luteus</i> from New Caledonia	0.49
<b>PMD</b>	
- <i>C. l. luteus</i>	0.77 - 0.90
- <i>C. l. richardsae</i>	0.76 - 0.94
- ? <i>C. luteus</i> from New Caledonia	0.75
<b>RSH</b>	0.13 - 0.21

Ground colour red or yellow in *C. l. luteus* (Pl. 49, Figs. 1-3), reddish violet in *C. l. richardsae* (Pl. 49, Figs. 4-6). *C. l. luteus* with a spiral row of red-brown axial blotches on each side of centre, and with dotted and dashed reddish brown spiral lines from base to shoulder, or restricted to centre. In *C. l. richardsae*, last whorl with 3 spiral bands of brown axial clouds, below shoulder and on both sides of centre; dashed spiral lines from base almost to the shoulder. Larval shell white to pale yellow in *C. l. luteus*, slightly darker in *C. l. richardsae*. In *C. l. luteus*, early postnuclear sutural ramps light yellow with brown dots at inner margins, following ramps with brown radial blotches. In *C. l. richardsae*, sutural ramps grey to reddish violet with brown radial blotches. Aperture white.

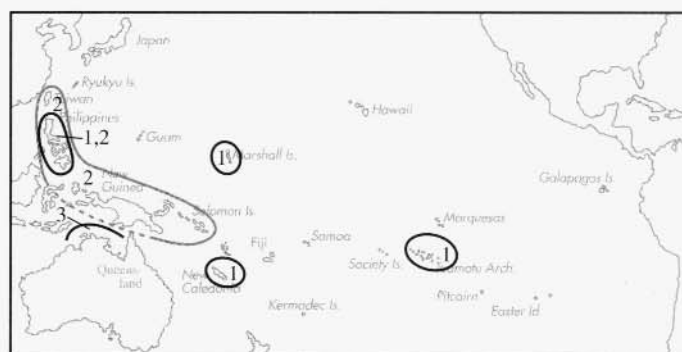
**Habitat and Habits:** In Marshall Is., in 12-18m, in caves and coral rubble; in Philippines, in 100-240 m.

**Discussion:** For comparison of *C. luteus* with *C. coral-linus*, *C. nucleus*, *C. granum*, and *C. viola*, see the Discussions of those species.

We consider the differences between the allopatric populations in French Polynesia to the Marshall Islands and the Philippines insufficient for separation at the species level, and we regard them as geographic subspecies.

A single specimen from New Caledonia (Pl. 49, Fig. 7) also seems to be a member of this species. It differs in its more ovate shape (PMD 0.75), which is more similar to *C. viola*, but it matches *C. luteus* in its other characters, including its yellow apex. It may represent another subspecies of *C. luteus*.

Map 94



1: *C. luteus* 2: *C. viola* 3: *C. austroviola*

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### *Conus viola* CERNOHORSKY, 1977

(Plate 49, Figures 8-14; Plate 82, Fourth row, right; Map 94)

- 1843 *Conus violaceus* Reeve, Proc. Zool. Soc. London, **11**: 176-177; 1844: Conch. Icon., **1**, *Conus*: Pl. 44 sp. 241 (non *C. violaceus* Gmelin, 1791)
- 1977 *Conus viola* Cernohorsky, Nautilus, **91** (2): 72-73, figs. 1, 2 (nom. nov. for *C. violaceus* Reeve)
- 1979 *Conus (Leporiconus) blatteus* Shikama, Sci. Rep. Yokosuka City Mus., **26**: 1-2, pl. 1, figs. 1, 2

**Type:** *C. viola*: Lectotype (Cernohorsky, 1977) in BMNH (41 x 15 mm); *C. blatteus*: Holotype in NSMT (35 x 14 mm).

**Type Localities:** *C. viola*: "Matnog, island of Luzon, Philippines"; *C. blatteus*: "off Taiwan."

**Range:** Typical form: Philippines to Melanesia (Papua New Guinea, Solomon Is.); W. Thailand. Form *blatteus*: Taiwan to Philippines.

**Description:** Moderately small to medium-sized, light. Last whorl narrowly conoid-cylindrical to narrowly ovate, narrowly cylindrical or narrowly conical; outline mostly straight with nearly parallel sides adapically, variably concave to straight (left side) or straight to slightly convex below (right side). Shoulder subangulate to rounded. Spire of moderate height; outline of teleoconch spire whorls domed. Larval shell projecting, of about 3 whorls; maximum diameter 0.8-0.9 mm. First 1-3.5 postnuclear whorls



weakly tuberculate. Early teleoconch sutural ramps flat, with 1-2 increasing to 4-5 spiral grooves; late ramps flat to slightly convex, steeper and stepped, with spiral striae; last ramp may be slightly concave. Last whorl with a few weak to obsolete spiral ribs at base.

Form *blatteus* of similar size. Last whorl similar in shape and outline, may be broader. Spire sometimes higher, outline convex to domed. Larval shell projecting, of 3-3.75 whorls; maximum diameter 1-1.1 mm. First 0.5-1.25 post-nuclear whorls weakly tuberculate. Teleoconch sutural ramps flat to slightly convex, with 2 increasing to 4-9 spiral grooves; latest ramps steep and strongly stepped in large specimens. Last whorl with weak spiral ribs at base grading to variably spaced threads above.

#### *C. viola* Shell Morphometry

	typical form	form <i>blatteus</i>
<b>L</b>	24 - 42 mm	25 - 48 mm
<b>RW</b>	0.03 - 0.08 g/mm	0.03 - 0.05 g/mm
<b>RD</b>	0.43 - 0.48	0.45 - 0.51
<b>PMD</b>	0.71 - 0.86	0.68 - 0.87
<b>RSH</b>	0.13 - 0.22	0.16 - 0.25

Typical form: Ground colour grey, violet or pinkish to purplish red. Last whorl with reddish brown axial clouds and blotches forming 2-3 spiral bands within basal third, near centre, and sometimes just below shoulder. Dotted or dashed brown spiral lines from base to shoulder, often reduced. Larval whorls and adjacent 0.5-2.5 sutural ramps orangish to purple red. Following sutural ramps with scattered brown radial streaks and blotches with spots at inner margins. Aperture matching last whorl in colour.

Periostracum thin, translucent, smooth.

Form *blatteus*: Ground colour reddish purple. Last whorl with 3 spiral rows of brown blotches, below shoulder, at centre and within basal third. Dotted to dashed brown spiral lines from base to shoulder, often reduced. Larval shell pale yellow to beige. Postnuclear sutural ramps grading from grey to purple, maculated with reddish brown radial blotches. Aperture matching last whorl in colour.

In typical form, dorsum of foot white, grading to pink at anterior end, spotted with cream medially. Sole of foot cream. Rostrum and tentacles white. Siphon mottled orange and red, paler proximally (Chaberman, pers. comm., 1981)(Pl. 82, Fourth row, right).

**Habitat and Habits:** In 20-240 m, associated with corals and in coral rubble.

**Discussion:** A number of similar and sympatric species are often confused with *C. viola*. For the distinctions from *C. austroviola* and *C. corallinus*, see the Discussions of those species. *C. luteus* has a more conical last whorl (PMD 0.76-0.94) and a white aperture; its late sutural ramps are not stepped and steep.

*C. blatteus* is tentatively assigned to *C. viola*, because we have only seen a few specimens from Taiwan and Philippines corresponding with the holotype from off Taiwan (Pl. 49, Fig. 12). They do not allow unequivocal separation at species level.

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### *Conus austroviola* RÖCKEL & KORN, 1991

(Plate 49, Figures 15-17; Map 94)

1991 *Conus austroviola* Röckel & Korn, Acta Conchyl., 3: 8-10, pl. 1 figs. 1-12.

**Type:** Holotype in SMNS (52 x 21.5 mm).

**Type Locality:** "Off Darwin, northern Australia."

**Range:** N. Australia.

**Description:** Medium-sized, moderately light to moderately solid. Last whorl usually narrowly conoid-cylindrical to narrowly ovate; outline slightly convex at upper two-thirds, tapering toward base. Shoulder subangulate to rounded. Spire of moderate height; outline almost straight or slightly domed with an elevated apex. Larval shell of 2-2.25 whorls, maximum diameter about 0.9 mm. First 4-6 postnuclear whorls tuberculate; later whorls distinctly stepped. Teleoconch sutural ramps flat to slightly convex, with 2 increasing to 4-6 spiral grooves. Last whorl with several widely spaced spiral ribs toward base, more closely spaced at base.

#### *C. austroviola* Shell Morphometry

<b>L</b>	40 - 55 mm
<b>RW</b>	0.08 - 0.16 g/mm (L 40-52 mm)
<b>RD</b>	0.45 - 0.51
<b>PMD</b>	0.73 - 0.85
<b>RSH</b>	0.14 - 0.19

Ground colour bluish grey to dark violet-brown. Last whorl encircled with a variable number of darker brown bands, usually leaving intervening ground-colour bands near centre and below shoulder. Median area bearing dark brown markings varying in size and number. Overlying variably spaced solid, dotted or dashed brown spiral lines from base to shoulder. Larval whorls light brown. First postnuclear sutural ramps pale brown to pale violet; following ramps bluish grey, with brown radial blotches. Aperture white or violet behind a translucent marginal zone.

**Habitat and Habits:** Reported from about 8-12 m under rocks.

**Discussion:** In 1977, Cernohorsky renamed *C. violaceus* Reeve as *C. viola* (q.v.) and gave a new description on the basis of the type specimens in the BMNH. He included shells from northern Australia in this taxon and

referred to them as "the banded form" or "dark coloured specimens of *C. viola*." In 1992, Röckel & Korn described this form as *C. austroviola*. It differs from *C. viola* in the following characters: *C. viola* has a smaller shell with its last whorl colour pattern dominated by reddish violet instead of dull brownish tones, a smaller number of tuberculate spire whorls (first 0.5-3.5), a greater number (about 3) variably red or pale yellow larval whorls, and less pronounced spiral sculpture on the late sutural ramps.

## 220

### *Conus corallinus* KIENER, 1845

(Plate 49, Figures 18-20; Map 95)

1845 *Conus corallinus* Kiener, Coq. Vivant, 2: Pl 73 fig. 2; 1849: 246-247

**Type:** Original figure 27 x 11 mm.

**Type Locality:** "Mactan Island, Philippines" (Coomans et al., 1985a).

**Range:** Okinawa to Papua New Guinea and New Caledonia.

**Description:** Small to moderately small, light. Last whorl conical to ventricosely conical; outline convex at adapical third, straight below. Shoulder angulate to subangulate. Spire of moderate height, outline straight to domed. Larval shell of 3-3.5 whorls, maximum diameter 0.8-0.9 mm. Teleoconch sutural ramps flat to slightly convex, with 0-3 increasing to 4-7 fine spiral grooves, inconspicuous on latest ramps. Last whorl with spiral ribs at base.

#### *C. corallinus* Shell Morphometry

<b>L</b>	15 - 30 mm
<b>RW</b>	0.02 - 0.06 g/mm (L 19-29 mm)
<b>RD</b>	0.52 - 0.61
<b>PMD</b>	0.80 - 0.93
<b>RSH</b>	0.17 - 0.23

Ground colour pale grey to pink. Last whorl with orange to pink, sometimes olive-brown to dark brown clouds and streaks, usually leaving interrupted spiral ground-colour zones at base and centre. Often spiral rows of dark dashes or dots extending from base to shoulder. Larval whorls orange to pink. Postnuclear sutural ramps with darker radial lines and blotches. Aperture violet, with exterior pattern shining through.

Periostracum thin and translucent, sometimes with widely spaced spiral rows of fine tufts.

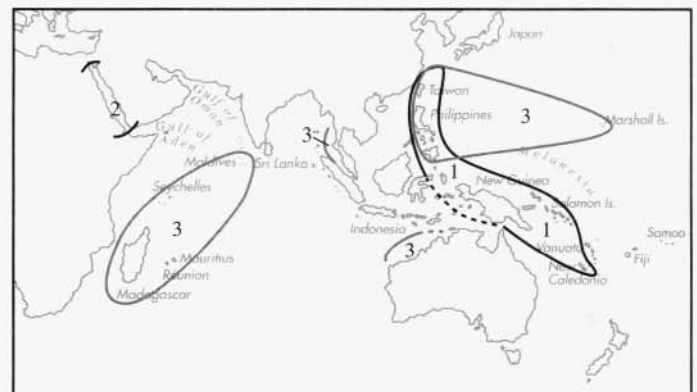
Animal coral red, dotted with white ((E. New Britain; Richards, 1989). Chaberman's animal description of "*C. luteus* Sowerby" (pers. comm., 1981) seems to refer to this species: Dorsum of foot pink, darker marginally and grad-

ing to red at anterior end, with brown spot beneath operculum. Sole of foot pale pink. Siphon bright red, dotted with tan and white.

**Habitat and Habits:** In 6-240 m, associated with corals, sponges and sea-weed and among coral rubble.

**Discussion:** *C. corallinus* is sometimes misidentified as *C. dilectus* (see *C. textile*) and *C. luteus*, or considered a juvenile of *C. pertusus*. Although *C. luteus* is often similar in colouration, it is a considerably larger species (to 54 mm) with narrower last whorl (RD 0.42-0.53). *C. viola* (including form *blatteus*) also differs from *C. corallinus* in being larger (to 48 mm), having a narrower (RD 0.43-0.51) and more cylindrical last whorl; its shoulder is subangulate to rounded and its late postnuclear whorls are distinctly stepped. For the differences between *C. corallinus* and *C. pertusus*, *C. granum*, and *C. nucleus*, see the Discussions of those species.

Map 95



1: *C. corallinus* 2: *C. hamanni* 3: *C. nucleus*

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### *Conus hamanni* FAINZILBER & MIENIS, 1986

(Plate 49, Figs. 21-25; Map 95)

1986 *Conus hamanni* Fainzilber & Mienis, Bull. Malac. R. O. C., 12: 1-4, figs. 1-3

**Types:** Holotype in HUI (29.5 x 13 mm).

**Type Locality:** "Saudi Arabia, entrance to large estuary known as 'The Creek' near Jeddah."

**Range:** S. Red Sea (Jeddah area, Saudi Arabia, and Dahlak Is., Eritrea) and Gulf of Aqaba, N. Red Sea.

**Description:** Small to moderately small, light to moderately light. Last whorl ventricosely conical to conical; outline slightly convex; left side concave near base. Shoulder angulate to subangulate. Spire usually of moderate height, often slightly stepped; outline straight to slightly convex. Larval shell of 1.75-2 whorls, maximum diameter 0.8-0.9 mm. About first 2 postnuclear whorls tuberculate. Teleoconch sutural ramps flat, with 1 increasing to 3-4 strong

spiral grooves. Last whorl with spiral ribbons on basal third or half, grading to ribs near base.

#### *C. hamanni* Shell Morphometry

<b>L</b>	0.18 - 0.30 mm
<b>RW</b>	0.04 - 0.09 g/mm
<b>RD</b>	0.58 - 0.64
<b>PMD</b>	0.81 - 0.90
<b>RSH</b>	0.12 - 0.24

Ground colour pale pink. Last whorl with spirally aligned brown dots and wavy brown axial lines partially combined in tent-like flammules; lines fusing into 2-3 indistinct spiral bands or increasingly reduced. Larval whorls and first postnuclear sutural ramps white. Following sutural ramps with brown radial lines and streaks crossing outer margins. Aperture pale pink.

Periostracum pale brown, thin, translucent, smooth.

Animal uniformly light pink (Fainzilber & Mienis, 1986; Hamann, pers. comm., 1989).

**Habitat and Habits:** In 30-40 m, on coarse sand mixed with coral rubble near coral reefs. In the Jeddah area, *C. hamanni* ranges deeper than in the Gulf of Aqaba.

**Discussion:** *C. hamanni* may resemble subadults of *C. locumtenens*, but the latter differs in its reticulate pattern, more angulate shoulder, rather concave spire outline, and the weaker spiral sculpture on the teleoconch sutural ramps.

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### *Conus nucleus* REEVE, 1848

(Plate 49, Figures 26-29; Map 95)

1848 *Conus nucleus* Reeve, Conch. Icon. 1, *Conus* suppl.: Pl. 3 sp. 280

**Type:** 2 syntypes in BMNH (22 x 10 mm; 20 x 9 mm).

**Type Locality:** "Matnog, Island of Luzon, Philippines."

**Range:** Indian Ocean: Réunion, Seychelles, Madagascar, N. W. Australia, Maldives, and W. Thailand; Pacific: Okinawa, Guam, Philippines, and Marshall Is.

**Description:** Small and light. Last whorl ventricosely conical to ovate, sometimes conical in small specimens; outline slightly convex, straighter toward base. Shoulder rounded to indistinct. Spire of moderate height to high, outline convex to domed. Larval shell of about 4 whorls, maximum diameter about 0.9 mm. First 1-3 postnuclear whorls weakly tuberculate. Teleoconch sutural ramps almost flat, with 1 increasing to 2-3 spiral grooves, very weak in latest whorls. Last whorl with weak spiral ribs at base.

#### *C. nucleus* Shell Morphometry

<b>L</b>	16 - 25 mm
<b>RW</b>	0.01 - 0.05 g/mm
<b>RD</b>	0.52 - 0.56
<b>PMD</b>	0.68 - 0.93
<b>RSH</b>	0.16 - 0.25

Colour orange to olive-brown, often tinged with violet; violet colouration may be restricted to base and columella. Last whorl with a lighter central band variably flecked with white and occasionally apically bordered with brown dots. Larval whorls and early postnuclear sutural ramps yellow. Following sutural ramps also immaculate or with brown blotches. Aperture light violet behind a marginal ground-colour zone.

Periostracum light brown and translucent.

**Habitat and Habits:** In 10-30 m.

**Discussion:** *C. nucleus* is similar to *C. luteus*, *C. granum*, *C. corallinus*, and *C. viola*. *C. luteus* attains larger size (to 54 mm), has a narrower and rather cylindrical last whorl (RD 0.42-0.53), and its last whorl pattern is stronger including dotted to dashed spiral lines. *C. corallinus* differs in its more distinct shoulder, more conical shape of last whorl, rather clouded last whorl pattern including dotted or dashed spiral lines, its red rather than yellow larval shell, and its more prominent spiral sculpture on the early teleoconch sutural ramps; its base and columella are not tinged with violet. *C. viola* is also larger (to 48 mm), has a narrower (RD 0.43-0.51) and rather cylindrical last whorl, subangulate shoulder, stepped late postnuclear whorls, and a strong colour pattern on the last whorl. For comparison with *C. granum*, see the Discussion of that species.

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### *Conus granum* RÖCKEL & FISCHÖDER, 1985

(Plate 49, Figures 30-34; Map 96)

1985 *Conus granum* Röckel & Fischöder, Spixiana, 8 (1): 67-72, figs. 1-4

**Type:** Holotype in ZSM (28.5 x 11 mm).

**Type Locality:** "Manobol, Sulu Archipel, Philippines."

**Range:** Okinawa and Philippines to Papua New Guinea and New Caledonia; W. Australia, Mauritius, W. Thailand, and Maldives; probably also Tuamotu Archipelago and Fiji.

**Description:** Small to moderately small, light to moderately light. Last whorl usually narrowly ovate to ovate or ventricosely conical; outline usually convex; left side may be concave at base. Shoulder indistinct, sometimes rounded. Spire of moderate height to high, outline sigmoid to convex.



Larval shell of 2.75-3.25 whorls, maximum diameter about 0.7 mm. First 2.5-5 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly convex, with 1 increasing to 3 spiral grooves in early whorls and with weak spiral striae in late whorls. Last whorl with closely spaced fine, weak to distinct spiral ribs from base to shoulder.

#### ***C. granum* Shell Morphometry**

<b>L</b>	20 - 36 mm
<b>RW</b>	0.04 - 0.10 g/mm
<b>RD</b>	0.45 - 0.55
<b>PMD</b>	0.71 - 0.85
<b>RSH</b>	0.18 - 0.26

Ground colour bluish violet, reddish violet in the Indian Ocean. Last whorl with 3 violet-brown spiral bands, below shoulder, at centre and within basal third. Subcentral band often adapically bordered by dark brown spots. Larval whorls and first 2-3 postnuclear sutural ramps reddish violet. Following sutural ramps with pale brown radial blotches. Aperture whitish violet behind a translucent marginal zone.

Periostracum brown, rather thin, nearly opaque, with interlaced axial ridges.

**Habitat and Habits:** In 25-240 m, in sand and coral rubble.

**Discussion:** Before its description, *C. granum* was sometimes identified as *C. luteus* or *C. tenuistriatus*, although these are markedly larger species. *C. luteus* differs in its more distinct shoulder, largely smooth surface, broader (0.95-1.1 mm) and white to yellow larval shell, and in colour pattern with brown spiral lines on the last whorl. *C. nucleus* can be distinguished by its orange to olive-brown

colour, largely smooth surface, and smaller number (1-3 vs. 2.5-5) of weakly rather than distinctly tuberculate early postnuclear whorls; its larval shell is yellow, broader (0.9 mm), and comprises 4 whorls. For comparison with *C. tenuistriatus*, see the Discussion of that species.

Indian Ocean specimens (Pl. 49, Figs. 33, 34) differ from typical *C. granum* (Pl. 49, Figs. 30-32) only in the ground colour of their shells; we therefore consider them to represent the same species.

## **224**

### ***Conus glans* HWASS in BRUGUIÈRE, 1792**

(Plate 50, Figures 1-3; Plate 76, Figure 54; Plate 83, First row, left; Map 96)

- 1792 *Conus glans* Hwass in Bruguière, Encycl. Méth., 1: 735-736, no. 130
- 1807 *Conus fusiformis* Fischer, Mus. Démidoff: 144, nos. 179-180 (non *C. fusiformis* Lamarck)
- 1807 *Conus violaceus* Link, Besch. Nat. Samml. Univ. Rostock, 3: 106 (non *C. violaceus* Gmelin)

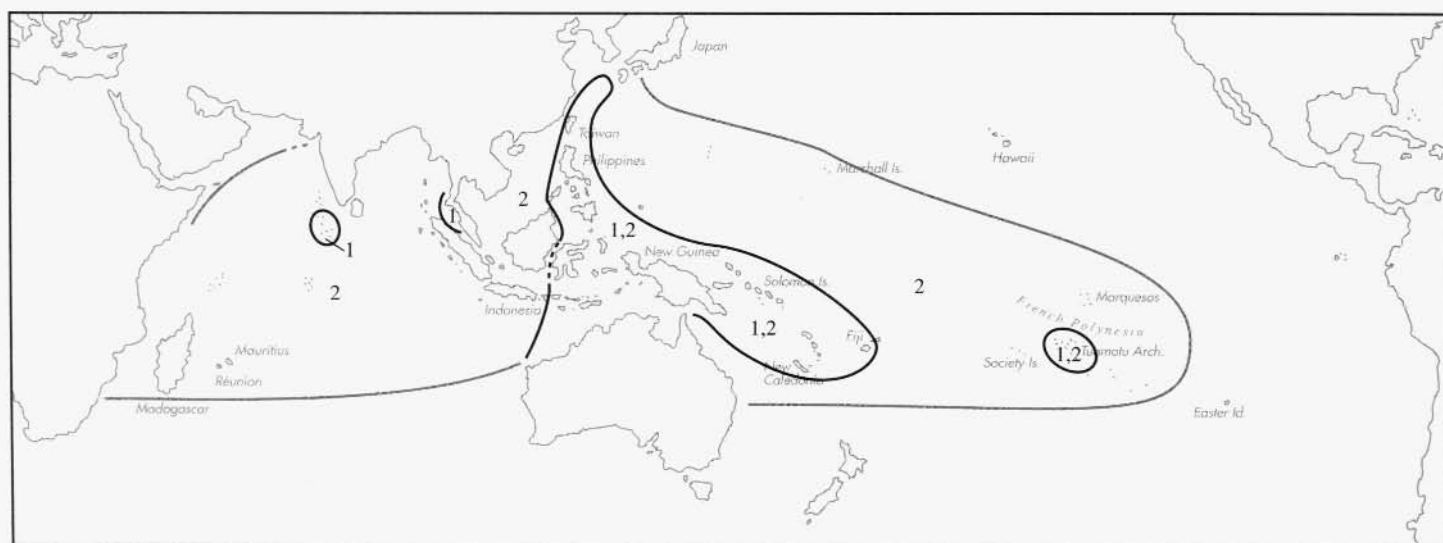
**Types:** *C. glans*: Lectotype (Kohn, 1968) in MHNG (38 x 16 mm); *C. fusiformis*: Lectotype (Kohn, 1981) in ZMMU (44.5 x 19 mm); *C. violaceus*: Lectotype (Kohn, 1981) in UZMC (45 x 20 mm).

**Type Localities:** *C. glans*: "les mers d'Afrique."

**Range:** Entire Indo-Pacific, except for Hawaii.

**Description:** Moderately small to moderately large, moderately light to moderately solid. Last whorl usually cylindrical, sometimes ovate, ventricosely conical or conoid-cylindrical; outline straight and parallel-sided adapically to uniformly convex; left side concave at base.

Map 96



1: *C. granum* 2: *C. glans*

Shoulder indistinct to rounded. Spire of moderate height to high, outline convex. Larval shell paucispiral in Sri Lanka (Kohn, 1961b), of about 2.5 whorls in Philippine specimens, and of 3 or more whorls in specimens from Samoa; maximum diameter 0.6-0.7 mm. First 4-7 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly convex, with 0-1 increasing to 3-7 spiral grooves and often granulate strong ribs between; spiral sculpture sometimes very weak on last ramps. Last whorl with distinct, often granulate, closely spaced spiral ribs from base to shoulder.

#### ***C. glans* Shell Morphometry**

<b>L</b>	27 - 60 mm
<b>RW</b>	0.07 - 0.25 g/mm (L 27-44 mm)
<b>RD</b>	0.52 - 0.65
<b>PMD</b>	0.66 - 0.84
<b>RSH</b>	0.16 - 0.26

Ground colour white to pale blue, suffused with blue or violet. Last whorl variably encircled with 2-3 bluish brown bands, leaving light zones of different shades of grey, blue, violet or brown, occasionally overlaid with brown or blue axial streaks. Base usually dark violet. Larval shell and first 4-5 postnuclear sutural ramps pink to orange. Aperture light blue behind a violet marginal zone.

Periostracum grey or brown, thin to thick, and translucent to opaque, with spiral ridges on last whorl and along shoulder edges (Cernohorsky, 1964; Kohn, unpubl. observ.).

Dorsum of foot bright red, may be dotted with white. Sole of foot and rostrum rose to orange red. Tentacles white, often with black tips. Siphon red, dotted with white or mottled with black distally and dorsally (Pl. 76, Fig. 54; Pl. 83, First row, left) (Kohn, 1978, unpubl. observ.; Chaberman, pers. comm., 1981).

**Habitat and Habits:** Shallow subtidal to about 30 m. In Fiji, under corals on reefs. In New Caledonia, on debris, shell sand and dead corals in 2-10 m. In the E. Indian Ocean, on subtidal coral reef platforms and reef slopes (Cernohorsky, 1964; Kohn, 1960; Kohn & Nybakken, 1975; Tirard, 1989, pers. comm.).

In the Indian Ocean, the species is known to feed on Eunicidae and is vermivorous in the Tuamotu Archipelago as well (Kohn, 1960; Kohn & Nybakken, 1975; Salvat & Rives, 1980).

In Sri Lanka, egg capsules are deposited in clusters of about 33, lack confluent basal plates, and measure 7-7.5 x 6-6.5 mm. Observed number of eggs per capsule is 37-53 and number of eggs per egg mass 1,600. An egg diameter of about 440 µm in the N. Indian Ocean predicts a minimum planktonic period of only 3 days. In Palau, the eggs measure only 341 µm in diameter, and the minimum planktonic period lasts about 11 days. Narrow larval shells of 2.5 to 3 or more whorls in Philippine and Samoan shells also predict

the hatchling to be a veliger (Kohn, 1961; Perron & Kohn, 1985).

**Discussion:** *C. glans* is most similar to *C. tenuistriatus* and *C. coffeae*. For comparison, see the Discussions of those species.

## 225

### ***Conus tenuistriatus* SOWERBY II, 1858**

(Plate 50, Figures 4-7; Plate 76, Figure 55; Plate 83, Second row; Map 97)

- 1834 *Conus tendineus* var. *granulosus* Sowerby I, Proc. Zool. Soc. London, **1834** (2): 18 (non *C. granulosus* (Röding, 1798))
- 1858 *Conus tenuistriatus* Sowerby II, Thes. Conch., **3**: 46, pl. 22 figs. 532, 533
- 1937 *Conus glans* var. *tenuigranulata* Dautzenberg, Mém. Mus. Roy. Hist. Nat. Belgique, **2** (18): 129, pl. 1 fig. 11

**Types:** *C. tendineus* var. *granulosus*: No original specimen is known (Kohn, 1992); *C. tenuistriatus*: 3 syntypes in BMNH (47 x 19 mm; 37 x 16 mm; 36 x 15 mm); *C. g.* var. *tenuigranulata*: Original figure 41 x 19 mm.

**Type Localities:** *C. tendineus* var. *granulosus*: "ad Insulam Annaa"; *C. tenuistriatus*: "Philippines."

**Range:** Indian Ocean (absent from Red Sea); Philippines to Papua New Guinea, French Polynesia, and Marshall Is.

**Description:** Moderately small to moderately large, light to moderately solid. Last whorl usually ovate or ventricosely conical, sometimes conical; narrowly ovate to narrowly conoid-cylindrical in French Polynesia (Pl. 50, Fig. 7); outline usually convex, left side sometimes constricted at base. Shoulder rounded to indistinct. Spire of moderate height, outline domed to almost straight. Larval shell multispiral. First 3-6 postnuclear whorls distinctly to weakly tuberculate. Teleoconch sutural ramps flat to convex, with 1-2 increasing to 7-10 very weak spiral grooves or striae. Last whorl with fine, closely spaced, usually finely granulate spiral ribs from base to shoulder.

#### ***C. tenuistriatus* Shell Morphometry**

<b>L</b>	27 - 68 mm
-Fr. Polynesian form	27 - 34 mm
<b>RW</b>	0.08 - 0.25 g/mm (L 31 - 56 mm)
- Fr. Polynesian form	0.04 - 0.09 g/mm
<b>RD</b>	0.51 - 0.62
- Fr. Polynesian form	0.47 - 0.49
<b>PMD</b>	0.72 - 0.86
- Fr. Polynesian form	0.72 - 0.83
<b>RSH</b>	0.13 - 0.22

Ground colour white to pale blue, tinged with violet in specimens from French Polynesia. Last whorl with 2 broad

pale to dark brownish violet spiral bands, leaving 1 narrow ground-colour band below centre and sometimes 1 below shoulder. Base usually violet. Larval whorls and first post-nuclear sutural ramps pinkish violet. Following sutural ramps with irregularly set brown radial streaks and blotches. Aperture violet, grading to white during growth.

Periostracum brown, moderately thick, slightly translucent to opaque, with interlaced axial ridges.

Dorsum of foot light red, darker at ends, with white and sometimes black dots. Sole of foot uniformly red or paler centrally, with sparse white dots. Rostrum light red, darker basally. Tentacles white to light red, darker at tips. Siphon red, ringed with dotted tan lines and sparsely dotted with white, sometimes paler distally or ventrally (Pl. 76, Fig. 55; Plate 83, Second row) (Chaberman, pers. comm., 1981; Pearson, unpubl. observ.).

**Habitat and Habits:** Shallow subtidal to about 25 m, from coral reef lagoon to fore-reef; on lagoon pinnacles, in caves and under coral rocks.

**Discussion:** *C. glans* is the most similar species; specimens are often difficult to distinguish. On the sutural ramps, *C. glans* has usually strong spiral grooves separated by granulose ribs rather than weak spiral grooves or striae as in *C. tenuistriatus*. *C. glans* also has a generally cylindrical last whorl (PMD 0.66-0.84) with stronger, somewhat less closely spaced spiral ribs.

Other similar species are the sympatric *C. granum* and *C. coffeae*. *C. granum* differs in its bluish or reddish violet colour, and very weak spiral ribs on the last whorl; its pattern includes 3 (vs. 2) spiral colour bands and brown spots edging the subcentral ground-colour band adapically. For comparison with *C. coffeae*, see the Discussion of that species.

Shells from French Polynesia (Pl. 50, Fig. 7) have a narrower last whorl and are tinged with violet instead of blue. We provisionally consider them to represent a geo-

Map 97

graphic race of *C. tenuistriatus*. Indian Ocean specimens (Pl. 50, Figs. 4, 6) differ only slightly from those from the W. Pacific (Pl. 50, Fig. 5); the former have lighter and more brown colouration and more conical last whorls.

We include *C. tendineus* var. *granulosus* as a synonym of *C. tenuistriatus* rather than of *C. violaceus*, because its type locality, Annaa Id., Tuamotu Archipelago, is likely correct, as it was collected by Hugh Cuming (see Dance, 1986).

## 226

### *Conus coffeae* GMELIN, 1791

(Plate 50, Figures 8-12; Plate 76, Figure 56; Plate 83, First row, right; Map 97)

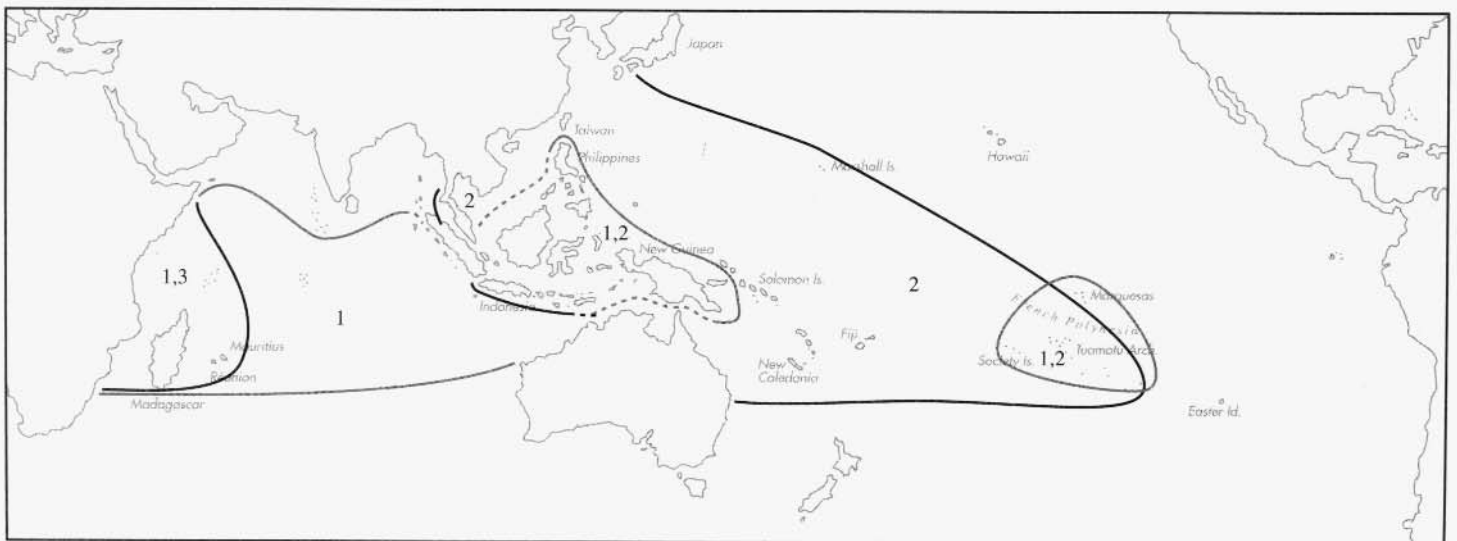
- 1791 *Conus coffeae* Gmelin, Syst. Nat., 13 ed., 1: 3388, no. 31
- 1798 *Cucullus caffer* Röding, Mus. Bolt., 2: 48, no. 606/100 (non *C. caffer* Krauss, 1848)
- 1817 *Conus scabriusculus* Dillwyn, Descr. Catal. Rec. Shells, 1: 406, no. 98
- 1833 *Conus fabula* Sowerby I, Conch. Ill.: Pt. 24, figs. 5, 5\*

**Types:** *C. coffeae*: Holotype in ZMA (27 x 16 mm); *C. caffer*: Lectotype (Walls, [1979]) is holotype of *C. coffeae*; *C. scabriusculus*: Lectotype (Kohn, 1984) figured in Chemnitz (1795: Pl. 182 figs. 1768, 1769) (17 x 10 mm); *C. fabula*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 24, fig. 5) (25 x 13 mm).

**Type Localities:** *C. scabriusculus*: "the coasts of Guinea about Sierra Leone."

**Range:** W. and Central Pacific, except for Hawaii and Marquesas; W. Thailand and Java.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl ventricosely conical to broadly and ventricosely conical, occa-



1: *C. tenuistriatus* 2: *C. coffeae* 3: *C. violaceus*



sionally ovate; outline convex at adapical third, almost straight below; left side slightly concave near base. Shoulder subangulate to rounded, sometimes nearly indistinct. Spire of moderate height, outline almost straight to slightly convex. Maximum diameter of larval shell about 0.65 mm. First 5 postnuclear whorls tuberculate. Teleoconch sutural ramps slightly convex, with 0-1 increasing to 3-4 spiral grooves, gradually finer and inconspicuous in late whorls. Last whorl with fine closely spaced, mostly granu-lose spiral ribs from base to shoulder.

#### *C. coffeae* Shell Morphometry

L	28 - 51 mm
RW	0.13 - 0.30 g/mm (L 30-45 mm)
RD	0.62 - 0.72
PMD	0.71 - 0.85
RSH	0.13 - 0.22

Ground colour white, often suffused with pale violet. Last whorl with 2 solid or interrupted brown spiral bands, intermittently connected by axial markings. Occasionally entire last whorl overlaid with brown except for a spiral row of white areas at centre or below shoulder. Base violet. Larval shell and about first 4 postnuclear sutural ramps pink. Following sutural ramps matching last whorl in colour pattern. Aperture violet with a pale band at centre, bluish white in larger specimens.

Periostracum yellow to yellowish brown, moderately translucent and smooth (New Caledonia; Estival, 1981) or ridged and finely tufted (Fiji and Papua New Guinea; Cernohorsky, 1964; Chaberman, 1981); in Marshall Is., periostracum variably thick, translucent to opaque, with well-separated spiral rows of long bristles on last whorl and spire (Pearson, pers. comm., 1989, unpubl. observ.)

In Marshall Is., foot flesh-coloured and spotted with white, dorsum dark red anteriorly and white posteriorly. Siphon dark brown mottled with reddish brown (Pearson, unpubl. observ.) (Pl. 83, First row, right). In N. Papua New Guinea, dorsum of foot light red dotted with white, solid red at its extremities. Sole light red, brighter at both ends. Rostrum red dotted with black. Tentacles red tipped with black. Siphon red with white and black dots (Pl. 76, Fig. 56). Operculum large, brick red (Chaberman, pers. comm., 1981). In W. Thailand, sole of foot light red, paler anteriorly; sides of foot of the same colour, heavily mottled with brown. Rostrum yellowish brown. Tentacles white. Siphon red, heavily mottled with blackish brown except for the tip (Kohn, unpubl. observ.). In New Caledonia, dorsum of foot and siphon reddish violet, mottled with reddish brown (Estival, unpubl. observ.).

Radular teeth with an adapical barb opposite a blade; serration ending in a cusp; central waist and basal spur present (Nybakken, 1990).

**Habitat and Habits:** In 2 to about 30 m. In Fiji, in and under corals as well as on sand. In New Caledonia, mostly

on dead coral on reef flats in 2-15 m (Cernohorsky, 1964; Tirard, pers. comm., 1989). At Hansa Bay, Papua New Guinea, it is an uncommon species on moderately deep fore-reefs (Chaberman, pers. comm., 1981).

*C. coffeae* is vermivorous, feeding on Eunicidae in the E. Indian Ocean (Kohn & Nybakken, 1975). The egg diameter is 222  $\mu$ m in Palau, predicting a minimum plank-  
tonic period of 22 days (Perron and Kohn, 1985).

**Discussion:** *C. coffeae* resembles *C. glans* and *C. tenuistriatus*. *C. glans* can be distinguished by its usually narrower and cylindrical last whorl (RD 0.52-0.65), generally less distinct shoulder and more prominent spiral sculpture on the teleoconch sutural ramps; its colour pattern is dominated by bluish brown rather than pure brown. *C. tenuistriatus* also differs in a narrower last whorl (RD 0.47-0.62) and less distinct shoulder; its aperture lacks the pale central band often present in *C. coffeae*.

## 227

### *Conus violaceus* GMELIN, 1791

(Plate 50, Figures 13-14; Map 97)

1791 *Conus violaceus* Gmelin, Sys. Nat., 13 ed., 1: 3391, no. 51

1792 *Conus tendineus* Hwass in Bruguière, Encycl. Méth., 1: 733-734, no. 127

**Types:** *C. violaceus*: Holotype figured in Martini (1777: Pl. 2 figs. 18, 19) (50 x 17 mm); *C. tendineus*: Lectotype (Kohn, 1968, as "holotype"; Walls, [1979]) in MHNG (76 x 27 mm).

**Type Localities:** *C. tendineus*: "les mers d'Afrique."

**Range:** E. African coast and W. Indian Ocean islands (Madagascar, Mascarenes, Seychelles); absent from Red Sea.

**Description:** Medium-sized to large, usually moderately solid. Last whorl narrowly conoid-cylindrical to narrowly cylindrical; outline convex at adapical third and straight below to almost uniformly straight and parallel-sided. Shoulder indistinct. Spire of moderate height; outline convex to domed, sutures narrowly channeled. Larval shell multispiral, maximum diameter about 0.6 mm. First 3-5 postnuclear whorls tuberculate. Teleoconch sutural ramps straight to slightly convex, last ramp may be slightly concave. Early ramps with 1-2 increasing to 2-4 spiral grooves; late ramps with additional striae or only with striae. Last whorl with well-separated narrow spiral ribs from base to shoulder; intermittent grooves axially and spirally striate.

#### *Conus violaceus* Shell Morphometry

L	50 - 93 mm
RW	0.14 - 0.30 g/mm (L 50-77 mm)
RD	0.41 - 0.47
PMD	0.71 - 0.83
RSH	0.14 - 0.22

Ground colour white. Last whorl with brown or violet-brown axial streaks and 2 spiral bands, above centre and within basal third. Base violet. Larval shell violet, sometimes brown. Early teleoconch sutural ramps white, violet or brown. Late sutural ramps largely brown to violet-brown or flecked with white. Aperture white.

Periostracum brown to olive-brown, thick, translucent to opaque, with interlaced axial and spiral ridges.

**Habitat and Habits:** In shallow water, often exposed to surface water currents; on coral rubble, among seaweed and in crevices or caves with algal encrustation (Grosch, pers. comm., 1989).

**Discussion:** *C. violaceus* can hardly be mistaken for any other *Conus* species. *C. tenuistriatus* is sometimes similar but differs in its broader last whorl (RD 0.47-0.62) with more closely spaced and usually granulose spiral ribs, its pink rather than dark violet larval shell and its generally violet aperture.

## 228

### *Conus nussatella* LINNÉ, 1758

(Plate 50, Figures 15-18; Plate 76, Figure 57; Map 98)

- 1758 *Conus nussatella* Linné, Syst. Nat. 10 ed., 1: 716, no. 273  
 1834 *Conus nussatella* var. *tenuis* Sowerby I, Conch. Ill.: Pt. 54, fig. 62 (non *C. tenuis* Sowerby I, 1833)  
 1970 *Hermes kawanishii* Shikama, Sci. Rpts. Yokohama Natl. Univ., 2(16): 26-27, pl. 1 figs. 28, 29

**Types:** *C. nussatella*: Lectotype (Kohn, 1963, as "holotype") in LSL (49 x 18 mm); *C. n.* var. *tenuis*: Lectotype (Kohn, 1992)

Map 98

figured in Sowerby (1834: Pt. 54, fig. 62) (35 x 12 mm); *H. kawanishii*: Holotype in GIYU (36.5 x 13.5 mm).

**Type Localities:** *C. nussatella*: "Nussatello Insulam, Asiae"; *C. n.* var. *tenuis*: "ad Insulam Annaa" (Sowerby, 1834a).

**Range:** Entire Indo-Pacific.

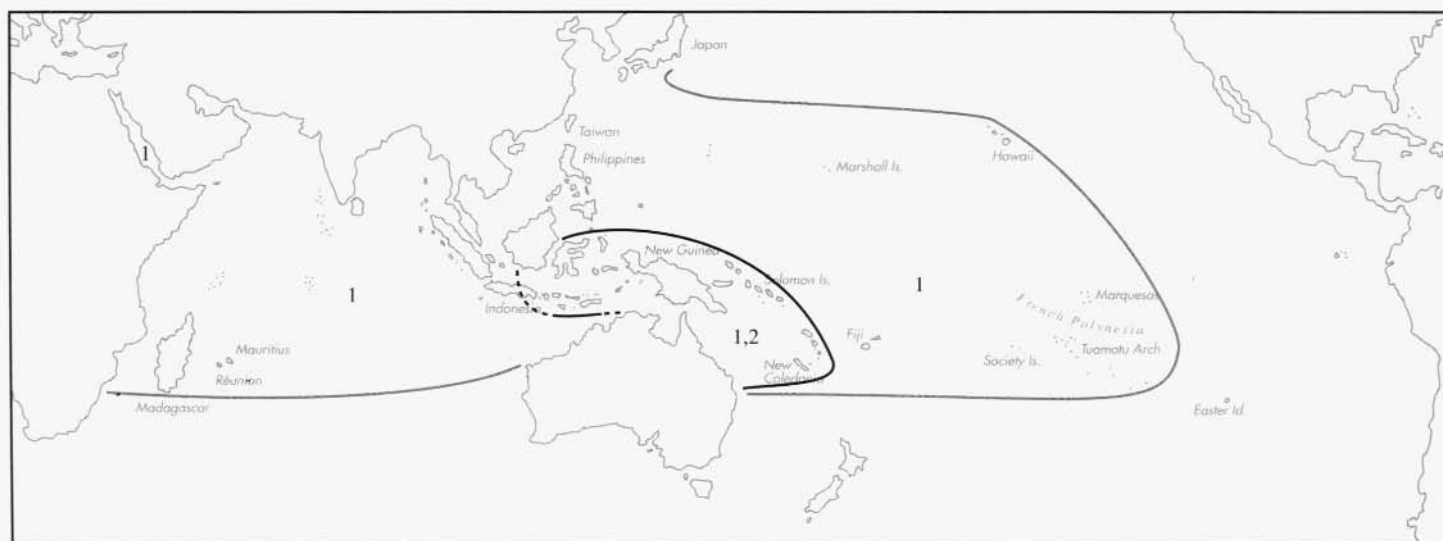
**Description:** Medium-sized to large, moderately solid. Last whorl usually narrowly cylindrical; outline straight and nearly parallel-sided at upper two-thirds, convex to straight toward base. Aperture wider at base than near shoulder. Shoulder subangulate to indistinct. Spire of moderate height; outline slightly convex to domed. Larval shell of 2.75-3 whorls, maximum diameter about 0.65 mm. First 6-7 postnuclear whorls tuberculate. Teleoconch sutural ramps almost flat, with 1 increasing to 4-10 spiral grooves. Last whorl with fine to strong, often granulose spiral ribs from base to shoulder; intervening grooves spirally striate and sometimes with 1 granulose spiral thread.

#### *C. nussatella* Shell Morphometry

<b>L</b>	40 - 95 mm
<b>RW</b>	0.11 - 0.27 g/mm (L 40-84 mm)
<b>RD</b>	0.38 - 0.49
<b>PMD</b>	0.60 - 0.77
<b>RSH</b>	0.13 - 0.20

Ground colour white. Last whorl with spiral rows of small orange to dark brown spots, and with variable orange, brown, or violet axial streaks and blotches, sometimes coalescing axially as well as spirally. Larval whorls white. Postnuclear sutural ramps blotched with orange to dark brown, outer margins with brown spots.

Periostracum yellow to brown, thin, almost opaque, smooth to rough.



1: *C. nussatella* 2: *C. artoptus*

In the Indian Ocean, animal pale to lemon yellow. Rostrum tipped with black. Siphon buff, with brown transverse lines dorso-laterally; tip and interior of siphon black (Kohn, unpubl. observ.; Fainzilber et al., 1992). In N. Papua New Guinea, foot white to pale yellow; dorsum mottled with tan to brown, less so medially. Rostrum and tentacles white to pale grey. Siphon brown basally, distal portion transversely banded with white, brown, grey, and black toward tip (Chaberman, pers. comm., 1981; Pl. 76, Fig. 57). Operculum yellow and tiny in the Red Sea (Fainzilber et al., 1992) but rather long at Hansa Bay, Papua New Guinea (Chaberman, pers. comm., 1981).

Radular teeth stout, with an adapical barb opposite a blade; internal serration ending in a prominent cusp near the central waist; base with a strong spur (Peile, 1939).

**Habitat and Habits:** In 0.5-25 m, on sand bottoms and pinnacles of reef lagoons, in sand pockets of subtidal reef flats, and in caves among living coral. Reported to be molluscivorous though its radular teeth are said to resemble those of vermivorous *C. imperialis* (Peile, 1939; Calabrese, 1971).

**Discussion:** *C. nussatella* may only be mistaken for *C. artoptus*, which lives in deeper water. For the distinctions, see the Discussion of the latter species.

## 229

### *Conus artoptus* SOWERBY I, 1833

(Plate 50, Figures 19-21; Map 98)

1833 *Conus artoptus* Sowerby I, Conch. Ill.: Pt. 33, fig. 35

1854 *Conus spectabilis* A. Adams, Proc. Zool. Soc. London, 1853: 117

**Types:** *C. artoptus*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 33, fig. 35) (41.5 x 15.5 mm); *C. spectabilis*: Type in BMNH (43 x 16 mm).

**Type Localities:** *C. artoptus*: "Biak, New Guinea" (Coomans et al., 1981); *C. spectabilis*: "Australia."

**Range:** Indonesia and Sulu Sea to Queensland, Papua New Guinea, Solomon Is., and Vanuatu.

**Description:** Medium-sized to moderately large, moderately light to moderately solid. Last whorl narrowly cylindrical to narrowly conoid-cylindrical; outline almost straight and nearly parallel-sided at adapical two-thirds, with attenuated sides below. Shoulder angulate to rounded. Spire of moderate height; outline straight or concave. Larval shell of about 2.25 whorls, maximum diameter about 0.85 mm. First 4-5 postnuclear whorls tuberculate. Teleoconch sutural ramps slightly convex, with 3-4 spiral grooves. Last whorl with fine, closely spaced spiral ribs from base to shoulder.

### *C. artoptus* Shell Morphometry

L	35 - 79 mm
RW	0.05 - 0.15 g/mm (L 33-47mm)
RD	0.39 - 0.47
PMD	0.72 - 0.84
RSH	0.12 - 0.15

Ground colour white, sometimes tinged with pink or violet. Last whorl with irregular light brown blotches usually fusing into 3 broad transverse bands, below shoulder, at centre and within basal third. Spiral bands occasionally connected by axial streaks. In some localities (e.g. Vanuatu, Solomon Is., New Caledonia), the last whorl also has spiral rows of tiny brown dots or dashes. Larval whorls white. Postnuclear sutural ramps with scattered brown spots. Aperture white.

**Habitat and Habits:** In 10-50 m, in sand and rubble.

**Discussion:** Walls ([1979]) synonymized *C. artoptus* with *C. viola* Cernohorsky, but the latter species has a grey to purplish red ground colour, a smooth last whorl except for a few spiral ribs basally, and only the first 1-3.5 postnuclear whorls weakly tuberculate. *C. austroviola* differs in its generally broader last whorl (RD 0.45-0.51), generally higher spire (RSH 0.14-0.19), bluish grey to brown colouration, and in its smoother last whorl with a few spiral ribs at base. *C. nussatella* can be distinguished from *C. artoptus* by its convex spire outline, distinct brown blotches on the teleoconch spire, and its last whorl pattern predominantly of spiral rows of reddish brown spots. In addition, *C. nussatella* has the maximum diameter of the last whorl generally closer to the base (PMD 0.60-0.77) and more postnuclear whorls tuberculate.

## 230

### *Conus mitratus* HWASS in BRUGUIÈRE, 1792

(Plate 50, Figures 22-24; Plate 76, Figure 58; Map 99)

1792 *Conus mitratus* Hwass in Bruguière, Encycl. Méth., 1: 738, no. 132

1870 *Conus mitraeformis* var. *pupaeformis* Sowerby III, Proc. Zool. Soc. London, 1870: 256, pl. 22 fig. 2

**Types:** *C. mitratus*: Lectotype (Kohn, 1968, as "holotype"; Walls, [1979]) in MHNG (43 x 15 mm); *C. mitraeformis* var. *pupaeformis*: Original figure 36 x 13 mm.

**Type Localities:** *C. mitratus*: "l'Océan indien"; *C. mitraeformis* var. *pupaeformis*: "Mauritius."

**Range:** Entire Indo-Pacific, except for Red Sea and Hawaii.

**Description:** Moderately small to medium-sized, light to moderately light. Last whorl usually ovate to ventricosely



conical; outline convex. Shoulder indistinct. Spire high; outline convex. Larval shell of about 3.5 whorls, maximum diameter 0.7-0.75 mm. First 3-5 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly convex, with 1 increasing to 2-6 spiral grooves and some striae; intervening ribs and subsutural ridge pronounced and often granulose. Last whorl with granulose spiral ribs or spiral rows of granules basally or to shoulder.

#### ***C. mitratus* Shell Morphometry**

<b>L</b>	28 - 50 mm
<b>RW</b>	0.04 - 0.10 g/mm (L 29-45 mm)
<b>RD</b>	0.49 - 0.57
<b>PMD</b>	0.62 - 0.82
<b>RSH</b>	0.28 - 0.38

Ground colour cream. Last whorl with light to dark brown blurred axial streaks and blotches and spiral dashes. Pattern elements fusing into a spiral band at centre and a similar but narrower band above base. Apex white to cream; shoulder edges of early postnuclear whorls including tubercles sometimes with a light brown band. Late sutural ramps with brown radial blotches. Aperture white.

Periostracum brown, translucent, smooth.

In N. Papua New Guinea, dorsum of foot yellow marginally and on anterior part, with a dark brown blotch at centre of anterior end; median zone with a brown wing-shaped pattern, gradually darker anteriorly. Rostrum white. Tentacles white, with brown tips. Siphon dark brown to black (Chaberman, pers. comm., 1981) (Pl. 76, Fig. 58).

**Habitat and Habits:** In 1-25 m, in sand pockets among corals and seaweed and on lagoon pinnacles.

Map 99

**Discussion:** *C. mitratus* resembles *C. cylindraceus* in size and shape. For the distinctions, see the Discussion of the latter species.

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### ***Conus cylindraceus* BRODERIP & SOWERBY I, 1830**

(Plate 50, Figures 25-27; Map 99)

1830 *Conus cylindraceus* Broderip & Sowerby I, Zool. J. London, 5: 51, pl. 40 fig. 5

**Type:** Holotype figured in Broderip & Sowerby (1830: Pl. 40 fig. 5) (35.5 x 12 mm).

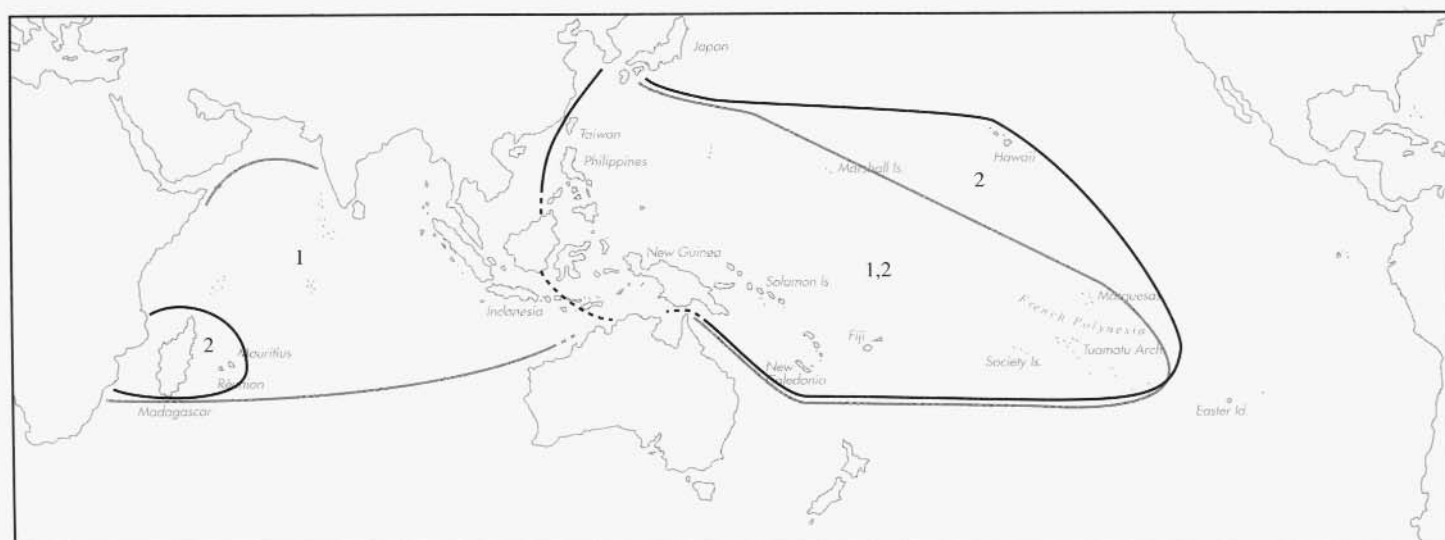
**Type Locality:** "New Caledonia" (Coomans et al., 1985a).

**Range:** Central Indian Ocean to French Polynesia and Hawaii.

**Description:** Moderately small to medium-sized, light to moderately light. Last whorl narrowly ovate or ventricosely conical; outline convex. Shoulder indistinct. Spire high; outline convex. Larval shell of about 3.25 whorls, maximum diameter 0.7-0.8 mm. First 3-4 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly convex, with 1 distinct spiral groove in early whorls and 2-6 very weak grooves in late whorls. Last whorl glossy, almost smooth or with weak, finely granulose spiral ribs at base.

Ground colour white. Last whorl with distinct, yellowish to dark brown axial flames, blotches and lines; one spiral ground-colour band below shoulder and often another below centre, crossed by axial lines. Apex white. Late sutural ramps with brown radial blotches. Aperture white to bluish white.

Periostracum light yellow, thin, translucent, smooth.



1: *C. mitratus* 2: *C. cylindraceus*

### *C. cylindraceus* Shell Morphometry

<b>L</b>	25 - 49 mm
<b>RW</b>	0.04 - 0.05 g/mm (L 24-40 mm)
<b>RD</b>	0.46 - 0.56
<b>PMD</b>	0.67 - 0.80
<b>RSH</b>	0.27 - 0.32

**Habitat and Habits:** In 1-25m, in coral rubble and on sand under corals.

**Discussion:** *C. cylindraceus* closely resembles *C. mitratus* in size and shape. The latter species is distinguished by its less glossy and less smooth last whorl with granulose spiral ribs or spiral rows of granules and the stronger spiral ribs on its sutural ramps. The early postnuclear sutural ramps have 1 spiral groove in *C. cylindraceus* but 1 increasing to 2-3 grooves in *C. mitratus*.

## 232

### *Conus cumingii* REEVE, 1848

(Plate 50, Figures 28-30; Map 100)

1848 *Conus cumingii* Reeve Conch. Icon., 1, *Conus* suppl.: Pl. 3 sp. 282

**Type:** Type in BMNH (34.5 x 17 mm).

**Type Locality:** "Island of Mindano, Philippines."

**Range:** N. Indian Ocean (India, Sri Lanka, W. Thailand, Indonesia) and W. Pacific (S. Philippines to Solomon Is.).

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl ventricosely conical to conical; outline variably convex. Shoulder

Map 100

subangulate. Spire of moderate height; outline straight to slightly concave. Larval shell of about 3.25 whorls, maximum diameter 0.8-0.9 mm. First 2-4 teleoconch whorls tuberculate. Teleoconch sutural ramps flat, with 1 increasing to 6-9 spiral grooves. Last whorl with often granulose spiral ribs near base.

### *C. cumingii* Shell Morphometry

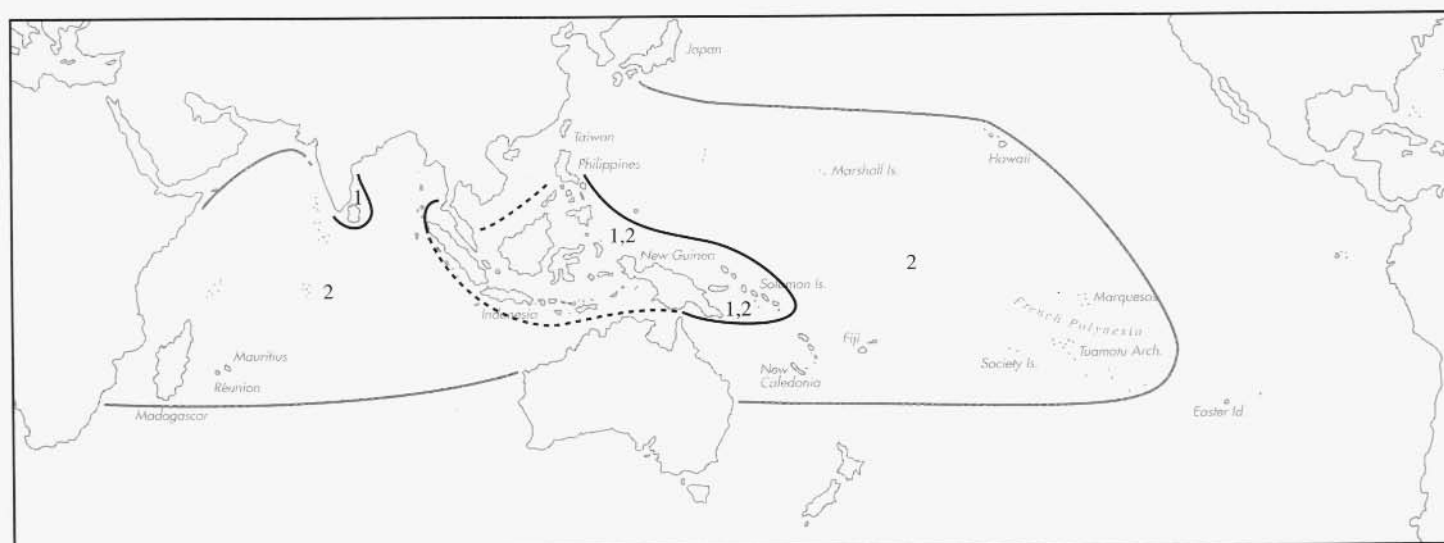
<b>L</b>	30 - 40 mm
<b>RW</b>	0.13 - 0.19 g/mm (L 30-37 mm)
<b>RD</b>	0.60 - 0.70
<b>PMD</b>	0.79 - 0.89
<b>RSH</b>	0.10 - 0.17

Ground colour white. Last whorl overlaid with broad olive, orange or dark brown spiral bands, leaving only a white central band and a spiral row of white blotches at the shoulder; central band edged by dark brown dotted and dashed spiral lines. Last whorl variably encircled with darker spiral lines or spiral rows of dots and dashes. Larval shell pink. Postnuclear sutural ramps with brown radial streaks and blotches. Aperture bluish white to light violet.

Periostracum olive, thin, translucent, with radial ridges on the sutural ramps.

**Habitat and Habits:** In 2-50 m, in dark silty sand (Solomon Is.).

**Discussion:** *C. cumingii* may resemble *C. fumigatus* and *C. sazanaka* in shape and colour pattern. *C. fumigatus* in its more conical last whorl (PMD 0.87-0.95), angulate shoulder, and in the weaker spiral sculpture on the late sutural ramps as well as on the basal part of the last whorl. *C. sazanaka* usually has a narrower and often more conical last whorl (RD 0.56-0.63; PMD 0.86-0.93), it lacks dotted



1: *C. cumingii* 2: *C. pertusus*

and dashed spiral lines on the last whorl, and its larval shell comprises more whorls (4 vs. 3.25).

## 233

### *Conus pertusus* HWASS in BRUGUIÈRE, 1792

(Plate 51, Figures 1-6; Plate 76, Figure 59;  
Map 100)

- 1792 *Conus pertusus* Hwass in Bruguière, *Encycl. Méth.*, **1**: 686-687, no. 75  
1810 *Conus amabilis* Lamarck, *Ann. Mus. Hist. Nat. Paris*, **15**: 425, no. 137  
1817 *Conus festinus* Dillwyn, *Descr. Catal. Rec. Shells*, **1**: 413, no. 116

**Types:** *C. pertusus*: Lectotype (Kohn, 1968, as "holotype"; Walls, [1979]) in MHNG (50.5 x 24.5 mm); *C. amabilis*: Lectotype (Kohn, 1981) in MHNG (29 x 16 mm); *C. festinus*: Lectotype (Kohn, 1986) in UZMC (23 x 16 mm).

**Type Localities:** *C. pertusus*: "les mers des grandes Indes"; *C. amabilis*: "Mer des grandes Indes"; *C. festinus*: "Molucca Islands" (Valentyn, 1773).

**Range:** Entire Indo-Pacific, except for Red Sea.

**Description:** Moderately small to moderately large, moderately solid to solid. Last whorl conical to ventricosely conical; outline convex below shoulder, straight below. In larger specimens, columella often curved to left near base. Shoulder angulate to subangulate. Spire of moderate height, outline domed. Larval shell projecting, of 3.25-4 whorls; maximum diameter 0.9-1.05 mm. First 0.5-2 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with 2-3 increasing to 4-5 spiral grooves; number of grooves may be smaller and grooves are often obsolete on latest ramps. Last whorl smooth except for a few weak spiral ribs at base, or with raised, widely spaced spiral ribs from base to shoulder; wide grooves between ribs, with numerous heavy axial striae occasionally crossing 1-3 spiral threads. Smooth and heavily sculptured specimens occur in the same populations.

#### *C. pertusus* Shell Morphometry

L	28 - 69 mm
RW	0.13 - 0.37 g/mm (L 28-58 mm)
RD	0.53 - 0.64
PMD	0.75 - 0.89
RSH	0.09 - 0.19

Juvenile shells (L less than 10 mm) uniformly lemon yellow, becoming overlaid with red and white colour zones during growth (Pl. 51, Fig. 6). In adults, ground colour varying from white to rose. Last whorl with orange-red to

pink or tan clouds fusing into 2 variably broad spiral bands, on each side of centre. Adapical and central ground-colour bands crossed by axial clouds. Fine dotted and dashed brown spiral lines may extend from base to shoulder but are very variable in number and arrangement. Basal part of columella, siphonal fasciole and siphonal notch pink to violet. Larval whorls and a variable number of early post-nuclear sutural ramps yellow; following ramps with clouds and blotches of same colour as last whorl. Aperture pale pink to violet.

Periostracum almost colourless to olive grey, thin, and translucent to almost opaque, with spiral rows of long tufts on last whorl and tufted margins in sutural ramps in Philippine specimens; variation in colour and thickness not dependent on size. A similar periostracum occurs in Hawaii (Kohn & Weaver, 1962) and Marshall Is.

In Hawaii and Marshall Is., animal white to pale yellow, densely mottled and suffused with greyish yellow, variably speckled with dark grey to black. Dorsum of foot more yellow at both ends; black spots denser marginally and fewer but larger at posterior end. Siphon with dense black spotting on anterior two-thirds; black spots fusing into blotches at base (Kohn & Weaver, 1962; Pearson, unpubl. observ.). At Hansa Bay, dorsum of foot with a spotted black pre-marginal band, the latter crescent-shaped anteriorly and separating a yellow marginal zone from a paler median zone; anterior part pale tan. Sole of foot dull white. Rostrum yellow. Tentacles white. Siphon cream, suffused with pink and dotted with dark brown, lighter ventrally (Pl. 76, Fig. 59; Chaberman, pers. comm., 1981).

Radular teeth with an adapical barb opposite a blade; strong serration to the centre of the shaft, ending in a blunt cusp; base with a spur (Rolán, unpubl. observ.).

**Habitat and Habits:** In 5-120 m. In Hawaii, in 18-90 m (Kohn, 1959a; Kohn & Weaver, 1962; Kay, 1979). In Fiji, subtidally under coral heads (Cernohorsky, 1964). In Marshall Is., in caves and coral rubble in 10-18 m. In New Caledonia, in white sand beneath coral boulders in 5-40 m (Tirard, pers. comm., 1989). In E. New Britain, subadults in 15-25 m among live coral but not in sand (Richards, pers. comm., 1989). At Hansa Bay, on coral rubble. In southern Natal, in 30 m and deeper (Liltved & Millard, 1989).

In Hawaii, *C. pertusus* feeds on polychaetes (Kohn, 1959b).

Egg diameter of 132 µm predicts a minimum pelagic period of 29 days (Hawaii, Perron, 1981b; Perron & Kohn, 1985).

**Discussion:** Despite its conchological variation, *C. pertusus* cannot be confused with any of its Indo-Pacific congeners, although juvenile specimens resemble *C. corallinus*. The larval and early teleoconch whorls of the latter species are pink, not yellow, the animal is pink to red, not greyish yellow with black spots.

*C. festinus* refers to the typical, smooth form of *C. pertusus*, and *C. amabilis* to a heavily sculptured form.



**Conus coccineus** Gmelin, 1791

(Plate 51, Figures 7-11; Map 101)

- 1791 *Conus ammiralis anglicus* Gmelin, Syst. Nat., 13 ed., 1: 3379  
 1791 *Conus coccineus* Gmelin, Syst. Nat., 13 ed., 1: 3390, no. 46  
 1830 *Conus solandri* Broderip & Sowerby I, Zool. J., 5: 50, suppl., pl. 40 fig. 4

**Types:** *C. coccineus*: Lectotype (Kohn, 1966) figured in Knorr (1771: Pl. 24 fig. 2) (32 x 16 mm); neotype (Coomans et al., 1985a) in ZMA, but selection of neotype invalid, because of the prior lectotype selection; *C. a. anglicus*: Lectotype (Kohn, 1966) same as lectotype of *C. coccineus*; *C. solandri*: Lectotype (Kohn, 1987) figured in Broderip & Sowerby (1830: Pl. 40 fig. 4) (42 x 21 mm).

**Type Localities:** *C. coccineus*: "Samar Id., Philippines" (Coomans et al., 1985a); *C. solandri*: "Tahiti."

**Range:** E. Indonesia, Philippines, Queensland, New Caledonia, Solomon Is., and Vanuatu.

**Description:** Moderately small to moderately large, moderately solid. Last whorl ovate to conoid-cylindrical, sometimes cylindrical; outline convex to almost straight and parallel-sided adapically; left side concave basally. Shoulder angulate, undulate to weakly tuberculate. Spire of low to moderate height. Larval shell of about 2 whorls, maximum diameter 0.8-0.9 mm. Early postnuclear whorls tuberculate, late whorls tuberculate to undulate. Teleoconch sutural ramps flat, with 1-3 increasing to 5-7 spiral grooves. Last whorl with closely spaced, variably granulose spiral ribs.

***C. coccineus* Shell Morphometry**

<b>L</b>	30 - 62 mm
<b>RW</b>	0.11 - 0.26 g/mm
<b>RD</b>	0.51 - 0.63
<b>PMD</b>	0.71 - 0.83
<b>RSH</b>	0.11 - 0.18

Colour variable: white, pink, orange, to dark brown. Last whorl with a white central band, usually containing brown blotches above and spirally arranged dots below. In light-coloured specimens, spiral ribs outside the central band occasionally bear dark spiral lines. Larval whorls and first 2-4 postnuclear sutural ramps white to pink; following sutural ramps matching the colour of last whorl, often with darker radial blotches; sutural margins usually darker. Aperture white to violet.

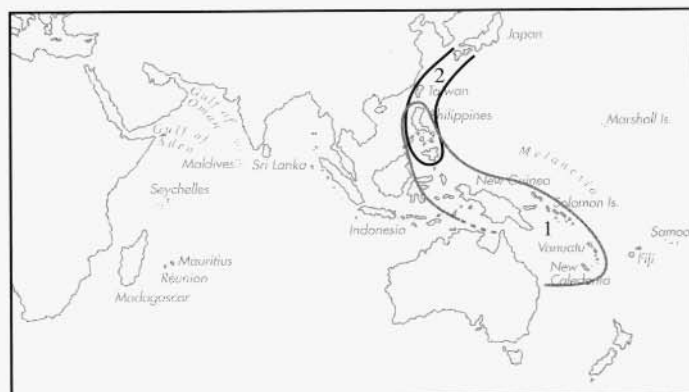
Periostracum greenish brown, thin to thick, translucent to opaque, with interlaced axial ridges.

**Habitat and Habits:** In 1-20 m, at exposed coral reef sites and in coral rubble.

**Discussion:** *C. coccineus* is most similar to *C. vittatus* from the Panamic Province. For comparison, see the Discussion of the latter species (see Vol. 2).

*C. ammiralis anglicus* and *C. coccineus* are two simultaneously described synonyms. Kohn (1966) selected *C. coccineus* as the valid name.

Map 101

1: *C. coccineus* 2: *C. otohimeae***Conus otohimeae** KURODA & ITO, 1961

(Plates 51, Figures 12-16; Map 101)

- 1961 *Conus* (*Endemoconus*) *otohimeae* Kuroda & Ito, Venus 21 (3): 250-251, 260-261, pl. 17 fig. 8  
 1982 *Conus rogmartini* da Motta, Carfel Philippine Shell News, 4 (2): 3, 1 (figs.)

**Types:** *C. otohimeae*: Holotype in KSM (27 x 14 mm); *C. rogmartini*: Holotype in MHNG (31 x 17.5 mm).

**Type Localities:** *C. otohimeae*: "Nada, Gobo, Kii Peninsula"; *C. rogmartini*: "in Balut Island in the Sarangani group, south of Mindanao."

**Range:** Japan to Philippines.

**Description:** Moderately small to medium-sized, moderately solid. Last whorl ventricosely conical to conical; outline slightly convex to straight, left side may be concave near base. Shoulder angulate to carinate, often weakly tuberculate or undulate. Spire of moderate height, outline straight to slightly sigmoid. Larval shell of about 3 whorls, maximum diameter 0.9-1 mm. First 5-7 teleoconch whorls tuberculate, following whorls often carinate; tubercles may re-appear within the last 2 whorls. Teleoconch sutural ramps flat to concave, bearing dominant curved axial threads. Last whorl glossy, sculpture variable: smooth, with weak spiral ribs below centre, ribs occasionally granulose, sometimes heavily, from base to shoulder, especially toward outer lip in shells from Philippines.

Ground colour white to pink. Last whorl variably encircled with orange-brown bands, often containing brown flecks and axial streaks. Overlying closely spaced spiral rows of brown dots extend from base to shoulder, but may be reduced or absent. Larval whorls white to grey. Postnu-

clear sutural ramps with brown radial blotches and brown dashes or dots on outer margins. Aperture translucent.

#### ***C. otohimeae* Shell Morphometry**

<b>L</b>	27 - 40 mm
<b>RW</b>	0.11 - 0.20 g/mm (L 27-37 mm)
<b>RD</b>	0.59 - 0.64
<b>PMD</b>	0.78 - 0.92
<b>RSH</b>	0.12 - 0.20

**Habitat and Habits:** In Japan in 50-150 m; Philippine shells in 240-300 m.

**Discussion:** *C. otohimeae* may resemble *C. spirophilis* and *C. memiae*; for the distinctions, see the Discussions of the latter species.

Shells described as *C. rogmartini* from S. Philippines (Pl. 51, Figs. 15, 16) have granulose spiral ribs on last whorl.

### **236**

#### ***Conus kanakinus* RICHARD, 1983**

(Plate 51, Figures 17-20; Map 102)

1983 *Conus kanakinus* Richard, J. Malac. Soc. Australia, 6 (1-2): 55-56, 58 (figs. 5-9)

**Type:** Holotype in MNHN (15 x 7.5 mm).

**Type Locality:** "22° 49' S, 167° 12' E (S.W. of Ile des Pins)."

**Range:** New Caledonia.

**Description:** Small and light. Last whorl usually conical; outline nearly straight. Shoulder angulate to subangulate, edge prominent. Spire of moderate height; outline sigmoid. Larval shell of about 2 whorls, maximum diameter about 1 mm. First 2-3 postnuclear whorls tuberculate. Teleoconch sutural ramps slightly concave, with 0 increasing to 5-7 fine spiral grooves. Last whorl with several spiral ribs near base and weak spiral striae to shoulder.

#### ***C. kanakinus* Shell Morphometry**

<b>L</b>	11 - 21 mm
<b>RW</b>	0.01 - 0.03 g/mm
<b>RD</b>	0.54 - 0.62
<b>PMD</b>	0.84 - 0.90
<b>RSH</b>	0.15 - 0.23

Ground colour white. Last whorl with 10-15 irregularly interrupted brown spiral lines. Line at shoulder of more regularly set brown dashes, visible on teleoconch spire whorls. Larval shell white. Postnuclear sutural ramps with pale brown radial blotches. Aperture white.

**Habitat and Habits:** In 350-595 m.

**Discussion:** In colour pattern of the last whorl and spire *C. kanakinus* resembles *C. hirasei*. The latter species is much larger (to 92 mm); it has a lower spire (RSH 0.09-0.14), solid rather than interrupted spiral lines around the last whorl and spots rather than dashes at the shoulder, and it lacks brown radial blotches on the spire.

### **237**

#### ***Conus boucheti* RICHARD, 1983**

(Plate 51, Figures 21-24; Map 102)

1983 *Conus boucheti* Richard, J. Malac. Soc. Australia, 6 (1-2): 53-54, 57 (figs. 1-4)

**Type:** Holotype in MNHN (17.5 x 9 mm).

**Type Locality:** "22° 50' S, 167° 15' E (Pointe Sud du Grand Recif, S. W. of Ile des Pins)."

**Range:** New Caledonia.

**Description:** Small to medium-sized, light to moderately light. Last whorl conical; outline almost straight; right side may be slightly convex, left side slightly sigmoid. Shoulder carinate. Spire of moderate height; outline concave. Larval shell of about 3 whorls, maximum diameter 1.1-1.2 mm.. About first 4 postnuclear whorls tuberculate, following whorls carinate. Teleoconch sutural ramps slightly concave, with closely-set, strong radial threads crossing obsolete spiral striae. Last whorl with wide, axially striate spiral grooves, narrower, weaker or obsolete adapically; 4 closely-set, punctate spiral grooves just below the shoulder.

#### ***C. boucheti* Shell Morphometry**

<b>L</b>	17 - 39 mm
<b>RW</b>	0.04 - 0.08 g/mm (L 17-25mm)
<b>RD</b>	0.57 - 0.65
<b>PMD</b>	0.87 - 0.96
<b>RSH</b>	0.13 - 0.23

Ground colour white to beige. Last whorl with about 6-8 broad, brown spiral lines on the ribbons between the basal spiral grooves; occasionally irregular brown blotches in the ground-colour zone. Larval whorls beige. Postnuclear sutural ramps with irregular brown radial blotches. Shoulder edge sometimes ornamented with brown spots.

Periostracum thin, translucent.

**Habitat and Habits:** In 300-560 m.

**Discussion:** *C. boucheti* differs strikingly from all other Indo-Pacific *Conus* species in its colour pattern of basal basal brown spiral lines on an otherwise uniformly beige last whorl.



1: *C. kanakinus* 2: *C. boucheti* 3: *C. chiangi*

## 238

### *Conus chiangi* (AZUMA, 1972)

(Plate 51, Figures 25-27; Map 102)

1972 *Taranteconus chiangi* Azuma, Venus 31: 56-57, 59, 60-61, figs. 5, 6 (July)

1972 *Cornutoconus lamellatus* Suzuki, Pacific Shell News, (5): 1 (text fig.), 2 (September; see Coomans et al., 1983)

**Types:** *T. chiangi*: Holotype in Azuma coll. (18 x 10 mm); *C. lamellatus*: Holotype 18.5 x 11 mm.

**Type Localities:** *T. chiangi*: "South China Sea"; *C. lamellatus*: "Off Sumisu Isle, near Hachijo Id., Izu Islands."

**Range:** Japan to Philippines, New Caledonia.

**Description:** Small, light to moderately light. Last whorl usually conical; outline almost straight, slightly convex below shoulder. Shoulder and late postnuclear whorls with sharp, upward-pointing, hollow marginal spines, extending slightly below shoulder as costae. Spire of moderate height to high; outline straight to slightly concave. Larval shell of about 3 whorls, maximum diameter 0.8-0.9 mm. Early postnuclear whorls tuberculate. Teleoconch sutural ramps concave, with 1 increasing to 3-6 spiral grooves; spiral sculpture sometimes obsolete. Last whorl with spiral ribs separated by wider grooves, from base to shoulder; sometimes with collabral costae extending entire length of last whorl, especially toward outer lip.

#### *C. chiangi* Shell Morphometry

L	16 - 25 mm
RW	0.05 - 0.09 g/mm
RD	0.62 - 0.71
PMD	0.86 - 0.95
RSH	0.15 - 0.26

Ground colour white to grey or beige. Last whorl with broad brownish grey and brown spiral bands leaving a

broad, lighter central band. Overlying spiral rows of alternating brown and white dots and dashes on ribs from base to shoulder. Larval whorls white. Teleoconch sutural ramps with fine radial brown lines or blotches extending across outer margins. Aperture white.

Periostracum yellow, thin.

Radular tooth "about 200  $\mu$ m in length, lanceolate, with triangular knob-like base, corpulent middle part and tapering tip with minute barb and sharp blade but no serration" (Azuma, 1972).

**Habitat and Habits:** In 200-400 m, on dead coral and rubble.

**Discussion:** *C. chiangi* is set apart within *Conus* by its unique sharp hollow marginal spines that continue as costae to the subshoulder area. Only *C. polongimarumai* shows certain similarities. For comparison, see the Discussion of that species. Coomans et al. (1983) determined priority of the name *chiangi* over *lamellatus*.

## 239

### *Conus dondani* KOSUGE, 1981

(Plate 51, Figures 28, 29; Map 103)

1981 *Conus dondani* Kosuge, Bull. Inst. Malac. Tokyo, 1: 114, pl. 39 figs. 8, 9

**Type:** Holotype in IMT (23 x 9 mm).

**Type Locality:** "Panglao, Bohol, Philippines."

**Range:** Philippines.

**Description:** Small to moderately small, light. Last whorl conical, outline straight. Shoulder angulate to subangulate. Spire of moderate height to high, outline nearly straight. Larval shell of 2.5 whorls, maximum diameter 0.8-0.9 mm. First 4-6 postnuclear whorls weakly tuberculate; in first whorl, tubercles at both margins and on intervening spiral rib. Teleoconch sutural ramps flat to slightly concave, with 2 increasing to 3-4 spiral grooves in early and spiral striae in late whorls. Last whorl almost smooth.

#### *C. dondani* Shell Morphometry

L	23 - 33 mm
RW	0.04 - 0.06 g/mm
RD	0.52 - 0.60
PMD	0.87 - 0.95
RSH	0.22 - 0.31

Ground colour cream. Last whorl with broad brown spiral zones leaving 3 narrower reticulated spiral bands, at centre, shoulder and base and 1-3 similarly patterned axial streaks; colour zones overlaid with spiral lines of alternating brown and tan dots and dashes. Larval whorls white. Post-



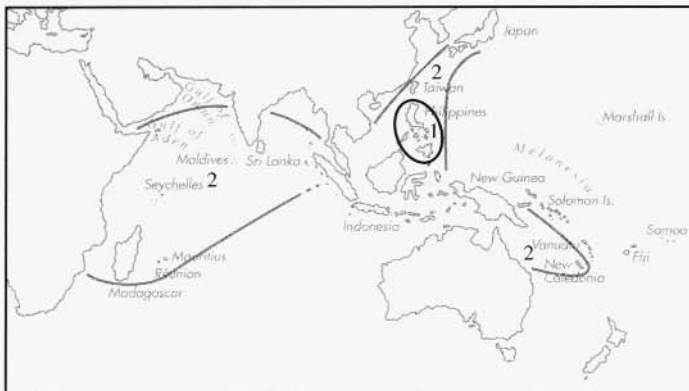
nuclear sutural ramps with brown dots and spots as well as reticulated radial lines and blotches. Aperture white.

Periostracum brown, thin, translucent.

**Habitat and Habits:** In 100-200 m.

**Discussion:** *C. dondani* superficially resembles juvenile shells of *C. gloriamaris* and *C. bengalensis* (see Kosuge, 1981). However, the latter species are clearly distinguished by their narrower last whorls (*C. gloriamaris*: RD 0.45-0.50; *C. bengalensis*: RD 0.36-0.46) with a typical *C. textile* pattern.

Map 103



1: *C. dondani* 2: *C. articulatus*

## 240

### *Conus articulatus* SOWERBY III, 1873

(Plate 52, Figures 1-8; Plate 76, Figure 60;

Map 103)

- 1873 *Conus articulatus* Sowerby III, Proc. Zool. Soc. London, **1873**: 146, pl. 15 fig. 3  
 1881 *Conus lombei* Sowerby III, Proc. Zool. Soc. London, **1881**: 637, pl. 56 fig. 6  
 1970 *Parviconus nadaensis* Azuma & Toki, Pacific Shell News, (2): 30, text figs. (April)  
 1970 *Endemnoconus nadaensis* Azuma & Toki, Venus, **29** (3): 77-80, text figs. 2, 4, 4a (August)  
 1970 *Conus (Pionoconus) tosaensis* Shikama, Sci. Rpts. Yokohama Natl. Univ., Sec. II (16): 25, pl. 1 figs. 22, 23

**Types:** *C. articulatus*: Original figure 18 x 10 mm; *C. lombei*: Holotype in BMNH (22.5 x 12 mm); *P. nadaensis*: Holotype in Azuma coll. (25.5 x 15 mm); *C. tosaensis*: Holotype in KPM (29 x 15 mm).

**Type Localities:** *C. articulatus*: "Mauritius"; *C. lombei*: "Mauritius?"; *P. nadaensis*: "About 4 km off Nada, Wakayama Pref., Kii Peninsula"; *C. tosaensis*: "Tosashimizu, Kochi Prefecture."

**Range:** E. Africa to W. Thailand and Indonesia; Japan to Philippines; Papua New Guinea, New Caledonia, and Queensland.

**Description:** Small to moderately small, light to moderately light. Last whorl usually conical to broadly conical;

outline variably convex adapically, straight (right side) or concave (left side) below. Shoulder angulate to sharply angulate. Spire of moderate height to high, slightly stepped; outline slightly to deeply concave. Larval shell of 3.0-3.5 whorls, maximum diameter 0.8-1.0 mm. First 3-6 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to concave, without spiral sculpture. Last whorl with punctate spiral grooves below centre and variably broad ribbons between.

#### *C. articulatus* Shell Morphometry

L	18 - 29 mm
RW	0.04 - 0.11 g/mm
RD	0.62 - 0.74
PMD	0.83 - 0.95
RSH	0.16 - 0.30

Colour variable, primarily brownish orange, red, or olive. Last whorl with a variably broad, axially maculated white spiral band below centre, mostly edged by darker flecks or bands and usually with a variable number of dotted brown spiral lines. Occasionally conspicuous solid brown spiral lines from base to shoulder. Base and columella often tinged with violet. Larval whorls pink to violet; early postnuclear sutural ramps of the same colour and immaculate. Following ramps white, variably marked with brown radial blotches and marginal spots; shoulder edge regularly ornamented with brown spots. Aperture translucent.

Periostracum yellowish grey, thin, translucent, smooth, except for oblique ridges on sutural ramps.

Dorsum of foot pink dotted with black and white, brighter pink at ends. Sole of foot pink, brighter at ends. Rostrum and tentacles pink. Siphon orangish pink spotted with white, spots larger proximally (Chaberman, pers. comm., 1981)(Pl. 76, Fig. 60).

Radular teeth lack barbs, bear a strong basal spur and have a slight waist at the centre (Azuma & Toki, 1970).

**Habitat and Habits:** In 35-240 m, in coral sand.

**Discussion:** *C. otohimeae* resembles *C. articulatus*, but it differs in its larger size (to 40 mm), often tuberculate shoulder, lower spire (RSH 0.12-0.20), and narrower last whorl (RD 0.59-0.64). It does not have a violet base, and the radular teeth also differ (Azuma & Toki, 1970). Juvenile specimens of *C. lischkeanus* from E. Africa (Pl. 52, Figs. 9, 10) may be very similar to *C. articulatus*, but can be distinguished by the presence of spiral grooves on sutural ramps and the absence of tuberculate whorls. *C. hamamotoi* has a generally broader last whorl (RD 0.70-0.79) and a generally lower spire (RSH 0.15-0.22); its early postnuclear sutural ramps have 1-2 spiral grooves, its larval shell is pale orange rather than pink to violet, its base consistently white, and its late sutural ramps are brownish red but not white. For comparison with *C. dayriti*, see the Discussion of that species.

*C. articulatus* is very variable in shape, especially colouration and spire height, irrespective of locality. Specimens described as *P. nadaensis* from Japan (Pl. 52, Figs. 6, 7) falls within the range of variation observed in *C. articulatus* from Philippines and W. Thailand. *C. lombei* refers to a colour pattern variant of *C. articulatus* with an evenly reddish brown last whorl. The holotype of *C. tosaensis* (Pl. 52, Fig. 8) was collected dead and most probably represents a very large specimen of *C. articulatus*.

## 241

### *Conus dayriti* RÖCKEL & DA MOTTA, 1983

(Plate 52, Figures 11-15; Map 104)

1983 *Conus dayriti* Röckel & da Motta, Bull. Inst. Malac. Tokyo, 1: 118, pl. 40 figs. 5, 6

**Type:** Holotype in SMF (20.5 x 11.5 mm).

**Type Locality:** "Punta Engano, Cebu."

**Range:** Philippines, New Caledonia.

**Description:** Small to medium-sized, light to moderately solid. Last whorl conical to ventricosely conical; outline slightly convex below shoulder, almost straight below; left side concave or constricted at base. Shoulder angulate. Spire of low to moderate height; outline slightly convex to straight. Larval shell projecting, of 3.25-3.5 whorls; maximum diameter 0.85-0.95 mm in Philippines, 1.1-1.2 mm in New Caledonia. First 0.25-2 postnuclear whorls weakly tuberculate to undulate. Teleoconch sutural ramps almost flat, with 1-2 increasing to 3-5 spiral grooves. Last whorl smooth and glossy, except for a few spiral ribs at base.

#### *C. dayriti* Shell Morphometry

<b>L</b>	16 - 36 mm
<b>RW</b>	0.05 - 0.12 g/mm
<b>RD</b>	0.59 - 0.70
<b>PMD</b>	0.83 - 0.93
<b>RSH</b>	0.07 - 0.17

Ground colour pale violet to reddish brown, occasionally yellow or white. Last whorl axially clouded with various shades of brown; clouds usually leaving a light central band and occasionally fusing into 2 spiral bands, on both sides of centre. Non-clouded areas variably encircled with rows of alternating dark brown and white dots or dashes. Larval whorls beige to light brown, with a brown blotch in specimens from New Caledonia. Postnuclear sutural ramps with brown radial markings, reduced in some places to dots along outer margins. Aperture pale violet, often partly translucent in smaller shells.

Periostracum olive-brown, thin, translucent, with widely spaced spiral rows of tufted lines.

**Habitat and Habits:** In 70-525 m.

**Discussion:** *C. dayriti* resembles *C. articulatus* and *C. aphrodite* most closely. *C. articulatus* can be distinguished by its characteristic white shoulder edge with regularly spaced brown spots, higher spire (RSH 0.16-0.30), distinctly tuberculate first 3-6 postnuclear whorls, and by the absence of spiral grooves on its teleoconch sutural ramps. For comparison with *C. aphrodite*, see the Discussion of that species.

Specimens from New Caledonia (Pl. 52, Fig. 15) differ from Philippine specimens (Pl. 52, Figs. 11-14) by their broader larval shell, slightly stepped spire whorls, and often pure white colouration. We provisionally assign them to *C. dayriti*.

Map 104



1: *C. dayriti* 2: *C. spirofilis*

## 242

### *Conus spirofilis* HABE & KOSUGE, 1970

(Plate 52, Figures 16-20; Map 104)

1970 *Conus spirofilis* Habe & Kosuge, Pacific Shell News, (3): 11, text fig.

1985 *Conus nipponicus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 4: 2-3, pl. 1 figs. 2a, b

**Types:** *C. spirofilis*: Holotype in IMT (31 x 16.5 mm); *C. nipponicus*: Holotype in MHNG (25 x 13.5 mm).

**Type Localities:** *C. spirofilis*: "South China Sea"; *C. nipponicus*: "off Kii-suido, east of Shikoku, Japan."

**Range:** Japan to Philippines.

**Description:** Small to medium-sized, light to moderately solid. Last whorl conical to broadly conical, sometimes ventricosely conical; outline variably convex adapically, straight (right side) or concave (left side) toward base. Shoulder carinate. Spire of moderate height, outline concave. Larval shell of 3 or more whorls, maximum diameter about 0.9 mm. First 2-3 teleoconch whorls tuberculate. Teleoconch sutural ramps flat to slightly concave, with prominent arcuate radial threads and obsolete spiral striation. Last whorl smooth, with a few weak spiral ribs at base or with spiral ribs from base to centre or to shoulder.

### *C. spirofilis* Shell Morphometry

L	23 - 37 mm
RW	0.04 - 0.12 g/mm
RD	0.63 - 0.75
PMD	0.84 - 0.92
RSH	0.14 - 0.22

Colour pale brown to pale violet. Last whorl with about 20 solid or dashed brown spiral lines. Orange or brown blotches form a subcentral spiral band. Additional small spiral bands may occur above centre and below shoulder. A varying number of white spots to blotches may be scattered on entire last whorl. Larval whorls white. Postnuclear sutural ramps white, with brown radial blotches forming darker spots at outer margins; orangish to reddish brown spots very prominent at shoulder. Aperture translucent, pale violet deeper within.

Periostracum brownish grey, thin, translucent to nearly opaque, with tufted radial ridges on sutural ramps and fine axial ridges as well as spiral rows of tufts on last whorl.

**Habitat and Habits:** Deep water; exact data not available.

**Discussion:** Emerson & Sage (1987) documented the availability of the name *C. spirofilis*. *C. otohimeae* may resemble *C. spirofilis*, but differs in its narrower last whorl (RD 0.59-0.64) with spiral rows of dots rather than dashed or solid lines and in its more tuberculate early postnuclear whorls (5-7 vs. 2-3). *C. memiae* may be similar in shape; for comparison, see the Discussion of that species.

A specimen from Loyalty Is. (Pl. 52, Fig. 20) resembles *C. spirofilis* in size and colour pattern but can be distinguished by its narrower last whorl (RD 0.60), straight spire outline, and the spiral grooves on its sutural ramps.

## 243

### *Conus polongimarumai* KOSUGE, 1980

(Plate 52, Figures 21-24, Map 105)

1980 *Conus polongimarumai* Kosuge, Bull. Inst. Malac. Tokyo, 1 (4): 63-64, pl. 18 figs. 6-8

**Type:** Holotype in IMT (22.5 x 10.5 mm).

**Type Locality:** "Punta Engano, Mactan, Philippines."

**Range:** Philippines, Marshall Is., New Caledonia, W. Thailand.

**Description:** Small to moderately small, light to moderately light. Last whorl conical to ventricosely conical; outline straight to slightly convex; left side often slightly

concave at base. Shoulder with strong, pointed tubercles continuing as costae below shoulder edge and often also across sutural ramps. Spire of moderate height to high, stepped; outline straight to slightly concave. Larval shell of 3.0-3.25 whorls, maximum diameter 0.7-0.8 mm. Postnuclear whorls with tubercles continuing as costae. Teleoconch sutural ramps concave, with 1-3 increasing to 3-7 spiral grooves; spiral sculpture may be weak in latest whorls. Sculpture of last whorl ranging from a few weak, smooth spiral ribs at base to granulate ribs from base to shoulder.

### *C. polongimarumai* Shell Morphometry

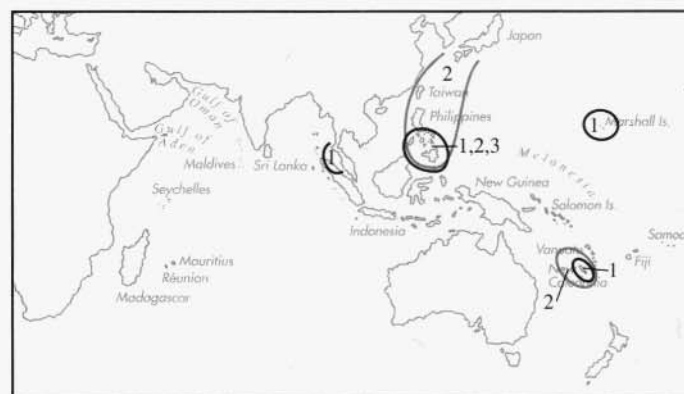
L	18 - 32 mm
RW	0.05 - 0.08 g/mm
RD	0.58 - 0.68
PMD	0.82 - 0.95
RSH	0.18 - 0.32

Colour of last whorl yellow-brown to dark brown on both sides of a usually narrow white spiral central band; base light. Dark zones often with spiral rows of variably spaced white dots. Central band with fine, brown connected lines, outlining white spots to blotches. In some specimens, brown areas consisting of axial zigzag lines and broader spiral lines. Larval whorls white. Postnuclear sutural ramps white, with brown radial blotches and fine lines. Aperture translucent to white.

**Habitat and Habits:** Shallow water to 350 m. In Marshall Is., in about 65 m, in coral rubble outside the lagoon at the base of the reef cliff; in New Caledonia, dredged in 300-350 m.

**Discussion:** *C. polongimarumai* resembles *C. chiangi* most closely. The latter species differs in its lighter colour pattern, with a primarily tan or grey rather than brown last whorl, and its hollow marginal spines rather than tubercles on the shoulder.

Map 105



1: *C. polongimarumai* 2: *C. kimioi* 3: *C. pseudokimioi*



*Conus kimioi* (HABE, 1965)

(Plate 52, Figures 25-27; Map 105)

1965 *Rhizoconus kimioi* Habe, Venus **24** (1): 47, 48-49, pl. 4 figs. 1, 2**Type:** Holotype in NSMT (15 x 7 mm).**Type Locality:** "off Okinoshima, Kochi Pref. Shikoku."**Range:** Japan to Philippines; Chesterfield Is. and New Caledonia.

**Description:** Small and light. Last whorl narrowly conical to conical; outline straight to slightly concave. Shoulder carinate, occasionally slightly undulate. Spire of low to moderate height, outline concave. Larval shell of 3.5-3.75 whorls, maximum diameter 0.8-0.9 mm. First 0.5-3 postnuclear whorls tuberculate to undulate. Teleoconch sutural ramps flat to concave, with 0-4 increasing to 3-6 spiral grooves crossed by fine arcuate radial threads. Last whorl glossy and smooth, except for about 9-12 spiral ribs at base and 4-6 fine spiral grooves below shoulder.

*C. kimioi* Shell Morphometry

L	16 - 23 mm
RW	< 0.06 g/mm
RD	0.46 - 0.54
PMD	0.85 - 0.97
RSH	0.09 - 0.16

Colour pink to orange, usually except for white shoulder area and white teleoconch spire. Last whorl with 9-16 reddish brown spiral lines. Rectangular or irregular brown blotches arranged between spiral lines, producing 3 "brick-wall" bands, below shoulder and on each side of centre; upper band may be absent. Larval whorls brownish grey. Postnuclear sutural ramps with large brown radial blotches extending over shoulder, darker at their outer margins. Aperture translucent.

Periostracum olive, thin, translucent, and smooth on last whorl, opaque and with arcuate radial ridges on sutural ramps.

**Habitat and Habits:** In 120-250 m.**Discussion:** *C. kimioi* resembles *C. pseudokimioi*. For comparison, see the Discussion of that species.*Conus pseudokimioi* DA MOTTA & MARTIN, 1982

(Plate 52, Figures 28-30; Map 105)

1982 *Conus [kimioi] pseudokimioi* ssp. nov. da Motta & Martin, Carfel Philippine Shell News, **4** (3): 9, text fig. 4**Type:** Holotype in MHNG (20 x 11 mm).**Type Locality:** "in Siquijor Is., Mindanao Sea."**Range:** Known only from the type locality.

**Description:** Small and light. Last whorl conical to slightly pyriform; outline straight to convex adapically, straight to concave below. Shoulder angulate. Spire low, outline concave. Larval shell of about 3 whorls, maximum diameter about 1 mm. First 1-3 postnuclear whorls tuberculate. Teleoconch sutural ramps flat, with 1-3 increasing to 4-7 spiral grooves. Last whorl with fine, variably spaced spiral ribs at base and about 6 fine spiral grooves below shoulder.

*C. pseudokimioi* Shell Morphometry

L	16 - 23 mm
RW	< 0.06 g/mm
RD	0.52 - 0.61
PMD	0.85 - 0.91
RSH	0.10 - 0.14

Ground colour light greyish violet. Last whorl encircled with about 20 fine brown spiral lines and with light brown axial streaks and rectangular blotches forming an interrupted spiral band at centre. Larval whorls grey. Postnuclear sutural ramps with evenly spaced brown radial blotches extending over shoulder, darker at their outer margins or reduced to marginal dots in early whorls. Aperture violet.

**Habitat and Habits:** In 120-240 m.

**Discussion:** *C. pseudokimioi* was described as a subspecies of *C. kimioi*. We provisionally favour the status of a separate species for *C. pseudokimioi*, because *C. kimioi* differs in its narrower last whorl (RD 0.46-0.54) with a regular "brick wall" pattern and a concave rather than convex outline adapically; its shoulder is carinate rather than angulate and its larval shell slightly darker, slightly narrower and of slightly more whorls than that of *C. pseudokimioi*. *C. spirofilis* can be distinguished by its broader last whorl (RD 0.63-0.75), generally higher spire (RSH 0.14-0.22), and the absence of spiral grooves on its sutural ramps; its last whorl may have spiral ribs rather than fine spiral grooves below the shoulder.

*Conus aphrodite* PETUCH, 1979

(Plate 52, Figures 31-34; Map 106)

1979 *Conus aphrodite* Petuch, Nemouria, **23**: 11-12, 17, figs. 34, 35

**Type:** Holotype in DMNH (21 x 11 mm).

**Type Locality:** "off Panglao, Bohol Is., Philippines."

**Range:** Ryukyu Is., Philippines, New Caledonia.

**Description:** Small and light. Last whorl usually conical, outline almost straight; left side slightly concave at base. Shoulder angulate to carinate. Spire usually of moderate height, slightly stepped; outline concave. Larval shell of 3.25-3.5 whorls, maximum diameter 0.8-1 mm. First 2-5 postnuclear whorls tuberculate, following whorls carinate. Teleoconch sutural ramps flat or slightly concave, with arcuate radial threads; spiral striation obsolete or absent. Last whorl glossy, with a few spiral ribs and ribbons at base and 1-2 fine spiral grooves below shoulder.

### *C. aphrodite* Shell Morphometry

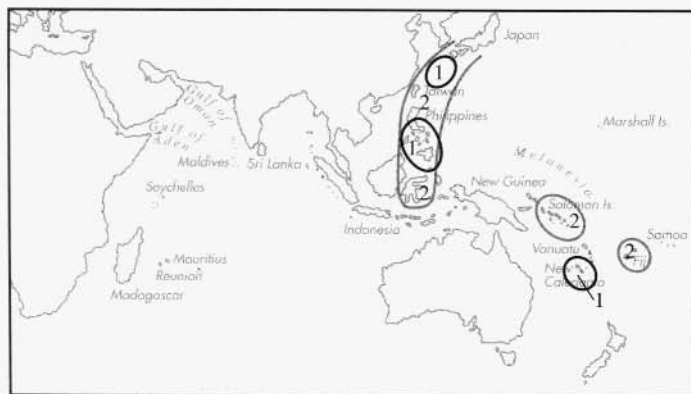
<b>L</b>	15 - 24 mm
<b>RW</b>	0.03 - 0.06 g/mm
<b>RD</b>	0.61 - 0.68
<b>PMD</b>	0.84 - 0.96
<b>RSH</b>	0.17 - 0.24

Ground colour violet-grey or beige. Last whorl variably overlaid with brown axial blotches and numerous variably broad spiral rows of alternating brown and light dots and dashes. A narrow light spiral band located below centre, often a similar but less prominent light band above centre. Larval whorls white to beige. Postnuclear sutural ramps with brown radial blotches and darker brown dots along the outer margin. Aperture violet.

**Habitat and Habits:** In 120-380 m.

**Discussion:** *C. aphrodite* resembles *C. memiae* and *C. dayriti*. The latter species differs in its lower spire (RSH

Map 106



1: *C. aphrodite* 2: *C. memiae*

0.07-0.17) and its spirally grooved sutural ramps; only its first 0.25-2 postnuclear whorls are weakly tuberculate or undulate. For comparison with *C. memiae*, see the Discussion of that species.

*Conus memiae* (HABE & KOSUGE, 1970)

(Plate 53, Figures 1-9; Map 106)

1970 *Asprella memiae* Habe & Kosuge, Venus, **29** (3): 82-83, pl. 5  
figs. 1, 2

1971 *Conus (Asprella) adonis* Shikama, Sci. Rep. Yokohama Natl. Univ., (2) **18**: 33-34, pl. 3 figs. 25-28

**Types:** *A. memiae*: Holotype in NSMT (33 x 17 mm); *C. adonis*: 2 syntypes in KPM (34 x 18 mm; 26 x 15 mm).

**Type Localities:** *A. memiae*: "South China Sea"; *C. adonis*: "Kashiwajima Island, southwestern Kochi Prefecture."

**Range:** Japan to Philippines and Indonesia (Makassar); Solomon Is. and Fiji.

**Description:** Small to moderately small, light to moderately light. Last whorl usually conical to ventricosely conical or pyriform, some specimens broader; outline convex adapically, straight to concave below. Shoulder angulate to carinate. Spire of moderate height to high, slightly stepped; outline concave. Larval shell of 3-3.25 whorls, maximum diameter 0.8-0.9 mm. First 2.5-5 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to concave, with arcuate radial threads and 0-1 increasing to 4-9 spiral grooves; grooves usually obsolete on first ramps and weak but definite on latest ramps. Last whorl with spiral grooves, wider toward base and separated by ribbons; spiral sculpture weaker but definite on upper half.

### *C. memiae* Shell Morphometry

<b>L</b>	20 - 32 mm
<b>RW</b>	0.04 - 0.10 g/mm
<b>RD</b>	0.62 - 0.73
<b>PMD</b>	0.80 - 0.93
<b>RSH</b>	0.18 - 0.28

Ground colour white, often suffused with pink, occasionally tinged with grey, beige, or yellow. Last whorl usually with 2 narrow white spiral bands, on each side of centre, showing 1 or 2 spiral rows of brown dots on ribbons, and other spiral rows of brown dots and dashes often fusing into axial streaks and flecks. Larval whorls grey. Postnuclear sutural ramps with fine, regularly spaced brown dots along the outer margin and with very sparse to densely set brown radial blotches. Aperture translucent.

Periostracum pale olive, thin, translucent, smooth except for strong radial ridges on spire.

**Habitat and Habits:** In 50-240 m.

**Discussion:** *C. memiae* closely resembles *C. otohimeae*, *C. spirofilis*, *C. aphrodite*, *C. baileyi*, *C. eugrammatus*, and *C. wakayamaensis*. *C. otohimeae* has a similar colour pattern but differs in its somewhat larger size (to 40 mm) and somewhat heavier shell (L 27-37 mm; RW 0.11-0.20). Its shoulder is tuberculate to undulate, its spire lower (RSH 0.12-0.20), and its last whorl narrower (RD 0.59-0.64) and has spiral ribs rather than ribbons. *C. aphrodite* has a smaller shell (to 24 mm), without spiral ribbons adapically on its last whorl and without spiral grooves on its late sutural ramps. *C. spirofilis* is similar in shape, but lacks spiral grooves on the sutural ramps and has a usually lower spire (RSH 0.14-0.22); its last whorl bears many brown spiral lines and may be sculptured with ribs rather than ribbons. For comparison of *C. memiae* with *C. baileyi*, *C. eugrammatus*, and *C. wakayamaensis*, see the Discussions of those species.

There are minor conchological differences among shells of *C. memiae* from different geographic areas: In Japan, specimens attain larger size (32 mm) (Pl. 53, Figs. 1, 2); shells from Solomon Is. (Pl. 53, Fig. 7) have a beige ground colour and relatively low spires. The highest variability in shell characters is found in Philippines (Pl. 53, Fig. 3-6, 8).

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### *Conus baileyi* RÖCKEL & DA MOTTA, 1979

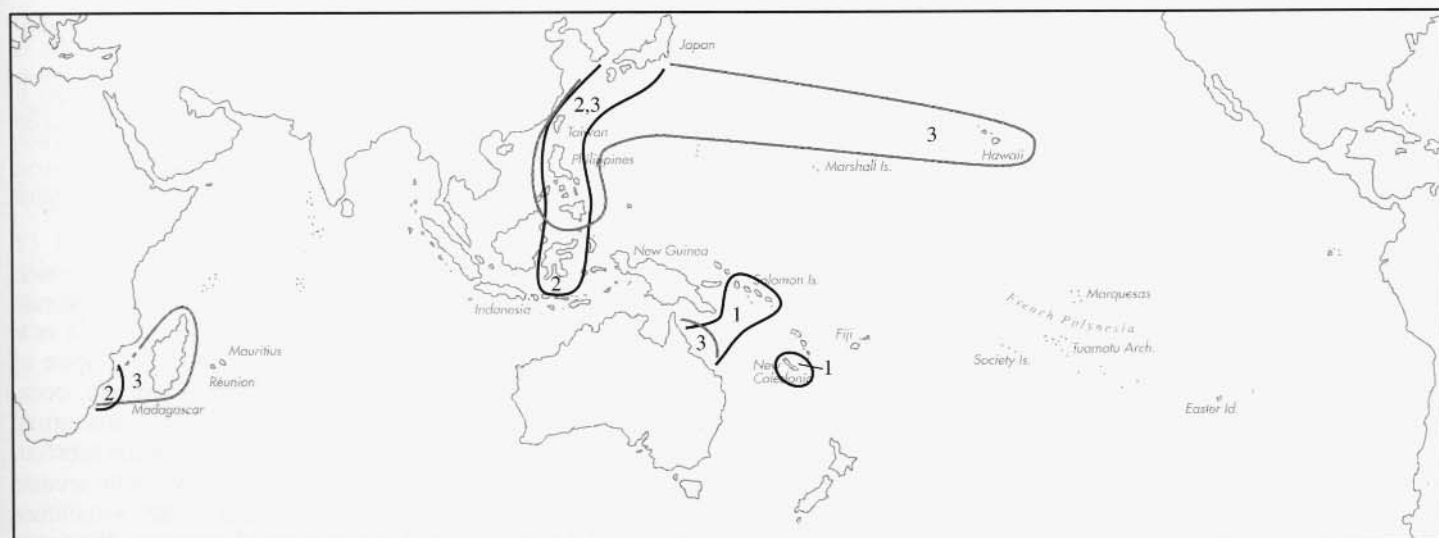
(Plate 53, Figures 10-14, Map 107)

1979 *Conus baileyi* Röckel & da Motta, La Conchiglia, **11** (124-125): 9, text figs.

**Type:** Holotype in MHNG (29 x 14 mm).

**Type Locality:** "off Russel Island, Solomon Sea."

Map 107



1: *C. baileyi* 2: *C. wakayamaensis* 3: *C. eugrammatus*

**Range:** Solomon Is., N. Queensland, New Caledonia, Loyalty Is.

**Description:** Small to moderately small, light to moderately light. Last whorl conical; outline almost straight; left side concave near base. Shoulder carinate. Spire or moderate height to high, outline concave. Larval shell of 3 or more whorls, maximum diameter about 0.9 mm. About first 4 postnuclear whorls tuberculate. Teleoconch sutural ramps concave, with 2-3 obsolete spiral striae in early and 3 increasing to 4-5 spiral grooves in late whorls. Last whorl with evenly spaced spiral grooves and ribbons between; elevations narrower below shoulder.

#### *C. baileyi* Shell Morphometry

L	21 - 32 mm
RW	0.04 - 0.09 g/mm
RD	0.51 - 0.63
PMD	0.88 - 0.94
RSH	0.18 - 0.24

Ground colour white. Last whorl usually with spiral rows of yellowish brown dots. Spirally aligned brown blotches below shoulder, on both sides of centre and at base, forming 2 central spiral bands and a pale band below shoulder. Larval whorls white to light orange. Postnuclear sutural ramps with light brown radial blotches and regularly spaced darker brown spots at outer margins. Aperture white.

Periostracum brown, very thin, translucent, smooth.

**Habitat and Habits:** In Solomon Is., in 100-150 m, in rubble and sand. In New Caledonia and Loyalty Is, in 120-390 m (Richard, pers. comm., 1991)

**Discussion:** The similar *C. memiae* can be distinguished by its broader (RD 0.62- 0.73) and often ventricose or pyriform last whorl, finer dots along the shoulder edge, and



often pink ground colour. Shells of co-occurring *C. memiae* from Solomon Is. (Pl. 53, Fig.7) also have less carinate shoulders. *C. baileyi* also resembles *C. wakayamaensis*; for the distinctions, see the Discussion of the latter species.

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### *Conus wakayamaensis* (KURODA, 1956)

(Plate 53, Figures 15-21; Map 107)

1956 *Asprella (Conasprella) wakayamaensis* Kuroda, Venus, **19** (1): 9-10, pl. 1 fig. 2

1979 *Conus nereis* Petuch, Nemouria, **23**: 18-19, 17 (figs. 32, 33)

**Types:** *A. wakayamaensis*: Holotype in KSM (26.5 x 14 mm); *C. nereis*: Holotype in DMNH (23 x 12 mm).

**Type Localities:** *A. wakayamaensis*: "Sea of Kii Peninsula"; *C. nereis*: "off Panglao, Bohol Is., Philippines."

**Range:** Typical form: Japan to Taiwan; Natal, South Africa; form *nereis*: Philippines and Makassar Straits.

**Description:** Small to moderately small, light to moderately solid; form *nereis* (Pl. 53, Figs. 19-21) smaller than typical form. Last whorl conical to ventricosely conical, also broadly conical to broadly and ventricosely conical in form *nereis*; outline straight to convex adapically, straight (right side) or concave (left side) below. Shoulder angulate to carinate, with deep exhalant notch. Spire of moderate height to high, outline concave. Larval shell of 3.0-3.5 whorls, maximum diameter 0.85-0.95 mm. First 3-6 post-nuclear whorls tuberculate. Teleoconch sutural ramps flat to concave, with arcuate radial threads and often obsolete, fine or coarse spiral striae. Last whorl with axially striate spiral grooves from base to or occasionally beyond centre and 1-4 fine spiral grooves below shoulder; grooves separated by ribs at subshoulder area and by ribbons below.

#### *C. wakayamaensis* Shell Morphometry

<b>L</b>	
- typical form	23 - 34 mm
- form <i>nereis</i>	20 - 27 mm
<b>RW</b>	
- typical form	0.06 - 0.13 g/mm
- form <i>nereis</i>	0.05 - 0.10 g/mm
<b>RD</b>	
- typical form	0.59 - 0.70
- form <i>nereis</i>	0.58 - 0.76
<b>PMD</b>	
- typical form	0.77 - 0.94
- form <i>nereis</i>	0.82 - 0.95
<b>RSH</b>	
- typical form	0.16 - 0.26
- form <i>nereis</i>	0.20 - 0.26

Ground colour white. Last whorl with spiral rows of brown dots varying in number and size. Overlying brown flecks forming 3 solid or interrupted spiral bands, below shoulder, at centre, and near base. Larval whorls white. Postnuclear sutural ramps with irregular brown radial markings, sometimes forming a row of brown dots on shoulder. Aperture white.

Periostracum greyish brown, thin, and translucent on last whorl, opaque and with curved radial ridges on sutural ramps.

**Habitat and Habits:** In 30-240 m.

**Discussion:** *C. wakayamaensis* is most similar to *C. eugrammus*, *C. memiae*, and *C. baileyi*. The latter species differs in having a usually narrower last whorl (RD 0.51-0.63) and distinct spiral grooves on the late sutural ramps. *C. memiae* also differs from *C. wakayamaensis* in having distinct spiral grooves on the late sutural ramps; the outer margins of its teleoconch sutural ramps have regularly spaced brown dots and its last whorl pattern is more complex with usually narrower white spiral bands centrally. For comparison with *C. eugrammus*, see the Discussion of that species.

Shells from Philippines described as *C. nereis* generally are smaller and may be broader but otherwise do not differ significantly from typical *C. wakayamaensis*. We thus include them as a form in the latter species.

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### *Conus eugrammus* BARTSCH & REHDER, 1943

(Plate 53, Figures 22-31; Map 107)

1943 *Conus eugrammus* Bartsch & Rehder, Proc. Biol. Soc. Washington, **56**: 85-86

1982 *Conus lapulapui* da Motta & Martin, Carfel Philippine Shell News, **4** (3): 4, text fig. 3

**Types:** *C. eugrammus*: Holotype in USNM (30 x 16 mm); *C. lapulapui*: Holotype in MHNG (22.5 x 11 mm).

**Type Localities:** *C. eugrammus*: "off the north coast of Molokai Island near Mokapu Islet"; *C. lapulapui*: "in the Visayan Sea between Malapascua Is. and Bantayan Is. and nothward."

**Range:** Hawaii, Japan to Philippines, and Queensland; Natal and probably Madagascar.

**Description:** Small to medium-sized, light to moderately solid. Last whorl conical to ventricosely conical; outline straight to slightly convex, concave on left side near base. Shoulder carinate, often slightly undulate. Spire of moderate height to high, stepped; outline concave, occasionally straight. Larval shell of 3.25-3.5 whorls, maximum diameter 0.9-1.1 mm. First 4-8 postnuclear whorls tuberculate. Teleoconch sutural ramps flat to concave, with arcuate radial threads and often obsolete spiral striae; sometimes with 0-1 increasing to 2-5 weak spiral grooves, distinct in

Hawaiian shells. Last whorl usually with axially striate spiral grooves separated by narrow ribbons and ribs from base to shoulder.

#### *C. eugrammatus* Shell Morphometry

<b>L</b>	21 - 38 mm
<b>RW</b>	0.03 - 0.12 g/mm
<b>RD</b>	0.59 - 0.70
<b>PMD</b>	0.80 - 0.94
<b>RSH</b>	0.17 - 0.26

Ground colour white, sometimes suffused with violet. Last whorl variably encircled with irregular rows of brown dots or dashes. Brown markings clustering or fusing into 2 spiral bands, at centre and near base; occasionally a third, interrupted band below shoulder. Larval whorls usually white. Early postnuclear sutural ramps with widely and regularly spaced brown dots at outer margin. Late ramps with sparse brown radial blotches; marginal dots irregularly set to absent. Aperture translucent, white or light violet.

Periostracum grey to brown, translucent. Periostracum of specimens described as *C. lapulapui* yellowish grey and finely axially ridged on last whorl, and opaque with strong radial ridges on the sutural ramps.

**Habitat and Habits:** In 35-500 m.

**Discussion:** *C. eugrammatus* and *C. wakayamaensis* are extremely similar. We distinguish them primarily by colour pattern. *C. wakayamaensis* generally has more numerous and larger brown pigmented areas. Its spire has many irregular brown radial markings, and it lacks the widely and regularly spaced brown dots on the early postnuclear sutural ramps characteristic of *C. eugrammatus*. On the last whorl, *C. wakayamaensis* usually has 3 solid or interrupted brown spiral bands, while *C. eugrammatus* has 2-3 less regular and often less prominent bands. In addition, the spiral grooves on the last whorl are usually separated by broader ribbons in *C. wakayamaensis*. *C. memiae* is also very similar to *C. eugrammatus*, but it is smaller (to 32 mm) and its last whorl is often slightly pyriform. *C. memiae* usually has strong spiral grooves on the late sutural ramps, and its colour pattern is more complex, with narrower white spiral bands and spiral rows of brown dots and dashes often fusing into axial streaks and flecks.

Shells described as *C. lapulapui* tend to be smaller (Pl. 53, Fig. 26), but are so similar in all other conchological characters to *C. eugrammatus* that we consider them to be conspecific.

### *Conus praecellens* A. ADAMS, 1854

(Plate 54, Figures 1-14; Map 108)

- 1833 *Conus bicolor* Sowerby I, Conch. Ill.: Pt. 37, fig. 56 (post July) (non *C. bicolor* Sowerby I, 1833, Pt. 24, fig. 2 (March), non *C. bicolor* Sowerby I, 1833, pt. 28, fig. 18 (May)).
- 1841 *Conus sinensis* Sowerby II, Conch. Ill.: Index (nom. nov. for *C. bicolor* Sowerby I, 1833, Pt. 37, fig. 56; non *C. sinensis* Gmelin, 1791)
- 1849 *Conus sowerbii* Reeve, Conch. Icon., 1, *Conus* suppl.: 2 (nom. nov. for *C. sinensis* Sowerby I, 1841; non *C. sowerbei* Nyst, 1836, non *C. sowerbyi* Bronn, 1848)
- 1854 *Conus praecellens* A. Adams, Proc. Zool. Soc. London, 1853: 119
- 1857 *Conus sowerbyi* Sowerby II, Thes. Conch., 3: 12 (emendation of *C. sowerbii* Reeve, 1849; non *C. sowerbyi* Bronn, 1848)
- 1870 *Conus sowerbyi* var. *subaequalis* Sowerby III, Proc. Zool. Soc. London, 1870: 257, pl. 22 fig. 5

**Types:** *C. bicolor*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 37, fig. 56) (36 x 18 mm); *C. sowerbii*: Type in BMNH (36 x 15 mm); *C. praecellens*: Type in BMNH (35 x 15 mm); *C. s.* var. *subaequalis*: Original figure 23 x 10 mm.

**Type Localities:** *C. bicolor*: "China" (Sowerby II, 1841); *C. sowerbii*: "Feejee Islands"; *C. praecellens*: "China Seas"; *C. s.* var. *subaequalis*: "China Seas."

**Range:** Japan to Philippines and Melanesia (Papua New Guinea, Solomon Islands, New Caledonia, Vanuatu); Madagascar, Réunion, Somalia, India and W. Thailand; W. Australia; probably also in Indonesia.

**Description:** Moderately small to moderately large, moderately light to moderately solid; relative weight may vary by 40%. Last whorl conical to ventricosely conical or pyriform, sometimes to broadly and ventricosely conical; outline convex adapically, slightly convex to concave below. Shoulder carinate, with a moderately deep to deep exhalant notch. Spire high, stepped; outline straight to concave. Larval shell of about 2 whorls, maximum diameter 0.6-0.8 mm. First 4-5 postnuclear whorls weakly tuberculate; late whorls carinate. Teleoconch sutural ramps slightly concave, with 0-1 increasing to 5-12 spiral grooves. Last whorl with punctate or axially striate spiral grooves of equal or variable width separated by strong to weak ribbons.

#### *C. praecellens* Shell Morphometry

<b>L</b>	33 - 63 mm
<b>RW</b>	0.06 - 0.25 g/mm (L 34-54 mm)
<b>RD</b>	0.54 - 0.75
<b>PMD</b>	0.82 - 0.92
<b>RSH</b>	0.24 - 0.38

Ground colour white or pale brown. Last whorl with spiral rows of yellowish to dark brown dots and bars on ribbons, and fusing into 3 spiral bands, below shoulder and on both sides of centre. Larval whorls white. Postnuclear sutural ramps with sparse to many brown radial markings. Aperture white.

Periostracum yellowish grey, thin, translucent, smooth.

Sole of foot white; siphon white ventro-laterally, brown dorsally (Strait of Malacca; Kohn, unpubl. observ.). Shallow water form from E. New Britain with very small brown foot (Richards, pers. comm., 1989).

Radular teeth stout, with a small adapical barb opposite a weak blade; a short serration of 7-8 strong denticles adapically, proximal denticles very strong; base with a prominent spur (Rolán, in press).

**Habitat and Habits:** In 10-250 m. In Papua New Guinea, a coarsely sculptured typical form on muddy bottom in about 12 m or at depths of 30-40 m (Richards, pers. comm., 1989). A W. Australian specimen has been "taken by prawn trawler in 165 metres" (Turnbull 1975; 1987, pers. comm.); in Loyalty Is., down to 200-250 m (Richard, pers. comm., 1991).

**Discussion:** *C. acutangulus* is the most similar species. For the distinctions, see the Discussion of that species.

*C. praecellens* varies very widely in relative diameter of the last whorl, but the variation is continuous and is not correlated with other character differences. Shells from deep water may have a slender and weakly sculptured last whorl, maculated with light brown.

The type specimen of *C. sowerbii* is a typical specimen of *C. praecellens*. The taxonomic status of *C. bicolor* / *C. sinensis* remains disputable, because the type specimen is lost and the type figure (Pl. 54, Fig. 3) does not match *C. praecellens* in a satisfying way: The pictured shell has a

comparatively low spire (RSH about 0.25), is somewhat bulbous below the shoulder, and its colour pattern consists of brown axial flammes. Coomans et al. (1982) thus consider it to represent a valid species. We favour synonymy with *C. praecellens*, because such pyriform specimens occur within the populations of the latter species; moreover, axial flecks are also observed in typical *C. praecellens* (see also Kohn, 1992). *C. s.* var. *subaequalis* (Pl. 54, Fig. 2) refers to a small individual of *C. praecellens*. Cernohorsky (1965) documented *C. praecellens* as the earliest available name for this species. Morphologically very similar specimens that differ in a multispiral larval shell (about 3 whorls) are only provisionally attached to this species.

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### *Conus acutangulus* LAMARCK, 1810

(Plate 54, Figures 15-22; Plate 76, Figure 61; Map 108)

- 1810 *Conus acutangulus* Lamarck, Ann. Mus. Hist. Nat. Paris, **15**: 286, no. 121  
 1866 *Conus turriculatus* Sowerby II, Thes. Conch., **3**: 328-329, pl. 27 (288) figs. 643, 644 (non *C. turriculatus* Deshayes, 1865)  
 1870 *Conus gemmulatus* Sowerby III, Proc. Zool. Soc. Lond., **1870**: 257, pl. 22 fig. 8

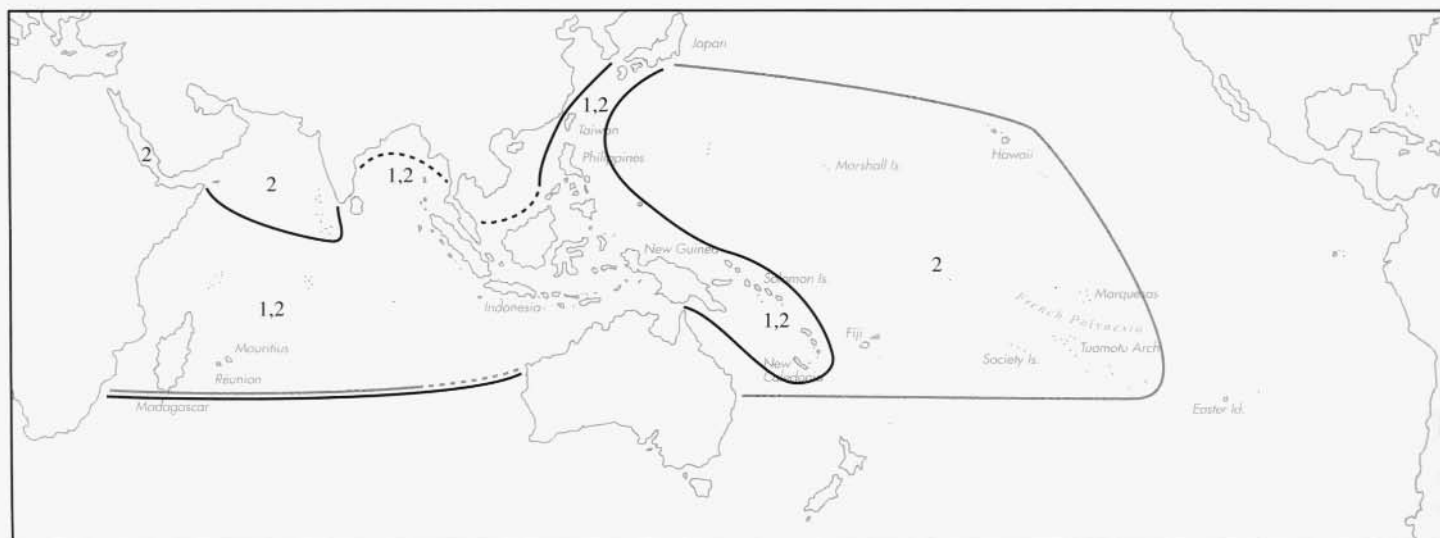
**Types:** *C. acutangulus*: Neotype (Kohn, 1981) in MNHN (27 x 12.5 mm); *C. turriculatus*: Type in BMNH (22 x 10.5 mm); *C. gemmulatus*: Holotype in BMNH (13 x 6 mm).

**Type Localities:** *C. acutangulus*: "Mer des grandes Indes"; *C. gemmulatus*: "China Seas."

**Range:** Entire Indo-Pacific.

**Description:** Small to medium-sized, light to moderately solid. Last whorl conical to broadly conical or slightly

Map 108



1: *C. praecellens* 2: *C. acutangulus*



pyriform; outline nearly straight to slightly sigmoid. Shoulder angulate to carinate, smooth to tuberculate, with a deep exhalant notch. Spire usually high, outline variably concave. Larval shell of 3.5-4 whorls, maximum diameter of 0.8-0.9 mm. First 8-10 postnuclear whorls tuberculate, following whorls undulate to smooth. Teleoconch sutural ramps flat to slightly concave, with 0 increasing to 3-6 spiral grooves crossed by arcuate radial threads. Last whorl with strong spiral ribbons or ribs, separated by narrow to occasional broad spiral grooves with strong axial threads.

Ground colour white. Last whorl variably patterned with light to dark brown: Largely brown except for small scattered ground-colour blotches at shoulder and centre, or white flecked with brown, or white spirally spotted with brown, or all white. Larval whorls white. Spire variably streaked with brown. Aperture white.

Periostracum brown, thin, translucent, smooth.

#### ***C. acutangulus* Shell Morphometry**

<b>L</b>	22 - 38 mm
<b>RW</b>	0.04 - 0.13 g/mm
<b>RD</b>	0.65 - 0.75
<b>PMD</b>	0.80 - 0.93
<b>RSH</b>	0.23 - 0.37

Dorsum of foot white to pale yellow, with a dotted brown wing-shaped pattern on anterior part continuing as a dotted brown pre-marginal line posteriorly; anterior edge with a black spot on each side of a triangular brown central fleck. Sole of foot white. Tentacles white, suffused with tan and tipped with black. Siphon white, suffused with beige to light brown dorsally; tip immaculate (Red Sea: Fainzilber et al., 1992; Papua New Guinea: Chaberman, pers. comm., 1981). Sole of foot buff anteriorly and light brown posteriorly. Rostrum buff. Siphon buff at tip, darker tan proximally (Hawaii: Kohn & Weaver, 1962) (Pl. 76, Fig. 61).

**Habitat and Habits:** Usually in 3-100 m, adults sometimes in 0.5-5 m, juveniles sometimes as deep as 180 m. On coral or shell sand often mixed with coral rubble, on muddy sand and on fine shell rubble with seaweed (Fainzilber, 1985; Fainzilber & Mienis, 1986; Fainzilber et al., 1992; Grosch, pers. comm., 1989; Tirard, pers. comm., 1989).

**Discussion:** *C. acutangulus* resembles *C. milesi*, *C. praececellens*, *C. tuberculosus*, and *C. helgae*. *C. milesi* is smaller (to 27 mm) and has a narrower last whorl (RD 0.49-0.59) and a paucispiral larval shell (1.75-2 whorls). *C. praececellens* is larger (to 63 mm) and differs in the absence of tubercles on its late postnuclear whorls, the greater number of spiral grooves on its late sutural ramps, and in the lower number of whorls of its larval shell (about 2.5 whorls). For comparison with *C. tuberculosus* and *C. helgae*, see the Discussions of those species.

*C. turriculatus* (Pl. 54, Fig. 22) and *C. gemmulatus* refer to white shells of *C. acutangulus*.

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### ***Conus tuberculosus* TOMLIN, 1937**

(Plate 54, Figures 23-26; Map 109)

1920 *Conus tuberculatus* Yokoyama, J. Coll. Sci. Imp. Univ. Tokyo, **39**(6): 34-35, pl. 1 figs. 15, 16 (non *C. tuberculatus* Dujardin, 1837)

1937 *Conus tuberculosus* Tomlin, Proc. Malac. Soc. London, **22**(4): 206 (nom. nov. for *C. tuberculatus* Yokoyama, 1920)

**Type:** Original figures 17 x 8 and 14 x 7 mm.

**Type Locality:** "Fossil occurrence.-Miyata Zone (Kami-Miyata); Koshiha Zone (Koshiha)."

**Range:** Sagami Bay, Japan.

**Description:** Small, light. Last whorl conical; outline slightly convex, left side concave near base. Shoulder angulate and weakly tuberculate. Spire of moderate height to high, outline slightly concave. Larval shell of about 1.75 whorls, maximum diameter about 0.9 mm. Postnuclear spire whorls tuberculate. Teleoconch sutural ramps flat, with 1-2 increasing to 4-6 spiral grooves. Last whorl with fine spiral ribs near base.

#### ***C. tuberculosus* Shell Morphometry** (recent and fossil specimens)

<b>L</b>	14 - 19 mm
<b>RW</b>	< 0.05 g/mm
<b>RD</b>	0.56 - 0.67
<b>PMD</b>	0.85 - 0.88
<b>RSH</b>	0.15 - 0.27

Ground colour light brown. Last whorl with yellowish brown blotches, irregularly arranged or tending to form 2 interrupted spiral bands; usually also with spiral rows of brown dots or dashes. Spire matches pattern of last whorl. Aperture white.

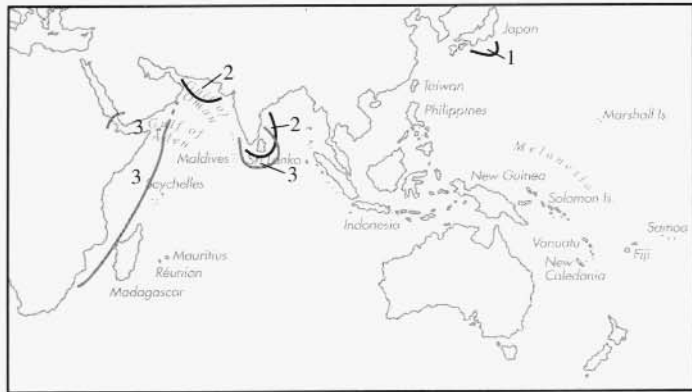
Radular teeth 0.7 mm long, with 3 barbs adapically approximately 120° apart; no serration or cusp (Taki, 1937).

**Habitat and Habits:** In 43-300 m, on sandy bottom (Taki, 1937).

**Discussion:** *C. tuberculosus* has no close similarities to known species; superficially it resembles *C. acutangulus* in size and sculpture, but differs in its pattern, smooth last whorl and paucispiral larval shell. Juveniles of *C. sieboldii* differ in the absence of spiral grooves and carinate early teleoconch whorls.

*C. tuberculosus* was described originally as a fossil species, but in 1935 live specimens were collected from Sagami Bay (Taki, 1937). It is one of the few recent species originally described as a fossil.

Map 109



1: *C. tuberculosus* 2: *Conorbis coromandelicus* 3: *C. eucoronatus*

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### *Conorbis coromandelicus* (E. A. SMITH, 1894)

(Plate 54, Figures 27-30, Map 109)

1894 *Conus coromandelicus* E. A. Smith, Ann. Mag. Nat. Hist., (6) 14: 159-160, pl. 4 figs. 1, 2

**Type:** Syntypes in ZSI (37 x 14 mm) and BMNH (33 x 15.5 mm).

**Type Locality:** "Off Coromandel coast, lat. 14°18'15"N., long. 80°18'30"E., and lat. 15°4'7"N., long. 80°25'7"E."

**Range:** Bay of Bengal (Coromandel coast), Sri Lanka, Gulf of Oman.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl ventricosely conical or conoid-cylindrical to pyriform; outline convex to straight adapically, straight to concave (right side) or concave (left side) below. Shoulder subangulate to rounded, slightly undulate. Spire high, outline almost straight. Larval shell multispiral, maximum diameter 0.8-0.9 mm. First 5-7 postnuclear whorls with many small tubercles, following whorls undulate. Teleoconch sutural ramps flat, with 0 increasing to 2 broad spiral grooves and arcuate radial threads, leaving a strongly granulose subsutural ridge and 2 less granulose spiral ribs, below centre and at outer margin. Last whorl heavily sculptured with about 20 prominent smooth or granulose spiral ribs and axially striate wide grooves between.

#### *C. coromandelicus* Shell Morphometry

<b>L</b>	29 - 38 mm
<b>RW</b>	0.07 - 0.11 g/mm
<b>RD</b>	0.59 - 0.63
<b>PMD</b>	0.75 - 0.81
<b>RSH</b>	0.25 - 0.29

Ground colour white to light brown. Last whorl with darker brown lines on ribs. Larval whorls white. Postnuclear sutural ramps with irregular brown radial markings. Aperture white or pale brown.

Periostracum dark olive or blackish brown, opaque, smooth.

Radular teeth adapically constricted, with an adapical barb opposite 2 barbs arranged in a line (Thiele, 1929: 372 fig. 460). The radular tooth figured by da Motta (1986a) for this species is erroneous..

**Habitat and Habits:** In 70-400 m.

**Discussion:** *C. coromandelicus* is the only recent species placed in the genus *Conorbis*. We include this genus in the Conidae, because partial resorption of inner walls, a hallmark of *Conus*, also occurs in *Conorbis* (see Kohn, 1978, 1990). In addition, its radular morphology is consistent with that of Conidae (Powell, 1942).

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### *Conus eucoronatus* SOWERBY III, 1903

(Plate 55, Figures 1-8, Map 109)

1903 *Conus eucoronatus* Sowerby III, Mar. Inv. South Africa, 2 (3): 217, pl. 3 fig. 9

**Type:** Lectotype (Coomans et al., 1986) in SAMC (45 x 25 mm).

**Type Locality:** "Cape St. Blaize bearing N. 85° W.; distant 4 1/2 miles."

**Range:** Natal to Somalia and S. Yemen; S. India (Gulf of Mannar) and Sri Lanka.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl generally pyriform, sometimes conical or ventricosely conical or broadly and ventricosely conical; outline convex adapically, straight to concave (right side) or concave (left side) below. Shoulder angulate, with many small tubercles; deep exhalent notch. Spire of moderate height to high, outline straight. Larval shell multispiral, maximum diameter about 1.05 mm. Postnuclear spire whorls closely tuberculate.

Teloconch sutural ramps slightly concave, with 0-2 increasing to 3-5 spiral grooves crossed by arcuate radial threads; grooves spirally striate and sometimes weak in latest whorls. Last whorl usually with strong, narrow or broad spiral ribbons from base to shoulder; grooves between rather broad, axially striate and often with an additional finer spiral rib. Spiral elevations crossed by distinct axial grooves, giving a costate or granulose appearance.

#### *C. eucoronatus* Shell Morphometry

<b>L</b>	27 - 50 mm
<b>RW</b>	0.09 - 0.27 g/mm
<b>RD</b>	0.62 - 0.80
<b>PMD</b>	0.82 - 0.94
<b>RSH</b>	0.17 - 0.28

Ground colour white. Last whorl with spirally arranged dark or light brown blotches, dashes, and dots and axial streaks and blotches. Pattern elements fuse into 2-3 spiral bands, below shoulder, at centre and near base. Shells from Somalia (Pl. 55, Figs. 7, 8) may have only irregularly scattered small brown blotches. Larval whorls grey to beige. Postnuclear sutural ramps with brown radial blotches or weakly patterned with brown spots between tubercles.

Periostracum pale yellow, translucent.

Radular teeth hollow and constricted above centre, with an adapical barb, a basal spur and a vestigial membrane (Taylor, 1990 & 1991).

**Habitat and Habits:** In 100-400 m, on sand and mud.

**Discussion:** The combination of shape and sculpture in *C. eucoronatus* is so unique to the species as to set it apart from all congeners.

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### *Conus raoulensis* POWELL, 1958

(Plate 55, Figures 9-12; Map 110)

1958 *Conus (Kermasprella) raoulensis* Powell, Rec. Auckland Inst. Mus., 5 (1-2): 83, pl. 9 fig. 1

**Type:** Holotype in AIM (18 x 9.5 mm).

**Type Locality:** "Galathea St. 674, 29° 15' S., 177° 57' W., off Raoul Island, Kermadecs."

**Range:** Norfolk Id. to Wanganella Bank and Kermadec Is.

**Description:** Small, light to moderately light. Last whorl conical to broadly conical, sometimes ventricosely conical to broadly and ventricosely conical; outline slightly convex; left side slightly concave near base. Shoulder an-

gulate, tuberculate. Spire of moderate height to high, stepped; outline straight to slightly concave. Larval shell of about 4 whorls, maximum diameter 1-1.1mm. Postnuclear spire whorls tuberculate. Teloconch sutural ramps concave with arcuate radial threads. Last whorl with strongly granulose spiral ribs and some intermittent smooth ribs.

#### *C. raoulensis* Shell Morphometry

<b>L</b>	16 - 22 mm
<b>RW</b>	0.05 - 0.08 g/mm
<b>RD</b>	0.67 - 0.76
<b>PMD</b>	0.82 - 0.95
<b>RSH</b>	0.22 - 0.31

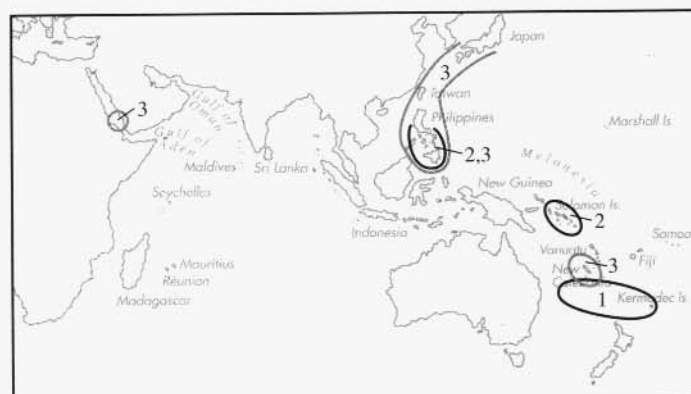
Ground colour white to pink. Last whorl with 3 spiral bands of yellow to orange blotches leaving ground colour zones below shoulder, on both sides of centre and at base, and often with indistinct brown axial lines. Occasionally, orange blotches covering the entire last whorl except for some irregular ground colour spots. Postnuclear sutural ramps with sparse orange or yellow radial streaks or flecks. Aperture pale pink.

Periostracum yellowish brown, thin.

**Habitat and Habits:** In 40-295 m.

**Discussion:** *C. raoulensis* resembles the strongly sculptured variants of *C. howelli*. For comparison, see the Discussion of the latter species.

Map 110



1: *C. raoulensis* 2: *C. leobrerae* 3: *C. pagodus*



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***Conus leobrerae* DA MOTTA & MARTIN,  
1982**

(Plate 55, Figures 13-16; Map 110)

1982 *Conus leobrerae* da Motta & Martin, Carfel Philippine Shell News, 4 (3): 3-4, text fig. 2

**Type:** Holotype in MHNG (34.5 x 14.5 mm).

**Type Locality:** "Visayan Sea in the area between Malapascua Is. and Bantayan Is. and northward."

**Range:** Philippines and Solomon Is.

**Description:** Moderately small, moderately light to moderately solid. Last whorl ventricosely conical to conical; outline convex adapically, straight (right side) or concave (left side) below. Shoulder angulate. Spire of moderate height to high, slightly stepped; outline concave. Larval shell of 2-2.25 whorls, maximum diameter 0.8-0.9 mm. First 1-2 postnuclear whorls often weakly tuberculate. Teleoconch sutural ramps flat to slightly concave, with 0-1 increasing to 4-7 spiral grooves. Last whorl with spiral ribs from base to shoulder, sometimes ribs basally and ribbons adapically; grooves between axially striate containing a fine spiral rib and/or 1-3 spiral threads.

***C. leobrerae* Shell Morphometry**

<b>L</b>	25 - 35 mm
<b>RW</b>	0.07 - 0.12 g/mm
<b>RD</b>	0.53 - 0.59
<b>PMD</b>	0.80 - 0.87
<b>RSH</b>	0.22 - 0.25

Ground colour white. Last whorl with spiral rows of brown dots on ribs; brown dots often reduced in large specimens. Dots fusing into spots and axial streaks below shoulder, above centre and occasionally also below centre, forming 1-2 or sometimes 3 spiral bands. Larval whorls white. Postnuclear sutural ramps with brown radial streaks and blotches. Aperture white.

**Habitat and Habits:** In 35-200 m.

**Discussion:** *C. leobrerae* resembles juvenile *C. australis*, which is distinguished by the less sigmoid left side of its last whorl, smaller number (3-4) of spiral grooves on the sutural ramps, 3 brown spiral bands on last whorl, and larger number of larval whorls (3.25 vs. 2-2.25). In similarly sized specimens, *C. mucronatus* differs in its straighter last whorl outline basally, its lower spire (RSH 0.13-0.22), and in a usually weaker spiral sculpture of last whorl; its larval shell also has more whorls (3) and is narrower (about 0.7 mm).

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***Conus pagodus* KIENER, 1845**

(Plate 55, Figures 17-21; Map 110)

1845 *Conus pagodus* Kiener, Coq. Vivant., 2: Pl. 70 fig. 4; 1849-1850: 310-311

**Type:** Original figure 42 x 21 mm.

**Type Locality:** "les côtes de l'île de Taïti."

**Range:** Japan to Philippines; New Caledonia; probably Red Sea (Dahlak Archipelago).

**Description:** Moderately small to medium-sized, moderately solid. Last whorl conical to pyriform; outline almost straight to variably sigmoid, gradually or abruptly constricted at basal third. Shoulder angulate to carinate, with a deep exhalant notch. Spire of moderate height to high, variably stepped; outline concave. Larval shell of 3-3.5 whorls, maximum diameter 0.9-1 mm. First 5-8 postnuclear whorls tuberculate. Teleoconch sutural ramps flat or concave, with strong radial threads crossing 0-1 increasing to 4-6 major spiral grooves; sometimes about 6 additional minor grooves in last whorls. Last whorl with spiral ribbons or ribs and ribbons from base to shoulder; ribs mainly below shoulder and at base.

***C. pagodus* Shell Morphometry**

<b>L</b>	34 - 50 mm
<b>RW</b>	0.11 - 0.26 g/mm
<b>RD</b>	0.59 - 0.71
<b>PMD</b>	0.85 - 0.94
<b>RSH</b>	0.21 - 0.28

Ground colour white. Below shoulder and at centre, last whorl encircled with 2 weak or distinct bands composed of light brown dots and flecks; occasionally basal third with an additional brown band, and ground colour areas with irregular dotted lines. Larval whorls white to beige. First 0-3 postnuclear sutural ramps variably suffused with brown; following ramps with scattered or regular brown radial markings. Aperture white.

Periostracum greyisholive, opaque, with interlaced axial ridges on last whorl and spire.

**Habitat and Habits:** In 50-420 m. In New Caledonia, specimens have been collected outside the lagoon in 335-420 m (Richard, pers. comm., 1991).

**Discussion:** This species has often been called *C. cancellatus*, but the holotype of that taxon represents a similar W. Atlantic species. *C. pagodus* resembles *C. arcuatus* from the Panamic Province; however, the latter species differs in its narrower and weaker grooves around the last whorl and in the absence of spiral grooves on its sutural ramps. Among Indo-Pacific species, *C. boholensis* and *C. asiaticus lovellreevei* have the most similar

colour pattern. *C. asiaticus* has a lower spire (RSH 0.15-0.20) and a narrower last whorl (0.53-0.59) that is not pyriform; its larval shell is also narrower (0.7-0.8 mm) and has fewer whorls (2-2.5), and its periostracum is smooth and translucent. For comparison with *C. boholensis*, see the Discussion of that species.

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### *Conus boholensis* PETUCH, 1979

(Plate 55, Figures 22-27; Map 111)

1979 *Conus boholensis* Petuch, *Nemouria*, **23**: 12-14, figs. 20, 21

**Type:** Holotype in DMNH (38.5 x 17.5 mm).

**Type Locality:** "off Panglao, Bohol Is., Philippines."

**Range:** Philippines, S. Vietnam, New Caledonia, N. W. Australia, and N. Somalia.

**Description:** Moderately small to medium-sized, light to moderately solid. Last whorl conical to ventricosely conical; outline slightly convex, with almost straight right side and sigmoid left side. Shoulder carinate, with a moderately deep exhalent notch. Spire of moderate height to high, stepped; outline almost straight. Larval shell of about 3 whorls, maximum diameter 1-1.1 mm. First 5-8 postnuclear whorls tuberculate; tubercles continuing as axial costae below outer margins and costae still present in smooth whorls. Teleoconch sutural ramps concave, with radial threads. Last whorl with spiral ribs at base and below shoulder, and ribbons or ribs between; intervening grooves variably broad, axially striate, and sometimes with a fine additional spiral rib. Subadults with a more uniform surface sculpture.

#### *C. boholensis* Shell Morphometry

L	25 - 51 mm
RW	0.03 - 0.10 g/mm (L 25-40mm)
RD	0.56 - 0.67
PMD	0.78 - 0.95
RSH	0.20 - 0.32

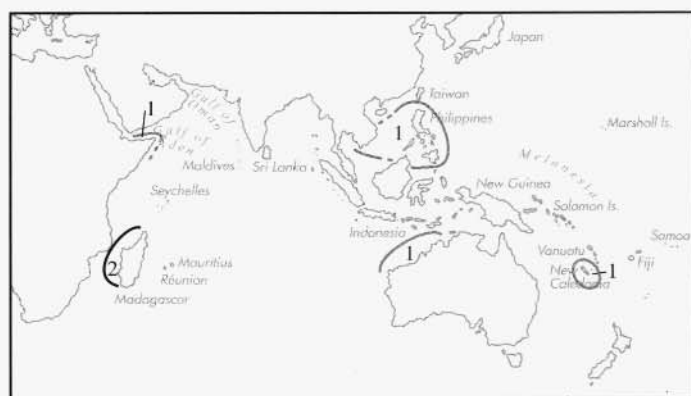
Ground colour white. Last whorl usually sparsely maculated with brown dots and flecks both spirally and axially aligned and sometimes clustered into a spiral row at centre; occasionally an additional adapical row present. Some specimens are entirely white. Larval whorls white. Postnuclear sutural ramps immaculate or sparsely marked with brown. Aperture translucent white.

**Habitat and Habits:** In 125-300 m (Philippines); in 300 m (N.W. Australia); at the edge of coral reef (Vietnam); in 310-550 m (New Caledonia region).

**Discussion:** Coomans et al. (1982) considered *C. boholensis* a synonym of *C. borneensis* Adams & Reeve. This

seems doubtful, because the lectotype of *C. borneensis* can be distinguished by its concave spire outline, smooth upper part of last whorl and weak tubercles in the early postnuclear whorls. *C. sieboldii* is much larger, has a narrower last whorl (0.49-0.56), its spire outline is concave, its last whorl more convex adapically, and the upper part of the last whorl is smooth. *C. pagodus* has a very similar colour pattern, but differs in the constricted basal third of its last whorl, strong spiral sculpture on its postnuclear sutural ramps, and its concave spire outline; axial costae below outer margins of sutural are absent.

Map 111



1: *C. boholensis* 2: *C. helgae*

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### *Conus helgae* BLÖCHER, 1992

(Plate 55, Figures 28-30; Map 111)

1992 *Conus helgae* Blöcher, *Acta Conchyl.*, **3**: 35-39, pl. 3, figs. 23-27

**Type:** Holotype in SMNS (36.5 x 18.5 mm).

**Type Locality:** "Off Grand Récif, Tuléar, SW-Madagascar."

**Range:** S. and N. W. Madagascar.

**Description:** Medium-sized, moderately solid. Last whorl ventricosely conical to conical; outline convex at right side, sigmoid to nearly straight at left side. Shoulder angulate and strongly tuberculate; tubercles widely spaced and outward-pointing. Spire of moderate height, outline concave. Larval shell of about 2 whorls, maximum diameter about 1 mm. Postnuclear spire whorls tuberculate. Teleoconch sutural ramps concave, with 1 increasing to 4-5 spiral grooves; grooves with a spiral thread on last ramp. Last whorl with granulate spiral ribs from base to subshoulder area, followed by weaker ribs; a spiral thread often present anterior to the ribs.

Ground colour white. Last whorl with spirally aligned brown bars and flecks, the latter concentrated in a spiral band on each side of centre. Base and basal part of columella pinkish violet. Larval shell white. Postnuclear sutural ramps

with brown radial streaks. Aperture tinged with pinkish violet.

#### *C. helgae* Shell Morphometry

<b>L</b>	36 - 37 mm
<b>RW</b>	0.14 g/mm
<b>RD</b>	0.60 - 0.62
<b>PMD</b>	0.78 - 0.90
<b>RSH</b>	0.17 - 0.19

**Habitat and Habits:** Holotype in 75-90 m, paratype in about 600 m.

**Discussion:** *C. helgae* is similar in size and pattern to *C. acutangulus* and to *C. sulcatus* form *samiae*. *C. acutangulus* differs in its less strongly tuberculate to smooth shoulder, broader last whorl (RD 0.65-0.75) with a more regular sculpture, in its higher spire (RSH 0.22-0.37), and its highly multispiral larval shell (3.5-4 whorls). *C. sulcatus* form *samiae* is larger (50-65 mm) and has at least 3 larval whorls; its last whorl is generally broader (RD 0.62-0.67), the granulose ribs on last whorl are stronger and its last whorl pattern forms brown spiral bands.

A specimen similar to the holotype is present in the MNHN. Further shells of this species have recently been collected in S. Madagascar.

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### *Conus orbignyi* AUDOUIN, 1831

(Plate 56, Figures 1-8, Map 112)

- 1831 *Conus orbignyi* Audouin, Mag. Zool., 1: 20, Pl. 20 figs. 1, 2  
 1833 *Conus planicostatus* Sowerby I, Conch. Ill: Pt. 28, fig. 15  
 1973 *Conus orbignyi aratus* Kilburn, Ann. Natal Mus., 21: 575-576, text figs. 15, 16 (non *C. aratus* Gabb, 1873)  
 1975 *Conus orbignyi elokismenos* Kilburn, Nautilus, 89(2): 50 (nom. nov. for *C. orbignyi aratus* Kilburn)  
 1995 *Conus orbignyi coriolisi*, Moolenbeek & Richard, Mém. Mus. natn. Hist. nat., 164

**Types:** *C. orbignyi*: Holotype in MNHN (53.5 x 20 mm); *C. planicostatus*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 28, fig. 15, ventral view) (51 x 18 mm); *C. o. aratus*: Holotype in NM (60 x 22 mm); *C. o. coriolisi*: Holotype in MNHN (44.5 x 15 mm).

**Type Localities:** *C. orbignyi*: "Chine"; *C. o. aratus*: "off Tongaat"; *C. o. coriolisi*: "Coral Sea, Banc Capel, 25°29' S - 159°46' E."

**Range:** Japan to Philippines; Queensland (*C. o. orbignyi*); Natal to Madagascar and Réunion (*C. o. elokismenos*); New Caledonia and Coral Sea (*C. o. coriolisi*).

**Description:** Medium-sized in *C. o. coriolisi*, medium sized to large in *C. o. orbignyi*, to moderately large in *C. o. elokismenos*, light to moderately solid. Last whorl often

pyriform, also narrowly conical or narrowly conoid-cylindrical in *C. o. orbignyi* (Pl. 56, Figs. 1-4), also conical or narrowly conical in *C. o. coriolisi* (Pl. 56, Fig. 7), and conical to ventricosely conical in *C. o. elokismenos* (Pl. 56, Figs. 5, 6); outline slightly convex at adapical two-thirds, concave to straight below. Siphonal canal often deflected to the dorsal side. Aperture very narrow. Shoulder angulate to sharply angulate, with weak tubercles often disappearing toward aperture in large specimens; exhalant notch rather deep. Spire high, stepped; outline straight to slightly concave. Larval shell of about 4 whorls, maximum diameter 0.85-1 mm. Postnuclear whorls tuberculate. Teleoconch sutural ramps slightly concave, with 0-1 increasing to 5-7 spiral grooves and with radial threads; in *C. o. elokismenos* spiral sculpture weaker on late ramps than in *C. o. orbignyi*. Entire last whorl with axially striate spiral grooves and ribbons between; 1-2 spiral ribs replacing ribbons just below shoulder. In *C. o. orbignyi*, spiral ribbons generally narrower and grooves wider than in *C. o. elokismenos*; some wide ribbons divided into pairs of narrow ribbons. In *C. o. elokismenos*, wide ribbons with spiral striae and surface sculpture weak on adapical fourth. In *C. o. coriolisi*, ribbons weak to obsolete adapically.

#### *C. orbignyi* Shell Morphometry

	<i>C. o. orbignyi</i>	<i>C. o. elokismenos</i>	<i>C. o. coriolisi</i>
<b>L</b>	38 - 87 mm	52 - 64 mm	40 - 53 mm
<b>RW</b>	0.05 - 0.18 g/mm	0.12 - 0.14 g/mm	0.05 - 0.08 g/mm
<b>RD</b>	0.42 - 0.50	0.46 - 0.54	0.45 - 0.55
<b>PMD</b>	0.83 - 0.90	0.84 - 0.92	0.89 - 0.93
<b>RSH</b>	0.21 - 0.28	0.24 - 0.30	0.24 - 0.30

Ground colour white. Last whorl with rectangular brown spots on ribbons, aligned axially and also clustering in 3 spiral bands, below shoulder and on both sides of centre. In *C. o. elokismenos*, spots of adapical band variably fused into axial streaks. In *C. o. coriolisi*, pattern reduced to 3 interrupted bands. Larval whorls white to pale brown, often with a brown sutural line. Postnuclear sutural ramps with irregular brown streaks and brown spots at outer margin, often between tubercles. Aperture white, dark cream deep within.

Periostracum brownish grey, thin, translucent, smooth.

In *C. o. elokismenos*, animal pale yellow, siphon and sides of foot speckled with blackish brown. Operculum absent. Radular teeth with an adapical barb opposite a second barb, and an additional posterior barb; base with distinct spur (Kilburn, 1973).

**Habitat and Habits:** *C. o. orbignyi* in 50-400 m; *C. o. elokismenos* in 270-310 m in mud (Kilburn, 1973); *C. o. coriolisi* in 150-550 m (Richard, pers. comm., 1991).

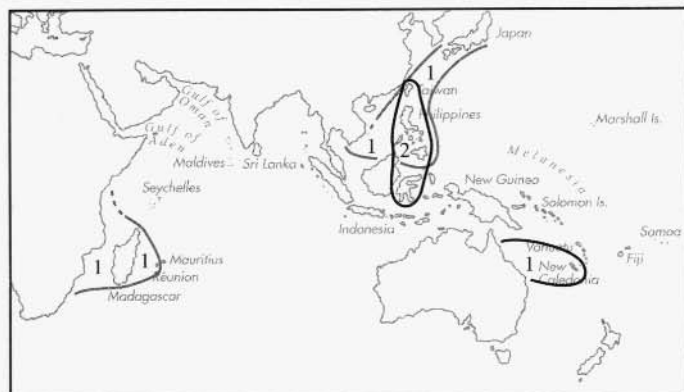
**Discussion:** *C. orbignyi* is very similar to *C. pseudorbignyi*, *C. ichinoseana* and *C. comatosa*. For the distinction, see the Discussions of those species.



*C. planicostatus* is considered a synonym of *C. orbigny*, although Sowerby's figure (Pl. 56, Fig. 8) has a relatively lower spire (RSH 0.21); all other shell characters suggest identity with *C. orbigny*.

*C. orbigny* has a discontinuous range. There appear to be 3 disjunct groups of populations, in the western Pacific and in the western Indian Ocean. They are generally considered geographic subspecies, *C. o. orbigny* in the W. Pacific, *C. o. coriolisi* in the New Caledonia-Coral Sea area, and *C. o. elokismenos* in the Indian Ocean.

Map 112



1: *C. orbigny* 2: *C. pseudorbigny*

## 262

### *Conus pseudorbigny* RÖCKEL & LAN, 1981

(Plate 56, Figures 9-12, Map 112)

1981 *Conus (Asprella) pseudorbigny* Röckel & Lan, Bull. Malac. R. O. C., 8: 15-17, text figs. 1-3, 6, 9

**Type:** Holotype in TMT (45.5 x 16.5 mm).

**Type Locality:** "Southwest off Taiwan or south Taiwan Strait."

**Range:** Taiwan, Philippines, and Indonesia (Sulawesi).

**Description:** Moderately small (shells from Philippines and Sulawesi) to medium-sized (shells from Taiwan), light to moderately light. Last whorl narrowly conical or narrowly conoid-cylindrical to slightly pyriform; outline slightly convex at adapical two-thirds, straight to concave below. Aperture very narrow. Siphonal canal often deflected to the dorsal side. Shoulder angulate to carinate, almost smooth to weakly tuberculate. Spire of moderate height to high, stepped; outline nearly straight to slightly sigmoid. Larval shell of 3.5-4 whorls, maximum diameter 0.9-1 mm. First 8-9 postnuclear whorls weakly tuberculate. Teleoconch sutural ramps concave, with radial threads and 1 increasing to 5-8 spiral grooves. Entire last whorl with axially striate spiral grooves separating ribs basally and

ribbons adapically; 1-3 fine spiral ribs replace ribbons just below shoulder.

Ground colour beige, variably tinged with light brown. Last whorl of shells from Taiwan (Pl. 56, Figs. 9, 11) usually with brown dots on spiral ribbons; dots not clustered into spiral bands but often arranged in axial streaks or lines. Larval shell light brown, with a brown sutural line. Postnuclear sutural ramps sparsely maculated with brown radial markings and with brown dots along outer margin. Aperture white to light brown.

#### *C. pseudorbigny* Shell Morphometry

L	32 - 55 mm
RW	0.05 - 0.10 g/mm
RD	0.41 - 0.47
PMD	0.80 - 0.91
RSH	0.20 - 0.28

Periostracum brown, thin, translucent, smooth.

**Habitat and Habits:** In 100-400 m on mud; trawled together with *C. orbigny orbigny*.

**Discussion:** *C. pseudorbigny* is similar to the co-occurring *C. orbigny orbigny*. Shells of the latter species attain larger size (85 mm), are strongly tuberculate, and have a colour pattern of spiral bands on the last whorl, while the colour pattern of *C. pseudorbigny* includes only less prominent, separate brown dots. For comparison with *C. insculptus*, see the Discussion of that species.

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### *Conus ichinoseana* (KURODA, 1956)

(Plate 56, Figures 13-15; Map 113)

1956 *Asprella (Conasprella?) ichinoseana* Kuroda, Venus 19 (1): 10-11, pl. 1 fig. 5

1956 *Asprella (Conasprella?) ichinoseana prioris* Kuroda, Venus 19 (1): 11, pl. 1 fig. 6

**Types:** *A. ichinoseana*: Holotype in KSM (58 x 21 mm); *A. ichinoseana prioris*: Holotype in KSM (69 x 26 mm).

**Type Localities:** *A. ichinoseana* and *A. ichinoseana prioris*: "off Tosa, Japan."

**Range:** Japan to Philippines, recently reported from Vietnam; New Caledonia and Loyalty Is.; N. W. Australia.

**Description:** Medium-sized to large, moderately light to solid. Last whorl often slightly pyriform, also narrowly conical or narrowly conoid-cylindrical to sometimes conical or ventricosely conical; outline slightly convex adapically, concave to sometimes straight below. Shoulder usually carinate, with a rather deep exhalant notch. Spire high, stepped; outline almost straight. Larval shell of about 3 whorls, maximum diameter about 1.1 mm. First 8-10

postnuclear whorls tuberculate; tubercles continuing as axial costae below outer margins, weaker in late whorls and absent from last 0.5-2 whorls. Teleoconch sutural ramps variably concave, with distinct radial threads. Last whorl with weakly to deeply punctate spiral grooves and ribbons between; spiral sculpture usually absent from adapical fourth, sometimes restricted to basal third or half in large specimens. Subshoulder area with 2-3 closely set, usually fine spiral grooves generally also present in stepped preceding whorls.

#### *C. ichinoseana* Shell Morphometry

L	50 - 105 mm
RW	0.08 - 0.34 g/mm (L 50-86 mm)
RD	0.43 - 0.52
PMD	0.79 - 0.92
RSH	0.23 - 0.29

Ground colour white. Last whorl with 2-4 variably wide and variably solid spiral bands composed of variably confluent brown flecks or blotches and sparse, irregularly arranged spiral rows of brown dashes, spots or bars. Heavily maculated shells intergrade with sparsely maculated specimens. Larval shell and earliest postnuclear sutural ramps white. Following sutural ramps with brown spots at outer margin; spots may be absent from last whorl. Aperture white, occasionally with a brown adapical blotch deep within.

Periostracum yellowish olive to brown, thin, slightly translucent, with axial ridges on last whorl and sutural ramps.

**Habitat and Habits:** In 80-575 m.

**Discussion:** *C. orbignyi* is similar in most shell characters but has a more strongly sculptured last whorl, with distinct spiral ribbons and ribs from base to shoulder. The brown spots on its last whorl are more numerous and are typically axially aligned, while those of *C. ichinoseana* are sparser and spirally but not axially aligned. *C. orbignyi* also

has distinct spiral sculpture on its sutural ramps, and often has stronger tubercles on the last whorl; its larval shell has more whorls (4 vs. 3). For the distinction from *C. comatosa*, see the Discussion of that species.

The type specimen of *C. i. prioris* was dredged together with specimens of *C. ichinoseana*; Kuroda considered it an ancestral representative of this species. *C. i. prioris* differs from typical *C. ichinoseana* in having a relatively higher spire and a smoother surface. Its fossil status and subspecific status need substantiation.

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### *Conus comatosa* PILSBRY, 1904

(Plate 56, Figures 16-20; Map 113)

- 1904 *Conus dormitor* Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, **56**: 6, pl. 1 figs. 9, 9a (non *C. dormitor* Solander, 1766)  
 1904 *Conus comatosa* Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, **56**: 550 (nom. nov. for *C. dormitor* Pilsbry, 1904)  
 1913 *Conus (Asperi) elegans* Schepman, Siboga Exp. 49'e, Prosobranchia, **5**, Toxoglossa: 393, pl. 25 fig. 4 (non *C. elegans* Sowerby III, 1895)  
 1936 *Conus schepmani* Fulton, Proc. Malac. Soc. London, **22**: 7 (nom. nov. for *C. elegans* Schepman, 1913)

**Types:** *C. comatosa*: Lectotype (Coomans et al., 1985a) in ANSP (43.5 x 16.5 mm); *C. schepmani*: Lectotype (Coomans et al., 1986) in ZMA (21 x 8 mm).

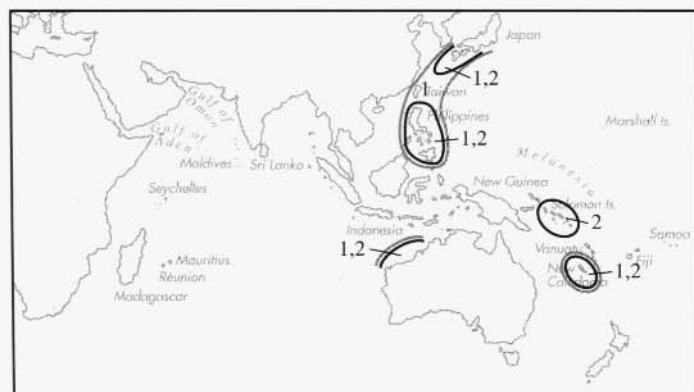
**Type Localities:** *C. comatosa*: "Kikai, Osumi, in a deposit probably Pliocene"; *C. schepmani*: "0° 3.8' N., 130° 24.3' E., Bougainville-strait."

**Range:** Japan, Philippines, N. W. Australia, Solomon Is., and New Caledonia; recently reported from Vietnam.

**Description:** Moderately small to medium-sized and light to moderately solid. Last whorl narrowly conical or conical to usually slightly pyriform; outline straight to slightly convex adapically, straight to slightly concave below. Shoulder sharply angulate to carinate, sometimes also tuberculate, with a rather deep exhalant notch. Spire of moderate height to high, variably stepped; outline concave. Larval shell of about 3.5 whorls, maximum diameter about 1.1 mm; type specimens of *C. schepmani* with 2.5-3 larval whorls. First 6-9, sometimes all postnuclear whorls tuberculate. Teleoconch sutural ramps concave, with radial threads and 1 increasing to 3-5 spiral grooves, and a few spiral striae in latest whorls. Entire last whorl with regularly spaced punctate spiral grooves separating flat ribbons; in large specimens, spiral sculpture weak on adapical fourth.

Ground colour white. Last whorl with 4 spiral rows of brown flecks, often fusing into variably continuous bands, located below shoulder, on both sides of centre and at base. Type specimens of *C. schepmani* with only 2 bands. Spiral rows of heavily to sparsely developed brown dots and dashes on ribbons of last whorl. Larval whorls white. Post-nuclear sutural ramps with scattered to closely set brown

Map 113



1: *C. ichinoseana* 2: *C. comatosa*

radial markings, partially with brown dots at outer margins. Aperture translucent white, occasionally with a brown or violet blotch deep within.

#### ***C. comatosa* Shell Morphometry**

<b>L</b>	31 - 50 mm
<b>RW</b>	0.03 - 0.15 g/mm
<b>RD</b>	0.41 - 0.56
<b>PMD</b>	0.78 - 0.88
<b>RSH</b>	0.18 - 0.26

Periostracum brown, thin, translucent.

Radular teeth with an adapical barb opposite 2 barbs in line and a narrow waist distal to the centre of the shaft; no serration but a large spur at base (Rolán, pers. comm., 1992).

**Habitat and Habits:** In 80-400 m, in sand and coral rubble. The type specimens of *C. schepmani* were found on "fine and coarse sand".

**Discussion:** *C. ichinoseana* is distinguished by its larger size (to 105 mm), straight-sided, often higher spire (RSH 0.23-0.29), usually with larger tubercles, and by the absence of spiral grooves on its sutural ramps. In addition, *C. comatosa* lacks the 2-3 incised spiral grooves just below the shoulder characteristic of *C. ichinoseana* and *C. orbignyi*. *C. orbignyi* can also be distinguished by its partly to completely tuberculate rather than mostly smooth shoulder and its 3 rather than 4 spiral colour bands on the last whorl. For comparison of *C. comatosa* with *C. saecularis*, see the Discussion of the latter species.

An extant species, *C. comatosa* was based on specimens originally thought to date from the Pliocene (ca. 3-5.5 my ago), but they are more likely late Pleistocene, perhaps 25,000 years ago. The synonymy of *C. schepmani* with *C. comatosa* remains uncertain (Coomans et al., 1986). The type specimens of *C. schepmani* are subadult; this growth stage may be responsible for a relatively higher spire (RSH 0.28) and heavier spiral sculpture of the last whorl in comparison with adult specimens of typical *C. comatosa*. The similarities in shape, colour pattern and sculpture of both last whorl and spire provisionally favour synonymy.

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### ***Conus saecularis* MELVILL, 1898**

(Plate 56, Figures 21-27; Map 114)

1898 *Conus (Leptoconus) saecularis* Melvill, Mem. Proc. Manchester Lit. Phil. Soc., 42 (4): 10-11, pl. 1 fig. 10

**Type:** Syntypes in BMNH (29.5 x 13 mm) and perhaps NMWC (24.5 x 11; 30 x 10.5; 17.5 x 7 mm)

**Type Locality:** "Malcolm Inlet, Persian Gulf."

**Range:** Type locality, W. Thailand, and N. E. Malaysia; Ryukyu Is., Philippines, Solomon Is., and Papua New Guinea.

**Description:** Small to medium sized, light to moderately light. Last whorl narrowly conical to conical, sometimes approaching pyriform; right side nearly straight in outline, occasionally slightly concave at base; left side usually concave in outline, sometimes straight to slightly convex below shoulder. Siphonal canal often deflected to the dorsal side. Shoulder sharply angulate to carinate, with a deep exhalant notch. Spire of moderate height to high, usually stepped; outline concave. Larval shell of 3-3.5 whorls, maximum diameter 0.8-0.9 mm. First 5-8 postnuclear whorls tuberculate. Teleoconch sutural ramps slightly concave, with radial threads crossing 0-1 increasing to 3-6 spiral grooves. Entire last whorl with weak axially striate spiral grooves separating distinct ribs at base, narrow ribbons below shoulder and wider ribbons inbetween.

#### ***C. saecularis* Shell Morphometry**

<b>L</b>	23 - 40 mm
<b>RW</b>	0.03 - 0.08 g/mm (L 23-36 mm)
<b>RD</b>	0.45 - 0.59
<b>PMD</b>	0.86 - 0.96
<b>RSH</b>	0.14 - 0.28

Ground colour white, usually suffused with grey. Last whorl with spiral rows of yellowish brown to dark brown dots, spots and bars fusing into 2-4 spiral bands, below shoulder, at base and on both sides of centre; the central bands are most consistently present. Some shells have pronounced spiral rows of brown dots and dashes from base to shoulder; some rows with distinct white articulations. Shoulder usually with a row of widely spaced reddish brown dots. Largely white shells with sparse ornamentation on last whorl intergrade with heavily maculated shells. Larval whorls usually beige to light brown. Postnuclear sutural ramps with yellowish brown to dark brown radial markings, sometimes producing regularly spaced dark dots at outer margin. Aperture translucent or white.

Periostracum yellowish grey, thin, translucent, smooth.

Radular teeth very similar to those of *C. comatosa*, but base and basal spur smaller (Rolán, pers. comm., 1992).

**Habitat and Habits:** Type specimens (Pl. 56, Figs. 21, 22) in 85-90 m; Pacific shells usually from 100-400 m.

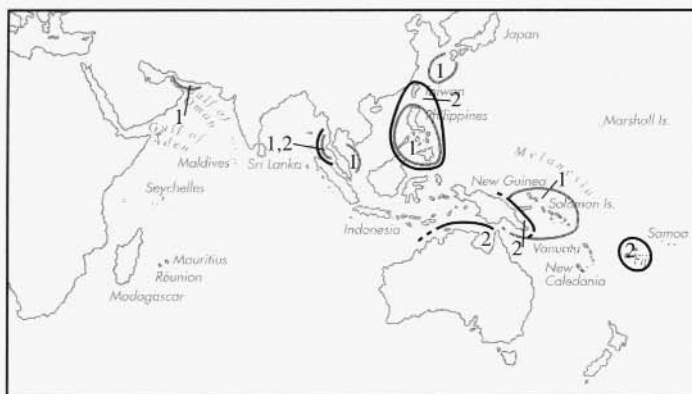
**Discussion:** *C. saecularis* is most similar to the larger *C. comatosa* (to 50 mm), and small individuals of the two species from Philippines are difficult to distinguish. *C. comatosa* has a rather pyriform last whorl with a mostly more convex outline adapically; the position of the maximum diameter is generally located closer to the base (PMD 0.78-0.88), and the left side is concave only basally. Its last whorl pattern has usually 4 spiral colour bands, its ground colour is white rather than shaded with grey, and its larval



shell is broader (1.1 mm) and white rather than beige to light brown.

For comparison with *C. insculptus*, see the Discussion of that species.

Map 114



1: *C. saecularis* 2: *C. insculptus*

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### *Conus insculptus* KIENER, 1845

(Plate 56, Figures 28-33; Map 114)

1845 *Conus insculptus* Kiener, Coq. Vivant., 2: Pl. 99 fig. 2; 1849-1850: 309-310

**Type:** "Probable syntype" in MNHN (21.5 x 8.5 mm).

**Type Locality:** "la mer de Chine."

**Range:** W. Thailand; Taiwan to Philippines; Papua New Guinea, N. Australia, and Fiji.

**Description:** Small to moderately small, light. Last whorl pyriform to conical or narrowly conical; outline convex at adapical two-thirds, concave to straight (right side) or concave (left side) below. Aperture very narrow. Shoulder angulate to carinate, often tuberculate, with a rather deep exhalent notch. Spire of moderate height to high, slightly stepped; outline straight to concave. Larval shell of about 2-2.75 whorls; maximum diameter about 0.75 mm. Postnuclear spire whorls tuberculate, usually weakly in last 1-2 whorls. Teleoconch sutural ramps slightly concave, with radial threads and 1 increasing to 6-8 spiral grooves and some additional striae. Last whorl with deep, regularly spaced, axially striate spiral grooves and raised ribs between; ribs sometimes replaced by narrow ribbons adapically.

A darker brown form known from central Philippines (Pl. 56, Figs. 32, 33) usually with a narrowly conical and less sigmoid last whorl. Shoulder distinctly carinate, sometimes undulate to tuberculate. Larval shell of 2-2.5 whorls. Postnuclear whorls tuberculate, late whorls also carinate; tubercles often weak or absent in last 1-3 whorls. Last whorl with deeply punctate spiral grooves separating ribs basally

and ribbons above. This form otherwise matching typical *C. insculptus* in shell morphology.

#### *C. insculptus* Shell Morphometry

<b>L</b>	19 - 30 mm
<b>RW</b>	0.01 - 0.05 g/mm
<b>RD</b>	0.47 - 0.55
<b>PMD</b>	0.83 - 0.95
<b>RSH</b>	0.20 - 0.29

Ground colour uniformly beige to brown. Last whorl occasionally with 2-3 slightly darker obsolete spiral bands. Larval shell beige to light brown. Postnuclear sutural ramps with brown dots between marginal tubercles or a solid brown line along outer margin. Aperture white.

**Habitat and Habits:** In 35-150 m. In E. New Britain, in 35 m on black sand (Richards, 1988).

**Discussion:** *C. insculptus* is most similar to *C. pseudobignyi*. The latter species is larger (L 32-55 mm), has a narrower last whorl (RD 0.41-0.47), and the colour pattern of its last whorl differs in bearing rows of brown dots on the spiral elevations; its larval shell has more whorls (3.5-4) and is distinctly broader (0.9-1.0 mm). *C. saecularis* may be similar in shell morphometry but can be distinguished by the outline of its last whorl that is straight rather than convex at the right side and concave rather than sigmoid at the left side; the last whorl is rather uniformly coloured in *C. insculptus*, while it has spiral rows of dots, spots and bars fusing into 2-4 spiral bands in *C. saecularis*.

Although Kiener neither mentioned nor illustrated tubercles on the spire whorls, the species described here agrees in all other respect with the original description and is most likely conspecific with his type specimen.

The darker brown shells from central Philippines were erroneously identified as *C. hypochlorus* by Walls ([1979]). We provisionally assign them to *C. insculptus*, because the differences in shell morphology do not justify separation at the species level.

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### *Conus aculeiformis* REEVE, 1844

(Plate 57, Figures 1-4, Map 115)

1843 *Conus aculeiformis* Reeve, Proc. Zool. Soc. London, 11:176; 1844: Conch. Icon., 1: Pl. 44 sp. 240b

1913 *Conus* (*Asperi*) *delicatus* Schepman, Siboga Exp. 49'e, Prosobranchia, 5, Toxoglossa: 392-393, pl. 25 fig. 3

**Types:** *C. aculeiformis*: Lectotype (Walls, [1979]; Coomans et al., 1979a) in BMNH (38 x 15 mm); *C. delicatus*: Holotype in ZMA (18.5 x 6 mm).

**Type Localities:** *C. aculeiformis*: "Cagayan, island of Mindanao, Philippines"; *C. delicatus*: "Madura-bay."

**Range:** Red Sea, S. Persian Gulf, S. E. India to Andaman Is., and S. Indonesia.

**Description:** Moderately small to medium-sized, light. Last whorl narrowly conical, outline almost straight. Shoulder angulate to carinate, with a deep exhalant notch. Spire of moderate height, outline variably concave. Larval shell of 3-3.5 whorls, maximum diameter 0.9-1 mm. Early postnuclear whorls often stepped. Teleoconch sutural ramps flat to slightly concave, with 1-3 increasing to 2-5 partly fine spiral grooves. Last whorl with widely spaced, axially striate spiral grooves separating very flat ribbons and extending from base to shoulder.

#### *C. aculeiformis* Shell Morphometry

L	28 - 38 mm
RW	0.03 - 0.05 g/mm
RD	0.40 - 0.47
PMD	0.86 - 0.95
RSH	0.17 - 0.22

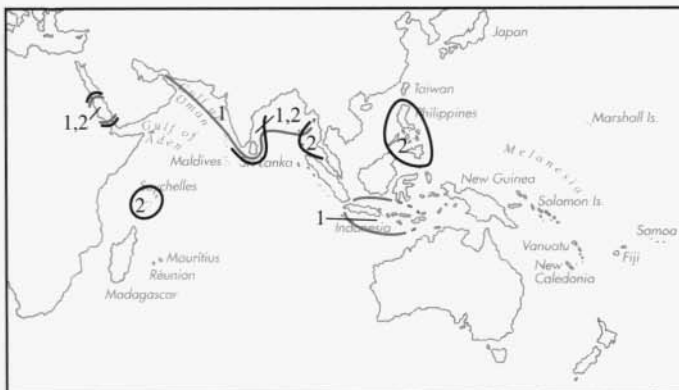
Ground colour cream or beige. Last whorl with spiral rows of brown squarish to rectangular spots on ribbons, often fused into an interrupted spiral band on each side of center. Teleoconch spire matching last whorl in pattern. Larval whorls grey to beige. Postnuclear sutural ramps with connected brown radial blotches. Aperture pale brown, sometimes darker deep within.

Periostracum thin and translucent.

**Habitat and Habits:** In 50-100 m.

**Discussion:** *C. aculeiformis* is similar to *C. longurionis*, *C. hopwoodi*, and *C. elegans*. For comparison, see the Discussions of those species.

Map 115



1: *C. aculeiformis* 2: *C. vimineus*

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### *Conus vimineus* REEVE, 1849

(Plate 57, Figures 5-8, Map 115)

1849 *Conus vimineus* Reeve, Conch. Icon., 1, *Conus* suppl.: pl. 7 sp. 269

**Type:** Type in BMNH (29 x 10.5 mm).

**Type Locality:** "Cagayan, Island of Mindanao, Philippines."

**Range:** S. Red Sea, Seychelles, S. India, Sri Lanka, W. Thailand, and Philippines.

**Description:** Moderately small to medium-sized, light. Last whorl narrowly conoid-cylindrical to narrowly conical, outline convex adapically, almost straight below. Columella deflected dorsally. Shoulder subangulate, often indistinct, with a moderately deep exhalant notch. Spire usually of moderate height, slightly stepped; outline slightly sigmoid to slightly concave. Larval shell of 4-4.5 whorls, maximum diameter 1.1-1.2 mm. Suture wide and deep in larval shell and early postnuclear whorls. Teleoconch sutural ramps flat, with radial threads and 3 wide spiral grooves that may increase to 4-5 grooves in late whorls. Entire last whorl with deep, axially striate spiral grooves separating regularly spaced ribs near base and variably arranged ribs and narrow ribbons above; elevations smooth or finely granulose.

#### *C. vimineus* Shell Morphometry

L	32 - 43 mm
RW	0.02 - 0.05 g/mm
RD	0.37 - 0.44
PMD	0.81 - 0.88 (Indian Ocean shells) 0.76 - 0.84 (Philippine shells)
RSH	0.15 - 0.25

Ground colour beige. Last whorl with spiral rows of rectangular light brown spots on ribs, fusing into flecks and axial streaks that usually cluster in 3 spiral bands, below shoulder, above centre, and near base. Colour pattern more pronounced in Indian Ocean shells (Pl. 57, Figs. 5, 6, 8) than in those from Philippines (Pl. 57, Fig. 7). Larval whorls grey to beige. Postnuclear sutural ramps sparsely marked with brown radial streaks. Aperture brown to brownish violet deep within.

Periostracum brownish grey, thin, translucent, smooth.

Operculum may be absent (Ramalho, pers. comm., 1989).

**Habitat and Habits:** Subtidal, to 50 m.

**Discussion:** *C. vimineus* is most similar to *C. longurionis*. For comparison, see the Discussion of that species.

***Conus longurionis* KIENER, 1845**

(Plate 57, Figures 9-21; Map 116)

1845 *Conus longurionis* Kiener, Coq. Vivant., 2: Pl. 92 fig. 6; 1849-1850: 308-3091982 *Conus kantanganus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 1: 11-12, figs. 10a-b**Types:** *C. longurionis*: Original figure 33 x 10 mm; *C. kantanganus*: Holotype in MHNG (33 x 10 mm).**Type Localities:** *C. kantanganus*: "off the coast of Kantang, S. W. Thailand in the Andaman Sea."**Range:** N. Mozambique and Tanzania, India and Sri Lanka, W. Thailand, Philippines, and Taiwan.**Description:** Moderately small to medium-sized, light to moderately light. Last whorl usually narrowly conoid-cylindrical to narrowly conical; outline nearly straight, occasionally sigmoid. Shoulder angulate, to subangulate in form *kantanganus* (Pl. 57, Figs. 14-17), to carinate in shells from Philippines and Taiwan (Pl. 57, Figs. 18-21); exhalant notch variably deep. Spire of moderate height to high, outline slightly concave to almost straight. Larval shell of 3 or more whorls, maximum diameter 0.9-1 mm. First 5-8 postnuclear whorls distinctly tuberculate. Teleoconch sutural ramps flat, with radial threads crossing 1 broad central spiral groove in first 3-5 (sometimes to 8) whorls and 1-2 (sometimes to 3) grooves in following whorls; sutures deep and wide. Last whorl with regularly spaced, axially striate spiral grooves and ribbons or occasionally ribs between; surface sculpture less prominent in E. African shells.

Ground colour white (shells from Mozambique) to beige (shells from India to Taiwan). Last whorl with spiral rows of regular or irregular brown dots or rectangular spots on ribbons and ribs, partly fusing into irregularly sized axial flecks and streaks that cluster into spiral bands above and below centre; a weaker spiral band sometimes present below shoulder. Pattern of shells from Mozambique often reduced to axial streaks of both sides of centre and below shoulder. Larval whorls grey, also brown in shells from Philippines and Taiwan. Teleoconch spire matching last whorl in pattern. Aperture translucent.

Periostracum greyish brown, thin, translucent.

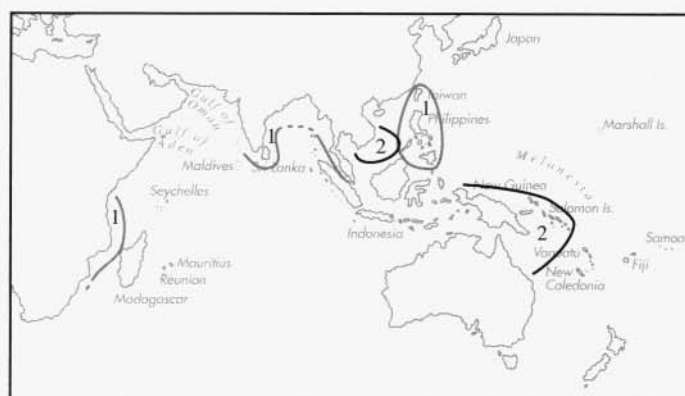
***C. longurionis* Shell Morphometry**

<b>L</b>	29 - 46 mm - 36 mm (form <i>kantanganus</i> )
<b>RW</b>	0.03 - 0.10 g/mm
<b>RD</b>	0.39 - 0.45 - 0.48 (Philippines, Taiwan)
<b>PMD</b>	0.83 - 0.90
<b>RSH</b>	0.19 - 0.30

Animals from Mozambique yellow, mottled with black. Operculum absent. The species has a very small radula, only about 0.01 as long as the shell (Ramalho, pers. comm., 1989).

**Habitat and Habits:** Subtidal fringe, buried in sand, 1-2.5 cm below surface in habitats sheltered from heavy wave action. The animals emerge and crawl toward shore on the incoming tide (Mozambique; Grosch, pers. comm., 1989). Empty shells in 50 and 75 m off Tranquebar, India (Kohn, 1978). Shells from W. Thailand in 20-50 m, those from Philippines and Taiwan on silty sand bottoms in 30-55 m.**Discussion:** *C. longurionis* resembles *C. aculeiformis*, *C. vimineus*, *C. hopwoodi*, and *C. elegans*. *C. aculeiformis* has a lower, concave-sided rather than straight-sided spire (RSH 0.17-0.22) and lacks tubercles on the postnuclear whorls; its last whorl is more conical (PMD 0.86-0.95), and the spiral grooves on its teleoconch sutural ramps are differently arranged. *C. vimineus* has a broader larval shell (1.1-1.2 mm) with 4.0-4.5 whorls separated by deep and wide sutures; its spire is generally lower (RSH 0.15-0.25) and has a slightly concave to sigmoid rather than straight outline; the early teleoconch sutural ramps have 3 spiral grooves, and the spire whorls lack tubercles. For comparison with *C. hopwoodi* and *C. elegans*, see the Discussions of those species.Shells from India and W. Thailand (Pl. 57, Figs. 14-17) were described as *C. kantanganus*, while the original figure of *C. longurionis* refers to E. African shells (Pl. 57, Figs. 9-13). *C. kantanganus* and the similar shells from Taiwan and Philippines (Pl. 57, Figs. 18-21) cannot be separated from *C. longurionis* at the species level and are considered geographical forms.

Map 116

1: *C. longurionis* 2: *C. hopwoodi*



***Conus hopwoodi* TOMLIN, 1936**

(Plate 57, Figures 22-26; Map 116)

1875 *Conus gracilis* Sowerby III, Proc. Zool. Soc. London, **1875**: 125-126, pl. 24 fig. 6 (non *C. gracilis* Sowerby I, 1823)1936 *Conus hopwoodi* Tomlin, J. Conchol. (London), **20**: 254 (nom. nov. for *C. gracilis* Sowerby III)**Type:** Holotype in NMWC (30.5 x 10 mm).**Type Locality:** Not stated.**Range:** Melanesia (Papua New Guinea, Solomon Is.), Queensland, and South China Sea.

**Description:** Moderately small, light. Last whorl narrowly conoid-cylindrical to narrowly conical; outline slightly convex, less so near base. Shoulder subangulate, with a deep exhalant notch. Spire usually of moderate height, outline nearly straight. Larval shell of about 3 whorls, maximum diameter about 1 mm. First 3-4.5 post-nuclear whorls tuberculate. Teleoconch sutural ramps with 1 strong spiral groove in first 3 whorls and 2 increasing to 2-4 grooves in following whorls. Last whorl almost smooth or with punctate shallow spiral grooves separating ribs near base and ribbons above.

***C. hopwoodi* Shell Morphometry**

<b>L</b>	25 - 31 mm
<b>RW</b>	0.02 - 0.04 g/mm
<b>RD</b>	0.37 - 0.43
<b>PMD</b>	0.81 - 0.88
<b>RSH</b>	0.19 - 0.24

Ground colour grey to beige. Last whorl with spiral rows of brown squarish dots and rectangular bars on ribbons. Brown markings usually variably fusing into flames; brown colouration occasionally more general, leaving only a few ground-colour flecks. Larval whorls brown (Solomon Is.) or beige (Papua New Guinea, Queensland). Postnuclear sutural ramps with connected brown radial markings. Aperture translucent.

Periostracum thin, translucent.

Dorsum of foot cream, with densely set brown to black dots pre-marginally; anterior part with brown dots medially, a yellow distal edge and a crescent-shaped black blotch behind; posterior median zone white, minutely dotted with black. Sole of foot white. Tentacles grey to black. Siphon white, mottled with black; tip immaculate (Chaberman, pers. comm., 1981). The animals described above had been identified as "*C. aculeiformis*" by Chaberman, but their shells suggest that they are *C. hopwoodi*. Chaberman's description agrees with that given by Richards for *C. hopwoodi* (pers. comm., 1989).

**Habitat and Habits:** In 6-36 m, in sand or mud (Solomon Is.; Bailey, pers. comm., 1976). In E. New Britain, on

coarse volcanic sand, debris and gravel in 18-36 m; it burrows in the sand during the day (Richards, pers. comm., 1989).

**Discussion:** *C. hopwoodi* closely resembles *C. longurionis* in shape and pattern. This species differs from *C. hopwoodi* in its larger size (to 46 mm), often higher spire (RSH 0.19-0.30), larger number of tuberculate teleoconch spire whorls (5-8), and in its often more conical and broader last whorl (RD 0.39-0.48; PMD 0.83-0.90). It is possible that the two are conspecific. *C. aculeiformis* differs in its generally broader last whorl (RD 0.40-0.47), angulate to carinate shoulder, absence of any tuberculate whorls, and different arrangement of the spiral grooves on its postnuclear sutural ramps. For comparison with *C. elegans*, see the Discussion of that species.

***Conus elegans* SOWERBY III, 1895**

(Plate 57, Figures 27-34; Map 117)

1895 *Conus elegans* Sowerby III, Proc. Malac. Soc. London, **1**: 215, pl. 13 fig. 81904 *Conus aculeiformis* f. *torensis* Sturany, Denkschrift K. Akad. Wiss. Wien, Exp. Pola, **23**: 227, pl. 4 figs. 8a-b1986 *Conus elegans ramalhoi* Coomans, Moolenbeek & Wils, Basteria, **50**: 103-104, figs. 670, 705

**Types:** *C. elegans*: Holotype in BMNH (32 x 11 mm); *C. a. f. torens*: 4 syntypes in NMW (24 x 9; 25 x 9.5; 27.5 x 10; 31.5 x 11 mm); *C. e. ramalhoi*: Holotype in NM (31.5 x 10.5 mm).

**Type Localities:** *C. elegans*: "Persian Gulf"; *C. a. f. torens*: "Station 88 (33° 35.5' E, 28° 9.3' N bei Tor im Golfe von Suez)"; *C. e. ramalhoi*: "Northern Mozambique, Angoche."

**Range:** Gulf of Suez, Somalia, Persian Gulf, Gulf of Oman to the Makran coast of Pakistan; W. Australia (*C. e. elegans*); Natal to Mozambique (*C. e. ramalhoi*).

**Description:** Moderately small to medium sized, light to moderately solid. Last whorl narrowly conoid-cylindrical, to narrowly conical in subadults; outline slightly convex apically, straight (right side) or slightly concave (left side) below. Shoulder angulate to carinate. Spire of moderate height to high, outline straight to slightly concave. Larval shell of 1.75-2.25 whorls, maximum diameter about 0.8 mm. First 5-7 postnuclear whorls tuberculate; suture deep and wide in first 2 whorls. Teleoconch sutural ramps slightly concave, with 2-3 increasing to 3-5 spiral grooves; spiral sculpture weak on latest ramps. Last whorl with punctate spiral grooves and flat ribbons between, mostly restricted to basal half, occasionally extending to shoulder. Surface sculpture weaker in *C. e. ramalhoi*.

Ground colour white to beige in *C. e. elegans* (Pl. 57, Figs. 27-30), light violet in *C. e. ramalhoi* (Pl. 57, Figs. 31-34). In *C. e. elegans*, last whorl encircled with rows of orange to brown dots, irregular blotches and axial streaks, often forming interrupted spiral bands below shoulder and on both sides of centre. In *C. e. ramalhoi*, last whorl some-

times with a few brown blotches near centre and up to 16 evenly spaced spiral rows of variably numerous and arranged reddish brown dots, from base to shoulder. Larval shell white or light brown. In *C. e. elegans*, late sutural ramps usually with irregular brown blotches; sometimes brown subsutural dots present (Somalia). In *C. e. ramalhoi*, postnuclear sutural ramps with scattered light brown blotches; late ramps often with regularly spaced brown dots at both margins, regularly set below suture. Aperture white or light brown (Somalia) in *C. e. elegans* and orange to violet-brown in *C. e. ramalhoi*.

#### *C. elegans* Shell Morphometry

<b>L</b>	24 - 40 mm
<b>RW</b>	0.02 - 0.11 g/mm
<b>RD</b>	0.41 - 0.47
<b>PMD</b>	0.77 - 0.85
	- 0.93 (in subadults)
<b>RSH</b>	0.18 - 0.28

Periostracum light brown, semi-translucent in *C. e. ramalhoi* (Coomans et al., 1986).

Animal yellowish mottled with black, lacking an operculum and having relatively small radular teeth (*C. e. ramalhoi*; Ramalho, pers. comm., 1989). Animal white (*C. e. elegans*; Kauch, pers. comm., 1991). Radular teeth small, of simple morphology; adapical fourth sharply pointed, without armature; serration absent; base with a spur (Rolán, pers. comm., 1993).

**Habitat and Habits:** Upper subtidal to about 60 m. *C. e. elegans* in 8-49 m in the Persian Gulf and in 9-11 m along the Makran coast. *C. e. ramalhoi* in shallow water, on sheltered muddy sand flats in Angoche Bay (Grosch, pers. comm., 1989).

**Discussion:** *C. aculeiformis* differs from *C. elegans* in its lower spire (RSH 0.17-0.22), non-tuberculate postnuclear whorls, and its more conical last whorl (PMD 0.86-

0.95); its larval shell is broader (0.9-1 mm) and has more whorls (3-3.25). *C. longurionis* has also a broader larval shell (0.9-1 mm) of generally more whorls (2.25-3) and a more conical last whorl (PMD 0.83-0.90); its postnuclear sutural ramps are separated by deeper and wider sutures and have only 1 central spiral groove in first 3-5 or more whorls; the surface sculpture of its last whorl is more prominent. *C. hopwoodi* has a narrower last whorl (RD 0.37-0.43), often lower spire (RSH 0.18-0.24), and a broader larval shell (1 mm) with more whorls (3); its first 3 postnuclear sutural ramps bear 1 strong spiral groove rather than 2-3 fine grooves. *C. milesi* has a higher spire (RSH 0.29-0.38), a broader and more conical last whorl (RD 0.49-0.59; PMD 0.88-0.95), and its shoulder is tuberculate.

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### *Conus minnamurra* (GARRARD, 1961)

(Plate 58, Figures 1-4; Map 117)

1961 *Mamiconus minnamurra* Garrard, J. Malac. Soc. Australia, 5: 32, pl. 1 figs. 4a-b

**Type:** Holotype in AMS (25.5 x 13.5 mm).

**Type Locality:** "east of Botany Bay, N.S.W."

**Range:** New South Wales to Queensland, Australia.

**Description:** Moderately small, moderately light to moderately solid. Last whorl conical to broadly conical, outline straight to slightly convex; left side concave above base. Shoulder angulate to slightly carinate. Spire of low to moderate height, slightly stepped in later whorls; outline straight to domed. Larval shell of 1.5-1.75 whorls, maximum diameter about 1.1 mm. Teleoconch sutural ramps flat, concave in late whorls, with 1 increasing to 5-6 spiral grooves. Last whorl with closely spaced spiral ribs.

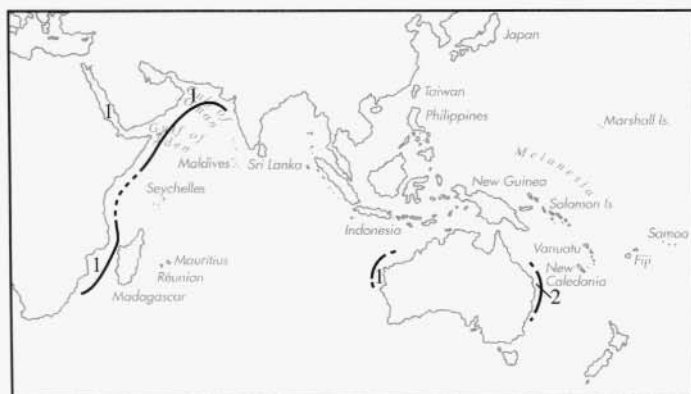
#### *C. minnamurra* Shell Morphometry

<b>L</b>	25 - 36 mm
<b>RW</b>	0.06 - 0.14 g/mm
<b>RD</b>	0.64 - 0.72
<b>PMD</b>	0.86 - 0.93
<b>RSH</b>	0.07 - 0.16

Ground colour white. Last whorl with 3 variably solid spiral bands of brown axial streaks and flecks, below shoulder, at centre and within abapical third; intervening white bands may have sparse spiral rows of widely set brown dots. Larval shell white. Postnuclear sutural ramps with rather sparse brown radial streaks and blotches extending beyond outer margins, partially reduced to marginal spots. Aperture white to pale brown.

**Habitat and Habits:** In 50-100 m. *C. minnamurra* seems to be restricted to the warm temperate and subtropical waters of the E. Australian overlap region.

Map 117



1: *C. elegans* 2: *C. minnamurra*

**Discussion:** *C. minnamurra* may be confused with *C. limpusi* (Walls, [1979]; Richard, 1990) and is also similar to *C. lizardensis*; for comparison, see the Discussions of those species.

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# *Conus colmani* RÖCKEL & KORN, 1990

(Plate 58, Figures 5-8; Map 118)

1990 *Conus colmani* Röckel & Korn, Acta Conchyl., 2:16-21, pl. 8 figs. 1-4, pl. 9 figs. 1-7, pl. 10, row 5 figs. 3-5

**Type:** Holotype in AMS (42 x 23.5 mm).

**Type Locality:** "SE von Swain Reefs, 22°26.27-20.20'S - 153°17.13-16.60'E (Great Barrier Reef, Queensland, Australien)."

**Range:** Swain Reefs in southern part of Great Barrier Reef, Queensland, Australia.

**Description:** Medium-sized, moderately solid. Last whorl conical or ventricosely conical to broadly conical or broadly and ventricosely conical, outline variably convex adapically and straight below; left side constricted just above base. In subadult specimens, last whorl may be slightly pyriform, outline slightly sigmoid. Shoulder angulate. Spire of low to moderate height, outline concave to nearly straight. Larval shell of about 2 whorls, maximum diameter 1.05-1.15 mm. First 3-6 postnuclear whorls tuberculate; specimens of about 45 mm with 8.5 teleoconch whorls. Teleoconch sutural ramps flat, with 1 increasing to 5-8 spiral grooves. Last whorl often with spiral ribs at base and a few weak spiral ribbons above; sometimes ribbons prominent, spirally striate and extending to shoulder; last whorl may also have groups of sometimes finely granulose elevations, each consisting of 2-3 fine spiral ribs anteriorly and 1 ribbon or 2 coarse ribs posteriorly.

## *C. colmani* Shell Morphometry

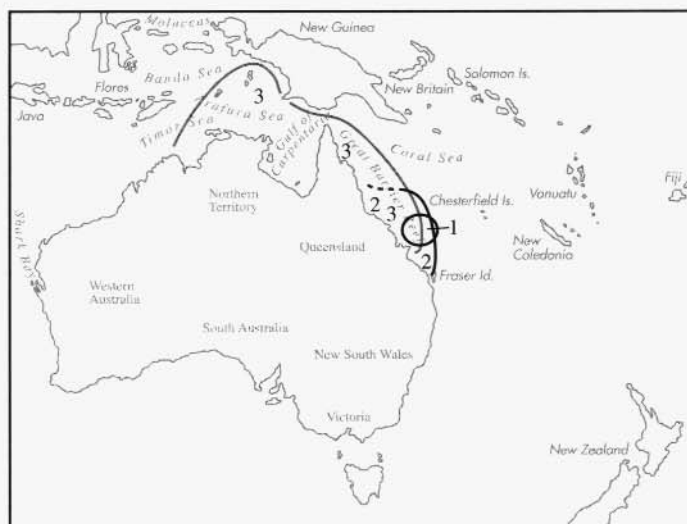
L	35 - 52 mm
RW	0.20 - 0.35 g/mm
RD	0.62 - 0.73
PMD	0.81 - 0.90
RSH	0.07 - 0.19

Ground colour white. Last whorl with 3 axially connected spiral rows of yellowishbrown to orange axial streaks and flames, below shoulder and on each side of centre; adapical markings partially extending to spire. Larval whorls white. Postnuclear sutural ramps with radial lines and streaks matching last whorl pattern in colour. Aperture white.

**Habitat and Habits:** In 170-250 m, on grey mud and sand.

**Discussion:** *C. colmani* is similar to *C. limpusi* and *C. lizardensis*; for comparison, see the Discussions of the latter species.

Map 118



1: *C. colmani* 2: *C. limpusi* 3: *C. lizardensis*

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# *Conus limpusi* RÖCKEL & KORN, 1990

(Plate 58, Figures 9-15; Map 118)

1990 *Conus limpusi* Röckel & Korn, Acta Conchyl. 2, 14-16; 21, pl. 5 figs. 1, 2; pl.6 figs. 1, 2, 5, 6; pl. 7 figs. 1-8; pl. 10, row 4 figs. 3, 4

1990 *Conus albellus* Röckel & Korn, Acta Conchyl. 2, 11-13, 20; pl. 3 figs. 1-5; pl. 4 figs. 1-7; pl. 10, row 5 figs. 1, 2

**Types:** *C. limpusi*: Holotype in AMS (44.5 x 22.5 mm); *C. albellus*: Holotype in AMS (42.5 x 22.5 mm).

**Type Localities:** *C. limpusi*: "Vor Yeppoon, Capricorn Group/Capricorn Channel (Queensland, Australien)"; *C. albellus*: "SE von Swain Reefs, 22° 31.4'S - 152° 32.6'E (Great Barrier Reef, Queensland, Australien)."

**Range:** Queensland, Australia, from Bundaberg area to southern part of Great Barrier Reef.

**Description:** Moderately small to medium-sized, moderately solid to solid. Last whorl conical to ventricosely conical, outline convex adapically and less so to straight toward base; left side constricted just above base. In form *albellus* (Pl. 58, Figs. 13-15), last whorl generally less ventricose and more straight-sided than in typical form. Shoulder angulate, sometimes subangulate in large specimens. Spire of low to moderate height, generally higher in typical form than in form *albellus*; outline concave to almost straight. Larval shell of 1.75-2 whorls, maximum diameter 1.2-1.3 mm. First 2-7 postnuclear whorls tuberculate; in similarly sized specimens, typical form with slightly



more postnuclear whorls than form *albellus* (L 45 mm: ca. 9.25 vs. ca. 8.5 whorls). Teleoconch sutural ramps flat, with 1-2 increasing to 4-7 spiral grooves. Last whorl with spiral ribs, ribbons and threads extending from base to shoulder in variable sequence; grooves between axially striate, wider toward base. In form *albellus*, sculpture of last whorl usually less prominent, with ribs concentrated near base and below shoulder and ribbons between; large specimens sometimes nearly smooth adapically.

#### *C. limpusi* Shell Morphometry

<b>L</b>	30 - 55 mm
<b>RW</b>	0.11 - 0.37 g/mm
<b>RD</b>	0.57 - 0.68
	0.55 - 0.66 (form <i>albellus</i> )
<b>PMD</b>	0.80 - 0.88
<b>RSH</b>	0.10 - 0.22
	0.07 - 0.16 (form <i>albellus</i> )

Ground colour white. Last whorl with brown spots, streaks, flames and blotches fusing into 3 interrupted to solid spiral bands, just below shoulder and above as well as below centre; specimens of typical form may have additional spiral rows of small brown spots and narrow bars. Shells nearly without any pattern elements intergrade with shells that have almost solid brown last whorls. In form *albellus*, pattern elements usually sparse and less prominent than in typical form, white shells more frequent. Larval whorls white. Postnuclear sutural ramps with brown radial markings partially extending beyond outer margins and matching last whorl pattern in prominence. Aperture white.

**Habitat and Habits:** In 80-225 m. At the type locality, form *albellus* was dredged from blue-grey mud and shell substrate.

**Discussion:** *C. limpusi* is similar to *C. minnamurra*, *C. colmani*, and *C. lizardensis*. For comparison with the latter species, see the Discussion of *C. lizardensis*. *C. minnamurra* differs in its usually broader last whorl (RD 0.64-0.72), non-tuberculate early postnuclear whorls and in its generally fewer larval whorls (1.5-1.75 vs. 1.75-2). In addition, its spire outline is convex to straight instead of concave to almost straight. *C. colmani* can be distinguished by its generally broader last whorl (RD 0.62-0.73), narrower larval shell (1.05-1.15 mm), mostly more uniform spiral sculpture of the last whorl and by its more axially oriented last whorl pattern. Subadult shells are rather pyriform in *C. colmani* but conical in *C. limpusi*. Strongly sculptured specimens of *C. colmani* are sometimes nearly inseparable from *C. limpusi*.

The typical form and form *albellus* of *C. limpusi* occur sympatrically and have almost identical bathymetric ranges. Although *C. albellus* was originally considered a separate species, additional material from several localities in the Swain Reefs includes shells intermediate in shape, sculpture and pattern between it and *C. limpusi*. We therefore provisionally regard *C. albellus* and *C. limpusi* as conspecific and

determine the name *C. limpusi* as the species name (Art. 24 (a), ICZN).

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### *Conus lizardensis* CROSSE, 1865

(Plate 58, Figures 16-21; Map 118)

1865 *Conus lizardensis* Crosse, J. Conchyl. (Paris), 13: 305-307, pl. 9 fig. 5

1913 *Conus* (*Asperi*) *mucronatus* var. *sibogae* Schepman, Siboga Exp. 49'e, Prosobranchia, 5, Toxoglossa: 390-391, pl. 25 fig. 2

**Types:** *C. lizardensis*: Holotype in BMNH (18 x 8.5 mm); *C. sibogae*: Holotype in ZMA (25.5 x 12.5 mm).

**Type Localities:** *C. lizardensis*: "Habitat in insula «Lizard» dicta, Australiae"; *C. m.* var. *sibogae*: "5°28'.2 S. 134°53'.9 E. Aru-islands."

**Range:** Keppel Bay (S. Queensland, Australia) to Arafura Sea (Aru, Indonesia) and Timor Sea (Joseph Bonaparte Gulf, N.W. Australia).

**Description:** Moderately small to medium-sized, moderately solid. Last whorl conical to ventricosely conical or conoid-cylindrical, outline slightly convex at adapical third and straight below. Shoulder usually sharply angulate. Spire of low to moderate height, outline concave. Larval shell of about 2 whorls, maximum diameter 0.8-0.9 mm. First 0.75-3 postnuclear whorls weakly tuberculate; specimens of about 45 mm with about 10 postnuclear whorls. Teleoconch sutural ramps flat, sometimes concave in late whorls, with 1 increasing to 4-6 spiral grooves. Last whorl with variably broad spiral ribbons extending from base to shoulder, sometimes replaced by ribs near base and just below shoulder; intervening grooves axially striate, wider at base and often containing a fine spiral rib; large specimens almost smooth on adapical third to half.

#### *C. lizardensis* Shell Morphometry

<b>L</b>	30 - 55 mm
<b>RW</b>	0.10 - 0.22 g/mm
<b>RD</b>	0.52 - 0.63
<b>PMD</b>	0.83 - 0.91
<b>RSH</b>	0.08 - 0.15

Ground colour white. Last whorl with rather sparse spiral rows of widely separated brown spots, concentrated and fusing into larger axial markings below shoulder and within adapical as well as basal third. Brown spots often irregularly scattered. Larval whorls white. Postnuclear sutural ramps sparsely maculated with brown spots or radial streaks. Aperture white.

**Habitat and Habits:** In 25-60 m.

**Discussion:** *C. lizardensis* resembles *C. minnamurra*, *C. colmani*, and *C. limpusi*. *C. minnamurra* can be distinguished from *C. lizardensis* by its broader last whorl (RD 0.64-0.72), non tuberculate postnuclear whorls, straight to convex spire outline and usually smaller size (to 36 mm). *C. colmani* has a broader last whorl (RD 0.62-0.73), an angulate rather than sharply angulate shoulder, and strong tubercles on its first 3-6 postnuclear whorls. In similarly sized specimens, *C. colmani* is heavier but has fewer postnuclear whorls (8.5) than *C. lizardensis*. *C. limpusi* differs in its more solid shell (L 55 mm: RW 0.30-0.40 g/mm), generally more convex-sided last whorl, angulate rather than sharply angulate shoulder, and in its strongly tuberculate 2-7 early postnuclear whorls. *C. minnamurra*, *C. colmani*, and *C. limpusi* have a broader larval shell (maximum diameter in *C. minnamurra* 1.1 mm; in *C. colmani* 1.05-1.15 mm; in *C. limpusi* 1.2-1.3 mm).

This species is often referred to as *C. sibogae* (see Walls, [1979]). Cernohorsky (1978) and Coomans & Filmer (1985) considered *C. sibogae* a junior synonym of *C. lizardensis*. Röckel & Korn (1990) agreed with this conclusion, in particular as the same larval shell diameter (0.8-0.9 mm) suggests conspecific status for the (subadult) type specimens of *C. lizardensis* Crosse and *C. mucronatus* var. *sibogae* Schepman. Bathymetric and zoogeographical data support this taxonomic hypothesis: The type localities of *C. lizardensis* and *C. sibogae* as well as the depth in which the latter holotype was collected (57 m) do not correspond with the geographical and bathymetrical ranges of *C. limpusi*, *C. minnamurra* or *C. colmani*.

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### *Conus dampierensis* FILMER & COOMANS, 1985

(Plate 58, Figures 22-24; Map 119)

1985 *Conus dampierensis* Filmer & Coomans in Coomans & Filmer, *Beaufortia*, 35: 4-5, figs. 5-7

**Type:** Holotype in ZMA (32.5 x 18.5 mm).

**Type Locality:** "Back Beach, Dampier, West Australia."

**Range:** W. Australia, Onslow to Port Hedland area.

**Description:** Moderately small, moderately light to moderately solid. Last whorl conical to ventricosely conical; outline variably convex adapically, less so to straight toward base; left side constricted at base. Shoulder angulate. Spire of moderate height, often stepped in early postnuclear whorls; outline concave. Larval shell of 2-2.25 whorls, maximum diameter 0.8-1 mm. First 1.5-4 postnuclear whorls weakly tuberculate. Teleoconch sutural ramps flat, with 0-1 increasing to 4-6 spiral grooves; last 2 ramps often with a few additional spiral striae. Last whorl with variably broad spiral ribbons, narrower or grading into groups of ribs

at base and below shoulder; intervening grooves axially striate; sculpture may be weak or obsolete at adapical third to half.

#### *C. dampierensis* Shell Morphometry

<b>L</b>	25 - 34 mm
<b>RW</b>	0.07 - 0.15 g/mm
<b>RD</b>	0.62 - 0.68
<b>PMD</b>	0.80 - 0.92
<b>RSH</b>	0.12 - 0.18

Ground colour white. Last whorl with coalescing brown flames and blotches usually forming 4 interrupted or solid spiral bands, below shoulder, at base and on each side of centre; adapical markings extending to spire. Additional spiral rows of squarish brown spots may be present. Larval whorls white to grey. Postnuclear sutural ramps with brown radial streaks and blotches. Aperture bluish white.

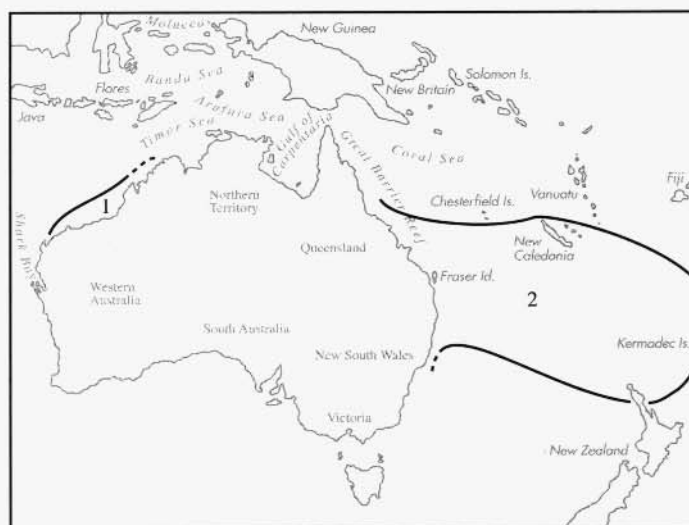
Periostracum yellowish brown, thin, translucent to opaque, with spiral rows of tufts on last whorl and fine hairs on spire (Turnbull, pers. comm., 1987).

Foot cream, densely spotted with black; rostrum and siphon black.

**Habitat and Habits:** To about 10 m, in sand and mud, often close to weeds; on offshore islands in cleaner sand (Filmer & Coomans, 1985).

**Discussion:** *C. dampierensis* has been misidentified as *C. tegulatus* (see Coomans & Filmer, 1985); it also resembles the typical form of *C. limpusi*. The latter species is usually larger (to 55 mm), has a broader larval shell (1.2-1.3 mm) and prominent shoulder tubercles at the first 2-7 postnuclear whorls, and it lacks brown markings at the base.

Map 119



1: *C. dampierensis* 2: *C. howelli*

***Conus howelli* IREDALE, 1929**

(Plate 58, Figures 25-28; Map 119)

1929 *Conus howelli* Iredale, Rec. Australian Mus., 17: 182, pl. 40 figs. 1,8**Type:** Holotype in AMS (26.5 x 13 mm).**Type Locality:** "off Montague Island, New South Wales."**Range:** New South Wales and S. Queensland, Australia to N. New Zealand; New Caledonia.

**Description:** Small to medium sized. Last whorl conical; outline usually straight; left side may be slightly sigmoid to slightly concave. Shoulder sharply angulate, tuberculate to smooth. Spire of moderate height to high, slightly stepped; outline concave to almost straight. Larval shell of about 4 whorls, maximum diameter about 1 mm. Postnuclear spire whorls usually tuberculate. Teleoconch sutural ramps concave, with closely spaced radial threads. Last whorl variable in sculpture: Almost smooth specimens with weak spiral ribs on basal third intergrade with specimens with widely spaced, strong and granulose ribs and some intervening weak and smooth ribs.

Ground colour white to cream. Last whorl with fine orange to brown, wavy axial lines and 2-3 slightly darker, interrupted to solid spiral bands. In some specimens, entire last whorl with orange to brown blotches. Postnuclear sutural ramps with curved radial lines and streaks matching last whorl pattern in colour. Aperture pale pink, grading to white at each end.

***C. howelli* Shell Morphometry**

<b>L</b>	18 - 49 mm
<b>RD</b>	0.60 - 0.69
<b>PMD</b>	0.88 - 0.95
<b>RSH</b>	0.16 - 0.25
(occasionally very low; Garrard 1961)	

Periostracum chestnut brown, paler brown in light-coloured shells.

**Habitat and Habits:** In 50-295 m.

**Discussion:** Strongly sculptured subadult specimens of *C. howelli* are very similar to adult specimens of *C. raoulensis*. The latter species is smaller (L 16-22 mm), has a generally broader last whorl (RD 0.67-0.76), and its last whorl pattern usually includes indistinct instead of prominent axial lines. In similarly sized specimens, the periostracum is yellowish brown in *C. raoulensis* but chestnut brown in *C. howelli*. Both species occur sympatrically on the Wanganella Bank (N.W. of N. New Zealand) without intergrading (Marshall, 1981).

***Conus ardisiaceus* KIENER, 1845**

(Plate 59, Figures 1-7; Map 120)

1845 *Conus ardisiaceus* Kiener, Coq. Vivant., 2: Pl. 108 fig. 1; 1849-1850: 316-317**Type:** Neotype (Coomans & Moolenbeek, 1990) in ZMA (36 x 20 mm).**Type Locality:** "Masirah Island, Oman" (Coomans et al., 1981).**Range:** Muscat to Al Masirah, Oman.

**Description:** Moderately small to medium-sized, usually moderately solid. Last whorl ventricosely conical to broadly and ventricosely conical, sometimes broadly ovate; outline convex, less so to straight toward base; left side constricted at base or sigmoid. Shoulder rounded to angulate. Spire of low to moderate height, outline concave to almost straight or slightly sigmoid. Larval shell of about 2 whorls, maximum diameter 1-1.1 mm. Teleoconch sutural ramps flat, with 3 increasing to 5-7 spiral grooves. Last whorl with a few usually weak spiral ribs at base.

Ground colour white to light greyish blue. Last whorl usually with brown, olive, orange, or blackish brown flecks, variable in shape and arrangement and often fusing into 3 spiral bands, at centre, below shoulder and at base, and with axial streaks or blotches. Pattern varying from scattered flecks to solid bands. Spiral rows of variably alternating brown and white to light grey dots and dashes generally extending from base to shoulder; rows without light markings intergrade with rows containing only a few dark dots and consisting mainly of light dashes. Base, siphonal fasciole and columella light to dark brown. Apex white to orange. Postnuclear sutural ramps with brown to blackish brown radial streaks and blotches, usually faded in early whorls. Aperture light to dark violet.

***C. ardisiaceus* Shell Morphometry**

<b>L</b>	25 - 55 mm
<b>RW</b>	0.10 - 0.32 g/mm
<b>RD</b>	0.65 - 0.73
<b>PMD</b>	0.70 - 0.83
<b>RSH</b>	0.10 - 0.20

Periostracum yellowish olive, rather thin, variably translucent, with tufted spiral ridges on last whorl and spire; tufts usually longer at shoulder edge.

**Habitat and Habits:** Shallow water; on coral reef.

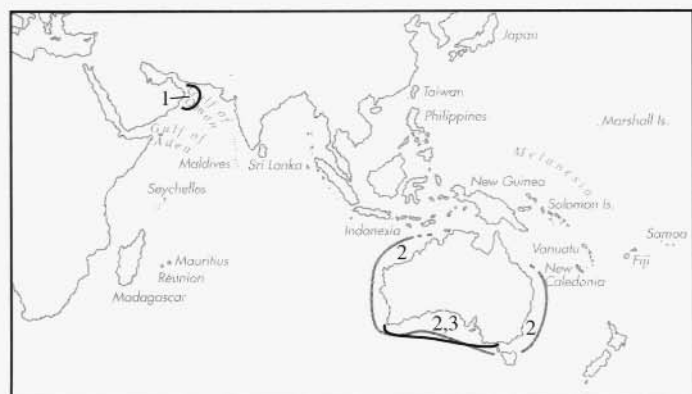
**Discussion:** *C. ardisiaceus* resembles *C. anemone*, *C. tinianus* and *C. papilliferus*. For comparison with *C. anemone* and *C. papilliferus*, see the Discussions of those species. *C. tinianus* (see Vol. II) differs in having a narrower



last whorl (RD about 0.53–0.66) that is ventricosely conical to conoid-cylindrical rather than to ovate (PMD about 0.76–0.84); the spiral sculpture on its late sutural ramps is finer and weak to obsolete. *C. tinianus* has a yellow to orange-red or a black animal that is heavily dotted with white.

The taxonomic status of *C. ardisiaceus* was disputed until Coomans et al. (1981) designated a neotype (Pl. 59, Fig. 2), satisfactorily corresponding with Kiener's original figure (Pl. 59, Fig. 1). We agree with these authors in applying the name to a *Conus* species endemic to Oman.

Map 120



1: *C. ardisiaceus* 2: *C. anemone* 3: *C. clarus*

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### *Conus anemone* LAMARCK, 1810

(Plate 59, Figures 8–20; Map 120)

- 1810 *Conus anemone* Lamarck, Ann. Mus. Hist. Nat. Paris, **15**: 272, no. 78
- 1810 *Conus fusiformis* Lamarck, Ann. Mus. Hist. Nat. Paris, **15**: 423, no. 129 (non *C. fusiformis* Fischer, 1807)
- 1833 *Conus maculosus* Sowerby I, Conch. Ill.: Pt. 24, fig. 3,3\* (non *C. maculosus* (Röding, 1798))
- 1854 *Conus novaehollandiae* A. Adams, Proc. Zool. Soc. London, **1853**: 119 no. 21
- 1854 *Conus comptus* A. Adams, Proc. Zool. Soc. London, **1853**: 119 no. 19 (non *C. comptus* Gould, 1853)
- 1858 *Conus superstriatus* Sowerby II, Thes. Conch., **3**: 37–38, pl. 13 (199) fig. 282
- 1858 *Conus maculatus* Sowerby II, Thes. Conch., **3**: 31, pl. 13 (199) fig. 296 (non *C. maculatus* Bosc., 1801)
- 1866 *Conus compressus* Sowerby II, Thes. Conch., **3**, *Conus* suppl.: 325 no. 404, pl. 25 (286) figs. 602, 603
- 1866 *Conus roseotinctus* Sowerby II, Thes. Conch. **3**, *Conus* suppl.: 325 no. 405, pl. 25 (286) fig. 604
- 1870 *Conus rossiteri* Brazier, Proc. Zool. Soc. London **1870**: 109; J. Conchyl. (Paris), **18**: 301
- 1877 *Conus carmeli* Tenison-Woods, Papers Proc. Rpt. Roy. Soc. Tasmania, **1876**: 134 no. 7
- 1898 *Conus flindersi* Brazier, Linn. Soc. New South Wales, **22**: 780
- 1898 *Conus remo* Brazier, Linn. Soc. New South Wales, **23**: 271

- 1931 *Floraconus peronianus* Iredale, Rec. Australian Mus., **18**: 224–225, pl. 25 fig. 12
- 1937 *Conus atractus* Tomlin, Proc. Zool. Soc. London, **22**: 206 (nom. nov. for *C. fusiformis* Lamarck)
- 1942 *Conus incinctus* Fenaux, Bull. Inst. Océan. (Monaco), **814**: 3, fig. 6
- 1942 *Conus nitidissimus* Fenaux, Bull. Inst. Océan. (Monaco), **814**: 3, fig. 7
- 1945 *Floraconus singletoni* Cotton, Rec. South Australian Mus., **8** (2): 263–264, pl. 4 fig. 10
- 1945 *Floraconus saundersi* Cotton, Rec. South Australian Mus., **8** (2): 264–265, pl. 4 fig. 8

**Types:** *C. anemone*: Lectotype (Kohn, 1981) in MHNG (45 x 21 mm); *C. fusiformis*: Holotype in MHNG (48 x 21 mm); *C. maculosus*: Lectotype (Kohn, 1992) figured in Sowerby I (1833: Pt. 24, fig. 3) (34 x 17 mm); *C. novaehollandiae*: 3 syntypes in BMNH (38 x 21; 36.5 x 20; 34.5 x 18.5 mm); *C. comptus*: Type in BMNH (21 x 12 mm); *C. superstriatus*: 3 syntypes in BMNH (38 x 20; 36 x 18; 26 x 12.5 mm); *C. maculatus*: Original figure 27.5 x 16 mm; *C. compressus*: Holotype in BMNH (25 x 10.5 mm); *C. roseotinctus*: Type in BMNH (21 x 10 mm); *C. rossiteri*: Holotype in AMS (14.5 x 8.5 mm); *C. carmeli*: Holotype in TMH (22 x 9 mm); *C. flindersi*: Holotype in SAM (28 x 15 mm); *C. remo*: Lectotype (Cotton, 1945) in SAM (35 x 17.5 mm); *F. peronianus*: Holotype in AMS (60.5 x 32.5 mm); *C. incinctus*: Original figure 27 x 12.5 mm; *C. nitidissimus*: Original figure 21 x 9.5 mm; *F. singletoni*: Holotype in SAM (43.5 x 22 mm); *F. saundersi*: Holotype in SAM (57 x 32 mm).

**Type Localities:** *C. anemone*: "les côtes de la nouvelle Hollande"; *C. fusiformis*: "l'Océan pacifique"; *C. maculosus*: "Swan River, New South Wales"; *C. novaehollandiae*: "Swan River"; *C. comptus*: "Natal"; *C. maculatus*: "Capul, Philippines"; *C. rossiteri*: "Cape Solander, Botany Bay, New South Wales"; *C. carmeli*: "North coast, Tasmania"; *C. flindersi*: "Flinders, Victoria"; *C. remo*: "San Remo, Victoria"; *F. peronianus*: "Sydney Harbour"; *C. incinctus*: "Australie"; *C. nitidissimus*: "Australie"; *F. singletoni*: "Victoria, Western Port"; *F. saundersi*: "Yorke Peninsula, Edithburgh, Levens Beach."

**Range:** Queensland southward and westward to W. Australia, northward to King Sound; N. coast of Tasmania.

**Description:** Moderately small to large, moderately light to solid. Specimens from shallow-water habitats in W. Australia smaller but relatively heavier than deeper subtidal specimens from eastern localities. Last whorl ventricosely conical to ovate, sometimes conoid-cylindrical or pyriform; outline slightly to strongly convex, rarely sigmoid; left side often variably concave above base. Shoulder angulate, occasionally subangulate. Spire low to high, outline straight to concave; spire height of form *carmeli* usually outside the range of all other variants (mean RSH 0.28). Larval shell "hooked", of 2–2.5 whorls, maximum diameter about 1.3 mm; surface with irregularly arranged minute granules (at high magnification; Kohn, 1993). First 2–5 postnuclear whorls tuberculate; in form *carmeli*, first 6–8 postnuclear whorls tuberculate. Teleoconch sutural ramps flat and steep to horizontal, with 2–3 increasing to 7–10 spiral grooves. Last whorl variable in surface sculpture: Often closely spaced and uniformly broad spiral ribs extending from base to shoulder; occasionally a few more widely spaced and stronger ribs at base. In largely smooth specimens, spiral ribs weak and restricted to base, followed adapically by spiral threads up to shoulder. In some populations (throug-

hout entire range), distinctly sculptured shells intergrade with fairly smooth ones; some variants are more constant in surface sculpture, e.g., the relatively smooth form *peronianus*.

#### ***C. anemone* Shell Morphometry**

<b>L</b>	30 - 93 mm
<b>RW</b>	0.08 - 0.30 g/mm (L 30-80 mm)
<b>RD</b>	0.54 - 0.69
- form <i>peronianus</i>	0.54 - 0.63
- form <i>carmeli</i>	0.57 - 0.75
<b>PMD</b>	0.70 - 0.84
<b>RSH</b>	0.09 - 0.23
- form <i>peronianus</i>	0.09 - 0.13
- form <i>carmeli</i>	0.21 - 0.34

Ground colour white, cream, pale blue, pink, or light violet; usually several of these colours merge on the same shell. Pattern of last whorl variable, consisting of 2-3 spiral bands, variably sized blotches, flames, axial streaks and lines. Pattern elements orange or brown to reddish and blackish brown. Immaculate white or pink shells intergrade with shells largely overlaid with solid dark brown, except for a central ground-colour band with brown reticulation. Additional spiral rows of orangish, reddish or blackish brown dashes vary considerably in number and arrangement; dark dashes may alternate regularly with ground-colour dashes within the rows. Colour pattern typically relatively sombre (dark brown markings on a bluish ground) in northwestern populations and often exhibiting bright, light colours (orange, pink, light violet) in populations from Southern Australia. Larval whorls white, cream, orange or brown (for development, see Kohn, 1993). Postnuclear sutural ramps variably maculated with brown radial streaks and blotches; immaculate spires intergrade with heavily blotched ones. Aperture mainly pale blue or violet variably suffused with brown, also dark brown or orange, pink or rarely white.

Periostracum light brown, thin, translucent, smooth.

Animal white, mottled with pinkish grey; dorsum of foot, rostrum and siphon edged with light pink (Whitehead, pers. comm., 1988). Siphon, foot and mantle dull white or pale grey, sparsely flecked with bright white (Rottnest Id., W. Australia; Kohn, pers. observ.). Bergh (1895) reports the animal to be brown or violet, with the rostrum and siphon brighter and the sole of the foot grey (Port Jackson, NSW).

Radular teeth with an adapical barb opposite a second barb; serration rather weak and terminating in a cusp; base with a distinct spur (Bergh, 1895; Peile, 1939, as *C. novae-hollandiae*; Cotton, 1945).

**Habitat and Habits:** Intertidal and subtidal to about 40 m; on reefs, rock platforms, sand bottoms or rock rubble, often sheltering beneath stones, rock or boulders and among algae or eel-grass. In N. W. Australia, *C. anemone* is reported from the intertidal zone to 6 m, and in S. W. Australia,

to approximately 30 m. Some variants from S. Australia are found even deeper: Form *peronianus* in 10-20 m, and form *carmeli* to 40 m. However, intertidal populations also occur in the southern part of the species range.

Preserved material from Victoria (AMS) shows that *C. anemone* preys on polychaetes (also Kohn & Almasi, 1993).

Egg capsules variable in size and shape: Dimensions range from 7-11 x 4-8 mm or 9-12 x 7 mm to 16-19 x 9-12 mm (Mornington Peninsula, Victoria; Jervis Bay, New South Wales), and capsule sacs are circular to rectangular in outline. Spawning takes place in sheltered sites, under rocks or stones in 1-5 m in typical form of *C. anemone*. Capsules are deposited in often irregular clusters and affixed to the substrate by confluent basal plates. Substrate may be hard (stone, shells) or capsules of the same spawn; some capsules may be affixed to others at various sites and in a variable orientation. Huish (1978) reports a mean number of 65 eggs per capsule and a mean egg diameter of 590 µm indicating a totally benthic development (acc. Peron & Kohn, 1985). Smith, Black & Shepherd (1935) report "large communal egg masses" with individually attached capsules of 8 x 3 mm each containing 15-60 eggs about 300-500 µm in diameter. In spite of this egg size, the hatchling is reported to be a crawling stage. At Rottnest Id., capsules contain 16-22 ovoid eggs each; egg diameter is 756-830 x 671-744 µm, and the hatchling is a veliconcha of about 1.6 mm (Kohn 1993).

**Discussion:** *C. anemone* may be similar to *C. cocceus*, *C. ardisiaceus*, and *C. clarus*. For comparison with *C. clarus*, see the Discussion of that species. *C. cocceus* is generally smaller and tends to have a broader last whorl (RD 0.60-0.71); its shoulder is rounded to indistinct, its spire outline convex rather than straight, and its postnuclear whorls are not tuberculate. *C. ardisiaceus* differs in its usually broader last whorl (RD 0.65-0.73) that is distinctly smoother and has a contrasting brown anterior end. The periostracum is smooth in *C. anemone* but bears tufted spiral ridges in *C. ardisiaceus*.

Diversity of suitable habitats and benthic development with reduced vagility apparently have led to a high intraspecific variability and the description of variants as different nominal taxa. Rather the variants appear to be individual forms, local forms or ecological variants of somewhat wider range. We consider the following nominal taxa to be such forms:

- *C. atractus* (nom. nov. for *C. fusiformis*) (Pl. 59, Fig. 20): The holotype is a relatively high-spined, faded pale brown shell lacking any pattern. With regard to the presence of tuberculate early postnuclear whorls and the absence of a carinate shoulder, we assign it to *C. anemone* rather than to *C. clarus*. Form *atractus* is very similar to form *carmeli*.

- *C. carmeli*: This variant (Pl. 59, Figs. 14, 15) has sometimes been considered a valid species. More often, it is erroneously referred to as *C. anemone* f. *compressus* (Wilson & Gillett, 1971; Walls, [1979]; Lauer & Richard, 1989), but this has been corrected by Kendrick & Ryland (1981) and Coomans et al. (1985a). Specimens described as

*C. carmeli* have biconic shells (RD 0.57-0.75) with a spire of moderate height to high. They differ from other forms of *C. anemone* in spire height (mean 0.28 vs. 0.14), larger number of tuberculate postnuclear whorls (6-8), and yellowish brown aperture. Only extreme variants of *C. carmeli* have RD outside the range of other *C. anemone* variants (0.53-0.68); the mean values, however, are the same. We consider the differences from *C. anemone* insufficient to justify separation at species level. The form described as *C. carmeli* occurs from the Bass Strait (Victoria/Tasmania) westward to Ceduna (S. Australia).

- *C. compressus*: A local form from the Houtman Abrolhos (see Kendrick & Ryland, 1981) (Pl. 59, Fig. 18).

- *C. maculosus*: A shape and colour pattern variant occurring in various parts of the species range.

- *C. novaehollandiae*: Considered a subspecies of *C. anemone* from northern W. Australia by Coomans et al. (1980) and Richard (1990). Coomans et al. cited *C. a. novaehollandiae* only as "with a low spire". However, the shells from the northwestern populations and the typical form of *C. anemone* cannot be separated by spire height (RSH 0.09-0.20 vs 0.10-0.23), nor by shape, sculpture and colour pattern. Therefore we favour the taxonomic status of a form rather than that of a geographical subspecies (Pl. 59, Fig. 19).

- *C. peronianus*: Probably an ecological variant, growing larger, usually with a lower spire and generally brighter in colour than other forms of *C. anemone* (Pl. 59, Figs. 11-13). It ranges from southern W. Australia eastward to Tasmania and Sydney, New South Wales. Walls ([1979]), da Motta (1986), and Richard (1990) considered *C. peronianus* a valid species, but its shell morphometry characters are entirely within the range of *C. anemone*, and there are no constant differences in colour, number of larval whorls, or sculpture of spire and last whorl.

- *C. remo*: A colour form ("splashed with bright orange"; Cotton, 1945) (Pl. 59, Fig. 16) from South Australia and Victoria (Cotton: Port Macdonnell to Western Port).

- *C. saundersi*: A shape and colour pattern variant very similar to *C. maculosus*.

- *C. singletoni*: A variant with a white shell (Pl. 59, Fig. 17).

- *C. comptus*, *C. flindersi*, *C. roseotinctus*, and *C. rossiteri* are based on subadult specimens. *C. rossiteri* (holotype: L 14.5 mm) may be a juvenile of *C. anemone* or of *C. papilliferus*.

**Types:** *C. clarus*: Holotype in BMNH (26.5 x 14 mm); *C. segravei*: Holotype in NMV (33 x 17 mm).

**Type Localities:** *C. clarus*: "West Australia"; *C. segravei*: "Shoreham, Western Port, Victoria."

**Range:** S. Australia, W. Port Bay (Victoria) to Cape Leeuwin (W. Australia).

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl ventricosely conical, outline moderately convex adapically and less so toward base. Shoulder usually carinate, rarely angulate. Spire of moderate height to high, often stepped; outline straight to slightly concave. Larval shell of 2-2.25 whorls, maximum diameter 1-1.2 mm. Postnuclear spire whorls carinate except for first 2-3 whorls. Teleoconch sutural ramps flat, with 2-3 increasing to 4-8 variably arranged spiral grooves, often weaker and with spiral striae in latest whorls. Last whorl smooth, except distinct spiral ribs on basal third, paired and grading to ribbons toward centre.

#### *C. clarus* Shell Morphometry

<b>L</b>	27 - 54 mm
<b>RW</b>	0.06 - 0.26 g/mm
<b>RD</b>	0.57 - 0.67
<b>PMD</b>	0.80 - 0.85
<b>RSH</b>	0.15 - 0.32

Ground colour white to pale pink. Last whorl with fusing pale violet-brown or orange-brown clouds concentrated on both sides of a subcentral spiral ground-colour band. Larval whorls white. Postnuclear sutural ramps with radial streaks matching last whorl pattern in colour. Aperture pink, violet, or orange-brown.

Periostracum light brown, thin, translucent, smooth.

**Habitat and Habits:** In 7-80 m; on sand substrate. Reported to feed on fishes (Coleman, 1975).

**Discussion:** *C. clarus* resembles *C. cocceus* and *C. anemone*. *C. cocceus* has a generally broader and often ovate last whorl (RD 0.60-0.71; PMD 0.71-0.85), convex spire outline, rounded to indistinct shoulder, and generally broader larval shell (1.2-1.5 mm). *C. anemone* mainly can be distinguished by its angulate to subangulate shoulder, its tuberculate first 2-8 postnuclear whorls, and its sculptured last whorl up to the shoulder.

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### *Conus clarus* E. A. SMITH, 1881

(Plate 59, Figures 21, 22; Map 120)

- 1881 *Conus clarus* E. A. Smith, Ann. Mag. Nat. Hist. (5) 8: 442  
1891 *Conus segravei* Gatliff, Victorian Nat. 7: 179, pl. figs.

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### *Conus papilliferus* SOWERBY I, 1834

(Plate 59, Figures 23-25; Map 121)

- 1834 *Conus papilliferus* Sowerby I, Conch. Ill.: Pt. 56, fig. 79  
1848 *Conus jukesii* Reeve, Conch. Icon. 1, *Conus* suppl.: Pl. 2 sp. 278



**Types:** *C. papilliferus*: Lectotype (Kohn, 1992) figured in Sowerby I (1834: Pt. 56, fig. 79) (23 x 13 mm); *C. jukesii*: Original figure 25 x 15 mm.

**Type Localities:** *C. jukesii*: "North Australia; Jukes."

**Range:** New South Wales, Australia.

**Description:** Small to medium sized, light to moderately solid. Last whorl ventricosely conical to broadly and ventricosely conical, sometimes slightly pyriform; outline convex, straight or sometimes slightly concave near base; left side sigmoid. Shoulder angulate to rounded. Spire of low to moderate height; outline almost straight, with projecting larval shell. Larval shell of 1.5-2 whorls, maximum diameter 1.1-1.2 mm. Teleoconch sutural ramps flat to slightly concave; 4 increasing to 6-10 rather fine spiral grooves on late ramps. Last whorl with variably spaced weak spiral ribs at base.

#### *C. papilliferus* Shell Morphometry

<b>L</b>	20 - 37 mm
<b>RW</b>	0.05 - 0.20 g/mm
<b>RD</b>	0.66 - 0.73
<b>PMD</b>	0.77 - 0.85
<b>RSH</b>	0.08 - 0.14

Ground colour grey to light blue or light violet. Last whorl with olive to dark brown flecks, blotches, flames and axial zigzag lines, usually arranged above and below a slightly paler spiral band at centre. Spiral rows of usually alternating brown and white dots extending from base to shoulder, variable in number and prominence. Base and basal part of columella white to light grey. Larval whorls grey to pale blue. Postnuclear sutural ramps with brown radial markings. Aperture dark violet-brown behind a white margin, with a paler central band.

Periostracum yellowish to greenish grey, rather thin, translucent, with closely spaced spiral rows of tufts on last whorl including shoulder.

Dorsum of foot brown to violet, sole greyish brown. Rostrum and siphon of similar but slightly paler colour. Edge of mantle yellowish brown, with short darker streaks.

Radular teeth with an adapical barb opposite a weak blade; serration ending in a cusp above the central waist; basal spur present (Bergh, 1895; Rolán, 1993).

**Habitat and Habits:** In shallow water; on flats, inhabiting areas sheltered from constant wave pounding.

Egg capsules of 10-16 x 6-6.5 mm deposited in clumps under rocks and in crevices, attached to hard substrate by confluent basal plates; about 20-30 capsules per female and spawn. Clumps often made by several females, then comprising more than 100 capsules. Observed number of eggs per capsule is 10, and observed mean egg diameter 1,000 µm predicting a completely benthic development (Huish, 1978; Loch, pers. comm., 1987).

**Discussion:** *C. papilliferus* resembles the sympatric *C. aplustre*; for comparison, see the Discussion of the latter species. *C. ardisiaceus* may also be similar but differs in its generally larger size (L 25-55 mm), higher spire (RSH 0.10-0.20) and more ventricose last whorl (PMD 0.70-0.83). Its last whorl pattern often forms 2-3 spiral bands, its base and columella are brown.

Map 121



1: *C. papilliferus* 2: *C. aplustre* 3: *C. rutilus* 4: *C. cyanostoma*

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### *Conus aplustre* REEVE, 1843

(Plate 59, Figures 26-28; Map 121)

- 1843 *Conus aplustre* Reeve, Proc. Zool. Soc. London, **11**: 171; Conch. Icon., **1**: Pl. 30 sp. 170
- 1854 *Conus neglectus* A. Adams, Proc. Zool. Soc. London, **1853**: 117-118
- 1870 *Conus cooki* Brazier, Proc. Zool. Soc. London, **1870**: 109; J. Conchyl. (Paris), **18**: 300-301

**Types:** *C. aplustre*: Lectotype (Coomans et al., 1981) in BMNH (26 x 16 mm); *C. neglectus*: Type in BMNH (19 x 12 mm); *C. cooki*: Lectotype (Coomans et al., 1985a) in AMS (17 x 11 mm).

**Type Localities:** *C. aplustre*: "Woody Head, New South Wales" (Coomans et al., 1981); *C. cooki*: "Cape Solander, Botany Bay, New South Wales."

**Range:** New South Wales and S. Queensland, Australia.

**Description:** Small to moderately small, light to moderately solid. Last whorl ventricosely conical to broadly and ventricosely conical; outline convex adapically, straight toward base; left side may be concave near base. Shoulder angulate to rounded. Spire of low to moderate height, outline straight to sigmoid. Teleoconch sutural ramps flat to slightly concave; 3 increasing to 5-8 variably fine spiral

grooves on late ramps. Last whorl with rather widely spaced distinct spiral ribs on basal third to half.

#### ***C. aplustre* Shell Morphometry**

<b>L</b>	20 - 27 mm
<b>RW</b>	0.05 - 0.13 g/mm
<b>RD</b>	0.62 - 0.73
<b>PMD</b>	0.75 - 0.85
<b>RSH</b>	0.09 - 0.14

Ground colour greyish to light blue. Last whorl with 2-5 (usually 3) variably broad, olive to brown or pink spiral bands. Variably spaced spiral rows of small to large squarish brown dots extending from base to shoulder, sometimes reduced and often with intermittent greyish to bluish white dashes. Postnuclear sutural ramps with brown wavy radial lines and streaks, sometimes extending over shoulder. Aperture brownish or dark violet behind a translucent marginal zone, with a pale band at centre and shoulder.

Periostracum yellowish to brownish olive, rather thin, translucent to opaque, rough.

Foot, rostrum and siphon white, speckled with black.

Radular teeth with an adapical barb opposite a weak blade; weak serration present (Bergh, 1895).

**Habitat and Habits:** In shallow water; under rocks.

**Discussion:** *C. aplustre* is similar to *C. papilliferus* in shape and sculpture. The latter species is often larger and less straight in outline. Its last whorl pattern lacks spiral colour bands but has olive to dark brown axial markings, and the dotted spiral lines are more often incomplete or absent; its last whorl sculpture is less prominent, and its periostracum has spiral rows of tufts. The animals have a quite different colouration.

*C. cooki* may be a colour form with reticulated red-brown axial lines and streaks but without spiral rows of dots. However, its assignment to *C. aplustre* remains doubtful mainly on account of its slightly more conical last whorl.

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### ***Conus rutilus* MENKE, 1843**

(Plate 59, Figures 29-33; Map 121)

- 1843 *Conus rutilus* Menke, Moll. Novae Hollandiae: 27, sp. 133  
 1876 *Conus tasmanicus* Tenison-Woods, Pap. Proc. Rept. R. Soc. Tasmania, 1875: 139 (non *C. tasmaniae* Sowerby II, 1866)  
 1877 *Conus macleayana* Tenison-Woods, Pap. Proc. Rept. R. Soc. Tasmania, 1876: 134 (nom. nov. for *C. tasmanicus* Tenison-Woods, 1876)

1877 *Conus (Stephanoconus) smithi* Angas, Proc. Zool. Soc. London, 1877: 36, pl. 5 fig. 8

**Types:** *C. rutilus*: Holotype lost ("6 x 4 lin." = 12 x 8 mm acc. Menke); *C. macleayana*: Holotype in TMH (13 x 8 mm); *C. smithi*: Type in BMNH (10.5 x 6 mm).

**Type Localities:** *C. rutilus*: "In litore septentrionali-occidentali"; *C. tasmanicus*: "Tasmania"; *C. smithi*: "Cape Solander, Botany Bay."

**Range:** S. Australia, New South Wales to Perth; Tasmania.

**Description:** Very small and light. Last whorl conical or ventricosely conical to broadly conical or broadly and ventricosely conical; outline convex to straight, straighter toward base; left side usually concave near base. Shoulder subangulate to broadly carinate, weakly tuberculate to undulate. Spire of low to moderate height, outline concave to straight. Larval shell of 1.25-1.5 whorls, maximum diameter 0.7-0.9 mm. Postnuclear spire whorls distinctly tuberculate to undulate. Teleoconch sutural ramps concave, rarely with obsolete spiral striae. Last whorl with weak spiral ribs or narrow ribbons near base, seldom to centre.

#### ***C. rutilus* Shell Morphometry**

<b>L</b>	8.5 - 13 mm
<b>RW</b>	≤ 0.03 g/mm
<b>RD</b>	0.66 - 0.80
<b>PMD</b>	0.75 - 0.95
<b>RSH</b>	0.06 - 0.21

Colour from white or grey through yellow, pink or orange to violet and brown. Last whorl usually with spiral rows of often alternating white and dark dots or dashes as well as with dark and white wavy to zigzag-shaped axial lines and streaks. In dark shells, last whorl may be encircled with a light band below centre; in light shells, with 2-4 interrupted to solid dark bands. Specimens with almost uniformly coloured last whorls intergrade with specimens with strongly speckled last whorls. Larval whorls white to dark brown. Postnuclear sutural ramps white to grey or matching last whorl in colour, immaculate or with brown radial markings. Aperture matching the exterior surface in colour.

Periostracum yellowish brown, thin, translucent, smooth.

**Habitat and Habits:** Intertidal and uppermost subtidal; on coral reef, in sand and short weed (Turnbull, pers. comm., 1987).

**Discussion:** *C. rutilus* cannot be confused with any other *Conus* species.

**Conus cyanostoma** A. ADAMS, 1854

(Plate 59, Figures 34-37; Map 121)

- 1854 *Conus cyanostoma* A. Adams, Proc. Zool. Soc. London, **1853**: 116-117
- 1875 *Conus coxeni* Brazier, Proc. Zool. Soc. London, **1875**: 34, pl. 4 fig. 10
- 1892 *Conus innotabilis* E. A. Smith, Proc. Zool. Soc. London, **1891**: 487, pl. 40 fig. 1

**Types:** *C. cyanostoma*: Type in BMNH (27 x 15 mm); *C. coxeni*: Original figure 32 x 15 mm; *C. innotabilis*: 2 syntypes in BMNH (17 x 9.5; 15 x 9 mm).

**Type Localities:** *C. cyanostoma*: "West Africa", corrected in "Keppel Bay, Queensland" (Coomans et al., 1985a); *C. coxeni*: "Moreton Bay"; *C. innotabilis*: "Rocky Point, four miles north of Richmond River, N. S. Wales; also Port Stephens near Sydney."

**Range:** Queensland to N. New South Wales, Australia.

**Description:** Small to moderately small, light to moderately solid. Last whorl conical or ventricosely conical to broadly conical or broadly and ventricosely conical; outline convex adapically, less so below; left side slightly concave near base. Shoulder angulate, sometimes subangulate. Spire usually of moderate height, outline concave to slightly sigmoid. Larval shell of 1.75-2 whorls; maximum diameter 0.7-0.8 mm in typical form, 0.8-1.1 mm in form *innotabilis* (Pl. 59, Fig. 37). First 3-4 postnuclear whorls smooth to very weakly tuberculate in typical form, weakly to distinctly tuberculate in form *innotabilis*. Teleoconch sutural ramps flat, with 0-1 increasing to 3-5 spiral grooves. Last whorl with variably spaced, axially striate spiral grooves on basal third to two-thirds and with 2-3 additional grooves just below shoulder; intervening ribbons narrow toward base and at shoulder. In form *innotabilis*, entire last whorl with strong spiral grooves.

**C. cyanostoma** Shell Morphometry

<b>L</b>	17 - 32 mm
<b>RW</b>	0.04 - 0.15 g/mm (L 17-27 mm)
<b>RD</b>	0.66 - 0.74
<b>PMD</b>	0.79 - 0.89
<b>RSH</b>	0.15 - 0.22
- form <i>innotabilis</i>	0.12 - 0.26

Ground colour light bluish grey in typical form, white to pinkish violet in form *innotabilis*. In typical form, last whorl without pattern, or with orangish brown to brown spots and flecks forming spiral bands below shoulder, above centre and often within basal third. Spiral rows of alternating brown dots and pale grey dashes extend from base to shoulder, varying in number and prominence. Form *innotabilis* differs in the yellowish brown to orange colour of the pattern. Larval whorls white, sometimes grading to pale olive in typical form. Postnuclear sutural ramps with radial lines to blotches extending beyond outer margins and

matching last whorl pattern in colour. In typical form, aperture violet, demarcated from the margin by a brown collabral band; form *innotabilis* with an orange aperture.

Radular teeth with an adapical barb opposite a weak blade; serration ending in a small cusp above the central waist; base with a spur (Rolán, 1993).

**Habitat and Habits:** Typical form in shallow water to about 55 m; form *innotabilis* in 40-150 m.

**Discussion:** *C. cyanostoma* cannot be confused with adult specimens of any of its Indo-Pacific congeners. Caribbean species as *C. puncticulatus* Hwass and *C. jaspideus* Gmelin may be similar in shape and colour, but differ mainly in the absence of spiral grooves from sutural ramps.

The holotype of *C. cyanostoma* represents the patternless variety of the typical form. The conchological differences between typical form and the deeper subtidal form do not justify a separation at the species level. Erosion allows no data on the apices of the 2 syntypes of *C. innotabilis*; they otherwise match the deeper-subtidal shells of *C. cyanostoma*. We therefore apply the form name "*innotabilis*" to these shells. *C. coxeni* is known only by the original figure showing a shell with a straight-sided high spire (RSH ca. 0.33) and a broad last whorl (RD ca. 0.78), strongly sculptured on its basal two-thirds. The figure does not match typical *C. cyanostoma* nor form *innotabilis* satisfactorily. We provisionally assign *C. coxeni* to *C. cyanostoma* as a form or an aberrant specimen, although it might represent a separate species (see Coomans et al., 1985a; Richard, 1990).

**Conus nielsenae** MARSH, 1962

(Plate 60, Figures 1-11; Map 122)

- 1962 *Conus (Leptoconus) nielsenae* Marsh, J. Malac. Soc. Australia, **6**: 40-42, pl. 4 figs. 1, 2
- 1975 *Conus (Leptoconus) typhon* Kilburn, Durban Mus. Nov., **10** (15): 213-216, text figs. 1a-b, pl. 1 figs. a-d
- 1979 *Conus nielsenae reductaspiralis* Walls, The Pariah, **5**: 5-6, text figs.
- 1987 *Conus thevenardensis* da Motta, La Conchiglia, **19** (222-223): 29-30, text figs. 1-5

**Types:** *C. nielsenae*: Holotype in AMS (49 x 28 mm); *C. typhon*: Holotype in NM (46 x 27 mm); *C. n. reductaspiralis*: Holotype in DMNH (33.5 x 16.5 mm); *C. thevenardensis*: Holotype in MHNG (47.5 x 29.5 mm).

**Type Localities:** *C. nielsenae*: "north-east of Cape Bowling Green, near Townsville, Queensland"; *C. typhon*: "off Ilha Chiloane, Moçambique (20°37'S., 34°55'E.)"; *C. n. reductaspiralis*: "Australia, Western Australia, Geraldton"; *C. thevenardensis*: "Thevenard Island (21.27 S 115.00 E) West Australia, within a stretch of 4 kilometres N. E. E. of the island."



**Range:** *C. n. nielsenae*: Queensland to New South Wales and Kermadec Is.; *C. n. reductaspiralis*: W. Australia, N. W. Cape to Cape Leveque (Coomans & Filmer, 1985; Turnbull, pers. comm. 1987); *C. n. typhon*: E. Transkei (South Africa) to Mozambique.

**Description:** *C. n. nielsenae* (Pl. 60, Figs. 1, 2): Medium sized, moderately solid. Last whorl conical, occasionally slightly pyriform; outline variably convex at adapical fourth, straight to slightly concave below. Shoulder angulate to slightly carinate. Spire usually low; outline deeply concave, with a conoid apex projecting from an otherwise rather flat spire. First 3-5 postnuclear whorls weakly tuberculate, late whorls often carinate. Teleoconch sutural ramps nearly flat, with 1-2 increasing to 3-5 weak spiral grooves in early whorls and an obsolete spiral striation in late whorls. Basal fourth of last whorl with a few spiral ribs anteriorly and very few spiral ribbons above.

*C. n. reductaspiralis* (Pl. 60, Figs. 3-8): Moderately small to medium sized or rarely to moderately large; moderately solid to solid; in large specimens, *C. n. reductaspiralis* twice as heavy as *C. n. nielsenae*. Last whorl usually conical, generally broader than in *C. n. nielsenae*, particularly in form *thevenardensis* (Pl. 60, Fig. 8); outline almost evenly straight or grading to convex at adapical fourth to third. Shoulder sharply angulate to carinate, less so in large specimens. Spire of low to moderate height in typical form, usually low in form *thevenardensis*; outline slightly to deeply concave. Larval shell of about 2 whorls, maximum diameter 1-1.1 mm. Teleoconch spire and last whorl match those of *C. n. nielsenae* in sculpture.

*C. n. typhon* (Pl. 60, Figs. 9-11): Moderately small to large, moderately solid to solid; deep-subtidal shells may have twice the maximum size of upper-subtidal shells. Last whorl conical to slightly pyriform; outline variably convex at adapical third, straight to slightly concave below. Shoulder carinate, angulate in larger specimens. Spire low, outline usually deeply concave. Larval shell of 1.75- 2.25 whorls, maximum diameter 1.1-1.2 mm. Teleoconch spire and last whorl match those of *C. n. nielsenae* in sculpture except for slightly more pronounced spiral striae on late sutural ramps.

*C. n. nielsenae*: Ground colour white, merged with light violet. Last whorl variably overlaid with orange, with variably prominent, closely spaced, orange-brown spiral lines. Base without spiral lines and usually lighter than adjacent area. Postnuclear sutural ramps with orange-brown radial streaks extending beyond outer margins. Aperture white, sometimes shaded with violet.

Periostracum thin, translucent, with spiral rows of hair-like tufts (Marsh, 1962).

*C. n. reductaspiralis*: Ground colour white. Last whorl immaculate white or more often variably overlaid with yellow to brown and sometimes additionally with violet. Latter shells with closely spaced brown spiral lines extending from shoulder to basal fifth; base light to dark brown, usually darker than adjacent area. Spiral lines often variably reduced, sometimes absent. Larval whorls white to cream, sometimes pale violet. Postnuclear sutural ramps immaculate white to heavily maculated with light to dark brown radial markings; early ramps sometimes immaculate pinkish orange to violet. Aperture white, sometimes violet.

Periostracum olive-grey to brown, thin to thick, opaque, with rather closely spaced, slightly tufted spiral ridges on last whorl (Pt. Hedland; Cape Keraudren; Thevenard Id.).

*C. n. typhon*: Ground colour white, sometimes largely suffused with yellow or violet on last whorl. Last whorl with 2 variably broad, light brown or violet spiral bands leaving ground colour zones at base, at centre and sometimes also below shoulder. Closely spaced brown spiral lines extending from base to shoulder, usually reduced at anterior end, sometimes completely absent. Base generally lighter than adjacent area. Immaculate white shells intergrade with heavily patterned shells. Larval whorls white or pale grey to brownish violet. Postnuclear sutural ramps variably suffused with light brown and violet, particularly in early whorls, immaculate or with sparse to numerous brown radial markings. Aperture white, sometimes with a pale violet band on each side of centre.

In shells from the upper subtidal, periostracum brown, thin, translucent, and smooth; deep-subtidal shells with a thicker and opaque periostracum bearing widely spaced tufted spiral ridges on the last whorl (Fernandes & Monteiro, 1992).

In *C. n. reductaspiralis*, animal pale cream flecked with brownish grey and brown (Whitehead, 1967; Singleton, 1979).

#### ***C. nielsenae* Shell Morphometry**

##### **L**

<i>C. n. nielsenae</i>	40 - 55 mm
<i>C. n. reductaspiralis</i>	27 - 51 mm, rarely to 61 mm
<i>C. n. typhon</i>	30 - 91 mm

##### **RW**

<i>C. n. nielsenae</i>	0.14 - 0.26 g/mm
<i>C. n. reductaspiralis</i>	0.06 - 0.50 g/mm
<i>C. n. typhon</i>	0.14 - 0.41 g/mm (L 30-47 mm)

##### **RD**

<i>C. n. nielsenae</i>	0.56 - 0.63
<i>C. n. reductaspiralis</i>	0.56 - 0.70
-f. <i>thevenardensis</i>	0.63 - 0.71
<i>C. n. typhon</i>	0.58 - 0.65

##### **PMD**

<i>C. n. nielsenae</i>	0.90 - 0.95
<i>C. n. reductaspiralis</i>	0.85 - 0.91
<i>C. n. typhon</i>	0.85 - 0.94

##### **RSH**

<i>C. n. nielsenae</i>	0.05 - 0.14
<i>C. n. reductaspiralis</i>	0.05 - 0.20
-f. <i>thevenardensis</i>	0.04 - 0.14
<i>C. n. typhon</i>	0.05 - 0.12

Radular teeth with an adapical barb opposite a narrow blade; weak serration from the posterior end of the barb to the posterior end of the blade; base with a spur. In form *thevenardensis*, serration slightly longer and consisting of 2-3 rows of stronger denticles. Radular teeth of *C. n. typhon* correspond with those of typical *C. n. reductaspiralis* in shape and armature (da Motta, 1987b; Kilburn, 1975; Rolán, pers. comm., 1992).

**Habitat and Habits:** *C. n. nielsenae*: In 30-100 m, in clean sand (Coomans & Filmer, 1985).

*C. n. reductaspiralis*: Intertidal to about 30 m; on intertidal flats of mud or muddy sand, on clean sand subtidally (Whitehead, 1967; Singleton., 1979; Turnbull, pers. comm., 1987). The population from Thevenard Id. is reported from the infralittoral fringe to 3 m, on muddy sand bottoms of coral reef (da Motta, 1987b; Gabelish, pers. comm., 1989). *C. n. reductaspiralis* may be active at bright daylight (Singleton, 1979), and one thousand specimens have been observed spawning in tidal creeks north of Pt. Hedland (Turnbull, pers. comm., 1987).

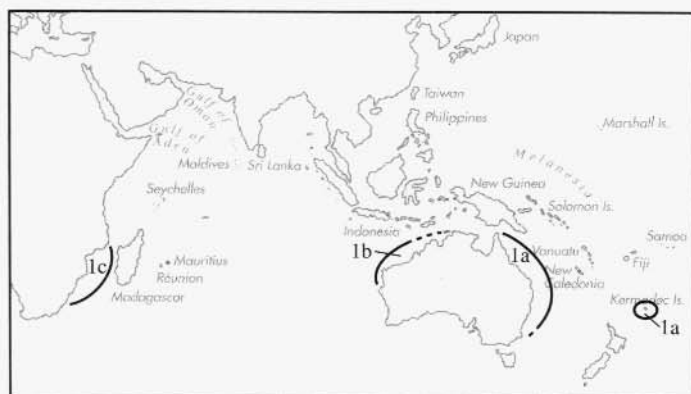
*C. n. typhon*: In 12-120 m. Populations with moderately small to medium-sized shells in 12-70 m on mud bottom; a population with moderately large to large shells was recently discovered in about 120 m off Quissico, S. Mozambique (Fernandes & Monteiro, 1992).

**Discussion:** *C. n. nielsenae* and *C. n. typhon* are similar to *C. voluminalis*. The latter species can be distinguished by its higher and more massive, projecting adapical part of the spire. Large specimens of *C. voluminalis* have an outwardly curved shoulder edge; typically patterned shells differ additionally in their long dark axial streaks as well as their more widely spaced and less uniform spiral lines on the last whorl.

With regard to the allopatric occurrence of *C. nielsenae*, *C. n. reductaspiralis*, and *C. typhon*, the conchological differences between them do not justify separation at the species level, but suggest the status of geographical subspecies (see Fernandes & Monteiro, 1992).

*C. thevenardensis* was described as a distinct species, although it cannot be distinguished from completely white

Map 122



1a: *C. nielsenae nielsenae* 1b: *C. nielsenae reductaspiralis*  
1c: *C. nielsenae typhon*

shells of *C. n. reductaspiralis*. The differences in the armature of radular teeth are very slight, and it is not known whether they are constant or not. In agreement with Coomans & Filmer (1985) we assign *C. thevenardensis* to *C. n. reductaspiralis* as the local form from Thevenard Id.

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### *Conus klemae* (COTTON, 1953)

(Plate 60, Figures 12-15; Map 123)

1953 *Rhizoconus klemae* Cotton, Trans. R. Soc. South Australia, **76**: 24, pl. 3 figs. 1-3

1970 *Rhizoconus coralinus* Habe & Kosuge, Venus, **29**(3): 81, pl. 5 figs. 3, 4 (con *C. coralinus* Kiener, 1845)

**Types:** *R. klemae*: Holotype in SAM (46.5 x 25.5 mm), *R. coralinus*: Holotype in NSMT (38.5 x 21.5 mm).

**Type Localities:** *R. klemae*: "Corny Pt., South Australia"; *R. coralinus*: "Zamboanga, Mindanao, Philippines."

**Range:** Western S. Australia to Houtman Abrolhos, W. Australia.

**Description:** Medium-sized to large, moderately solid to solid. Last whorl ventricosely conical, sometimes conical or slightly pyriform; outline convex adapically, straight or sometimes slightly concave below; left side usually concave near base. Shoulder angulate. Spire usually of moderate height, stepped; outline concave to slightly convex. Maximum diameter of larval shell about 0.8 mm. Early postnuclear whorls tuberculate. Teleoconch sutural ramps concave; 5-6 increasing to 7-10 spiral grooves on late ramps. Last whorl with a few widely spaced weak spiral ribs near base.

#### *C. klemae* Shell Morphometry

<b>L</b>	35 - 86 mm
<b>RW</b>	0.12 - 0.45 g/mm (L 35-65 mm)
<b>RD</b>	0.61 - 0.71
<b>PMD</b>	0.77 - 0.87
<b>RSH</b>	0.12 - 0.21

Ground colour light orange or light violet. Last whorl with a meshwork of orangish to dark brown flecks, blotches and flames, often variably fused into broad spiral bands on both sides of centre, leaving ground colour zones at base, centre and shoulder. Sparse spirally aligned brown dots may be present at centre, shoulder, and near base. Base nearly immaculate. Postnuclear sutural ramps with orangish to dark brown radial blotches, occasionally reduced to marginal spots. Aperture violet or orange.

Periostracum light brown, moderately thick, translucent, with regular spiral rows of tufts on last whorl (Turnbull, pers. comm., 1987).

Animal pale yellow (Turnbull, pers. comm., 1987).

**Habitat and Habits:** Intertidal to about 80 m; on coral reef from tidal flats to the reef slope; in sand beneath rocks, in pockets of sand or on bare limestone, and less common in pockets with algal turf (Kohn & Almasi, 1993).

*C. klemae* is known to feed on polychaetes of the family Eunicidae (Kohn & Almasi, 1993).

Egg capsules of 10-15 x 10-13 mm were found on the underside of small limestone rocks, each containing about 1,080 eggs. Egg diameter is about 280 µm, and the hatchling is a veliger (Kohn, 1993).

**Discussion:** *C. klemae* resembles *C. bruuni* and *C. wallangra*. *C. bruuni* is smaller (L 35-61 mm), generally has a narrower, conical last whorl (RD 0.55-0.64; PMD 0.84-0.91) and a broader larval shell (1.1-1.2 mm). For comparison with *C. wallangra*, see the Discussion of that species.

Map 123



1: *C. klemae* 2: *C. angasi*

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### *Conus angasi* TRYON, 1883

(Plate 60, Figures 16-20; Map 123)

- 1877 *Conus metcalfei* Angas, Proc. Zool. Soc. London, 1877: 173-174, pl. 26 fig. 13 (non *C. metcalfei* Reeve, 1843)
- 1883 *Conus angasi* Tryon, Man. Conch., 6: 62-63, pl. 19 fig. 99 (nom. nov. for *C. metcalfei* Angas)
- 1961 *Rhizoconus advertex* Garrard, J. Malac. Soc. Australia, 1 (5): 30-31, pl. 1 fig. 1

**Types:** *C. metcalfei*: Holotype in AMS (20 x 10.5 mm); *R. advertex*: Holotype in AMS (30 x 19 mm).

**Type Localities:** *C. metcalfei*: "at Sow and Pigs reef, Port Jackson"; *C. angasi*: "Port Jackson, Australia"; *R. advertex*: "off Moreton Is., Q."

**Range:** New South Wales and Queensland, Australia, possibly restricted to the area between Sydney and Fraser Id.

**Description:** Moderately small to medium-sized, moderately light to moderately solid; form *advertex* (Pl. 60, Figs. 19, 20) of smaller maximum size than typical form (Pl. 60, Figs. 16-18). Last whorl conical or ventricosely conical to broadly conical or broadly and ventricosely conical, form *advertex* often broader than typical form; outline convex at adapical third, straight below. Basal part of columella with a strong dentiform plait at its posterior end. Shoulder angulate, subangulate in large specimens. Spire low and usually with concave outline in form *advertex*, of low to moderate height and usually with slightly sigmoid outline in typical form. Larval shell of 1.75-2 whorls, maximum diameter 1.1-1.3 mm. Teleoconch sutural ramps almost flat, with 1-2 increasing to 4-8 spiral grooves, with additional spiral striae in latest whorls. Last whorl with rather closely spaced spiral ribs at base.

#### *C. angasi* Shell Morphometry

<b>L</b>	30 - 46 mm
-form <i>advertex</i>	27 - 37 mm
<b>RW</b>	0.08 - 0.20 g/mm (L 27-46 mm)
<b>RD</b>	0.65 - 0.71
-form <i>advertex</i>	0.66 - 0.75
<b>PMD</b>	0.77 - 0.89
-form <i>advertex</i>	0.81 - 0.90
<b>RSH</b>	0.08 - 0.19
-form <i>advertex</i>	0.01 - 0.09

Ground colour white to pale pink. Last whorl with pinkish to light brown spiral bands below shoulder, above centre and within basal third. Spiral rows of brown dots, dashes, spots and bars extending from base to shoulder, usually concentrated and partially fused near and within the spiral colour bands. Larval whorls white. Postnuclear sutural ramps with brown radial streaks usually extending beyond outer margins. Aperture white, tinged with cream and pink deep within.

**Habitat and Habits:** In 50-250 m. Form *advertex* is reported from sand bottom and seems to have a more limited bathymetric range (120-200 m).

**Discussion:** *C. angasi* is similar to *C. baeri* and *C. wallangra*; for comparison, see the Discussions of the latter species.

The conchological differences between *C. angasi* and *C. advertex* do not justify separation at the species level. Because they occur sympatrically, *C. advertex* should be provisionally considered a form of *C. angasi* (see Walls, [1979]; Coomans et al., 1979b; Richard, 1990).



***Conus baeri* RÖCKEL & KORN, 1992**

(Plate 60, Figures 21-24; Map 124)

1992 *Conus baeri* Röckel & Korn, Acta Conchyl., 3: 10-12, pl. 1 figs. 13-24.**Type:** Holotype in MHNG (44.5 x 26.5 mm).**Type Locality:** "Southern Mozambique."**Range:** Southern Mozambique.

**Description:** Moderately small to medium-sized, moderately solid. Last whorl usually conical to ventricosely conical; outline convex adapically, straight toward base; left side may be concave above base. Shoulder angulate. Spire of low to moderate height, outline almost straight to slightly concave. Larval shell of 2-2.25 whorls, maximum diameter 1.2-1.3 mm. Teleoconch sutural ramps nearly flat, with 2 increasing to 3-5 spiral grooves. Last whorl with distinct spiral grooves from base to centre or shoulder and ribbons between.

***C. baeri* Shell Morphometry**

<b>L</b>	30 - 45 mm
<b>RW</b>	0.10 - 0.25 g/mm
<b>RD</b>	0.62 - 0.71
<b>PMD</b>	0.82 - 0.90
<b>RSH</b>	0.09 - 0.17

Ground colour white to pale orange. Last whorl usually with a light orangish brown spiral band above and below centre, occasionally with an additional smaller band below shoulder. 10-15 spiral rows of reddish brown spots or bars extending from base to shoulder, sometimes fusing into irregular axial markings. Larval whorls white. Postnuclear sutural ramps with yellowish to reddish brown radial lines or streaks. Aperture brownish cream to pale orange.

**Habitat and Habits:** Reported from about 450 m.

**Discussion:** *C. baeri* is similar to *C. angasi* and *C. sydneyensis*. *C. angasi* can be distinguished by the presence of a strong tooth-like fold at the basal part of its columella and by the weaker sculpture of its last whorl (only a few fine spiral ribs near base). In addition, its spire has a slightly convex outline in late whorls and its late sutural ramps bear a finer spiral sculpture. For comparison with *C. sydneyensis*, see the Discussion of that species.

***Conus sydneyensis* SOWERBY III, 1887**

(Plate 60, Figures 25-27; Map 124)

1887 *Conus sydneyensis* Sowerby III, Thes. Conch., 5, *Conus* suppl.: 260, pl. 32 (510) fig. 6941961 *Leptoconus illawarra* Garrard, J. Malac. Soc. Australia, 5: 31-32, pl. 1 fig. 2

**Types:** *C. sydneyensis*: possible Holotype in IRSN (Moolenbeek, 1988) (22 x 12.5 mm); *L. illawarra*: Holotype in AMS (28.5 x 14.5 mm).

**Type Localities:** *C. sydneyensis*: "Port Jackson"; *L. illawarra*: "east of Stanwell Park, N. S. W."

**Range:** New South Wales, Australia.

**Description:** Moderately small, moderately light to moderately solid. Last whorl conical to ventricosely conical; outline slightly convex, left side concave near base. Shoulder angulate. Spire usually of moderate height, outline concave to slightly sigmoid. Larval shell of about 2.5 whorls, maximum diameter about 0.9 mm. Teleoconch sutural ramps flat, with 0-1 increasing to 3-4 wide spiral grooves. Last whorl with axially striate spiral grooves from base to centre; intervening ribbons narrower and arranged in pairs toward base, often grading to ribs at anterior end.

***C. sydneyensis* Shell Morphometry**

<b>L</b>	25 - 33 mm
<b>RW</b>	0.06 - 0.16 g/mm
<b>RD</b>	0.63 - 0.70
<b>PMD</b>	0.79 - 0.88
<b>RSH</b>	0.12 - 0.22

Ground colour white, suffused with light violet or cream. Last whorl with yellowish to orangish brown clouds and blotches, often arranged in spiral rows or forming a coarse meshwork. Larval whorls white. Postnuclear sutural ramps with radial blotches extending over shoulders and matching last whorl pattern in colour. Aperture light pink to pinkish brown.

**Habitat and Habits:** In 90-250 m.

**Discussion:** *C. sydneyensis* is similar to *C. baeri*, a larger species (L 30-45 mm) with a broader larval shell (1.2-1.3 mm). The last whorl pattern of *C. baeri* consists of spiral colour bands and separate spiral rows of spots and bars rather than coalescing blotches and clouds, and its aperture lacks pink or violet shades. *C. colmani* differs from *C. sydneyensis* in its larger size (to 52 mm), tuberculate early postnuclear whorls, broader larval shell (1.05-1.15 mm) of fewer whorls (2), and in the larger number of spiral grooves on the late sutural ramps; its last whorl pattern elements are narrower, and its aperture is white.

1: *C. baeri* 2: *C. sydneyensis* 3: *C. wallangra*

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***Conus wallangra* (GARRARD, 1961)**

(Plate 60, Figures 28-30; Map 124)

1961 *Floraconus wallangra* Garrard, J. Malac. Soc. Australia, 5: 29-30, pl. 1 fig. 3**Type:** Holotype in AMS (33.5 x 18.5 mm).**Type Locality:** "east of Stanwell Park, N. S. W."**Range:** New South Wales to S. Queensland, Australia.

**Description:** Moderately small to medium-sized, moderately light to moderately solid. Last whorl conical to ventricosely conical; outline convex at adapical fifth to half, straight below; left side variably concave at basal third. Basal part of columella with a tooth-like fold. Shoulder angulate. Spire usually low, outline concave to straight, with a projecting larval shell. Larval shell of 1.75-2 whorls, maximum diameter 1.1-1.3 mm. First 1-3 postnuclear whorls weakly tuberculate to almost smooth. Teleoconch sutural ramps flat, with 2-3 increasing to 7-9 spiral grooves. Last whorl with a few weak to obsolete spiral ribs and ribbons near base.

***C. wallangra* Shell Morphometry**

<b>L</b>	25 - 50 mm
<b>RW</b>	0.07 - 0.15 g/mm (L 25-40 mm)
<b>RD</b>	0.64 - 0.68
<b>PMD</b>	0.81 - 0.89
<b>RSH</b>	0.05 - 0.13

Ground colour pale bluish violet or pale pink. Last whorl with partially reticulated brown to orange-brown flecks, blotches and lines fusing into an interrupted spiral band on each side of centre. Spiral rows of similarly coloured dots variably arranged between base and shoulder. Larval

whorls white to light brown or light violet. Postnuclear sutural ramps with orange-brown to brown radial markings. Aperture light violet.

**Habitat and Habits:** In 100-200 m.

**Discussion:** *C. wallangra* resembles *C. klemae*, but the latter species is usually larger and differs in its higher and stepped spire (RSH 0.12-0.21), narrower larval shell (about 0.8 mm), and in the absence of a tooth-like fold from the basal part of its columella. *C. angasi* has a colour pattern that is not reticulated and comprises 3 rather than 2 spiral bands; the spiral rows on its last whorl consist of dots, dashes, spots and bars, and its aperture is white, suffused with cream and pink.

## 291

***Conus aulicus* LINNÉ, 1758**

(Plate 61, Figures 1-6; Plate 76, Figure 62; Map 125)

- 1758 *Conus aulicus* Linné, Syst. Nat., 10 ed., 1: 717, no. 279  
 1792 *Conus auratus* Hwass in Bruguière, Encycl. Méth., 1:740-741, no. 134  
 1798 *Cucullus aurifer* Röding, Mus. Bolten., 2: 49, no. 634/121  
 1810 *Conus particolor* Perry, Arcana: Pl. 39  
 1900 *Conus aulicus propenudus* Melvill, J. Conchol. (London), 9 (10): 310  
 1937 *Conus aulicus* var. *aurantia* "Lamarck" Dautzenberg, Mém. Mus. Roy. Hist. Nat. Belgique, 2 (18): 36 (non *C. aurantius* Hwass in Bruguière, 1792)  
 1982 *Conus gracianus* da Motta & Blöcher, Publ. Ocas. Soc. Portuguesa Malac., 1: 16-17, pl. figs. 15a, b

**Types:** *C. aulicus*: Lectotype (Kohn, 1963) in MSNP (96 x 40 mm); *C. auratus*: Lectotype (Kohn, 1968) in MHNG (106 x 49 mm); *C. aurifer*: Lectotype (Kohn, 1975) figured in Knorr (1768: Pl. 19 fig. 1) (84 x 33 mm); *C. particolor*: Holotype figured in Perry (1810: Pl. 39) (119 x 49 mm); *C. a. propenudus*: Holotype in NMWC (88 x 40 mm); *C. a. var. aurantia*: Lectotype (Coomans et al., 1981) figured in Knorr (1764: Pl. 1 fig. 1) (64 x 27 mm); *C. gracianus*: Holotype in MHNG (44 x 15 mm).

**Type Localities:** *C. aulicus*: "Asia"; corrected in "Moluccas, Indonesia"; (Coomans et al., 1981); *C. auratus*: "l'Océan Indien"; *C. gracianus*: "at the fringes of the Grand Recif towards the open sea of Tuléar, S.W. Madagascar."

**Range:** Indo-Pacific except for Hawaii.

**Description:** Moderately large to large, moderately solid to moderately heavy. Form *gracianus* (Pl. 61, Fig. 6) moderately small to moderately large, moderately solid. Last whorl narrowly cylindrical to narrowly ovate, sometimes cylindrical to ovate; outline straight and parallel-sided to slightly convex; left side concave and right side straight at basal fourth. Aperture wider at base than near shoulder. Shoulder subangulate to rounded. Spire usually of moderate height, outline straight to slightly concave. Larval shell of 2.5-3 whorls, maximum diameter about 0.8 mm. First 2-5 postnuclear whorls tuberculate, sometimes weakly tubercu-

late. Teleoconch sutural ramps slightly concave to slightly convex, with 1 increasing to 3-4 spiral grooves in early whorls; late ramps with numerous spiral striae. Last whorl with fine, closely spaced spiral ribs on basal fourth to third and spiral threads above.

#### *C. aulicus* Shell Morphometry

<b>L</b>	65 - 163 mm
- form <i>gracianus</i>	30 - 60 mm
<b>RW</b>	0.20 - 1.00 g/mm
- form <i>gracianus</i>	0.10 - 0.25 g/mm
<b>RD</b>	0.40 - 0.51
<b>PMD</b>	0.63 - 0.75
<b>RSH</b>	0.11 - 0.17

Ground colour white, often variably suffused with pink. Last whorl overlaid with reddish to blackish brown, leaving small to moderately large ground-colour tents and blotches. Brown areas interspersed with darker brown to black spiral lines often articulated with ground-colour dots. Predominantly brown shells intergrade with predominantly white shells. Form *aurantia* (Pl. 61, Fig. 5) with an orange-brown pattern. Larval whorls and first 3-5 postnuclear sutural ramps immaculate white. Late ramps with radial streaks and blotches matching last whorl pattern in colour. Aperture cream to yellow or orange, white in subadults.

Periostracum greyish yellow to reddish brown, thin, translucent, smooth.

Dorsum of foot brown mottled with black, grading to orange-brown medially; anterior part with a black median blotch surrounded by a few white markings; latero-posterior marginal zones with irregularly alternating black and white radial streaks and blotches. Sole of foot and rostrum white,

flecked with brown. Tentacles white, tipped with brown. Siphon white, mottled with brown and black dorsolaterally and tipped with red, or siphon red distally and brown proximally; a dotted black transverse band located 1/3 to 1/2 of the length from the tip (Chaberman, pers. comm., 1981; Kohn, unpubl. observ.) (Pl. 76, Fig. 62).

Radular teeth with 2 opposed barbs adapically; long serration ending in a cusp 1/7 of the length of the shaft above base (Peile, 1939; Endean & Rudkin, 1965).

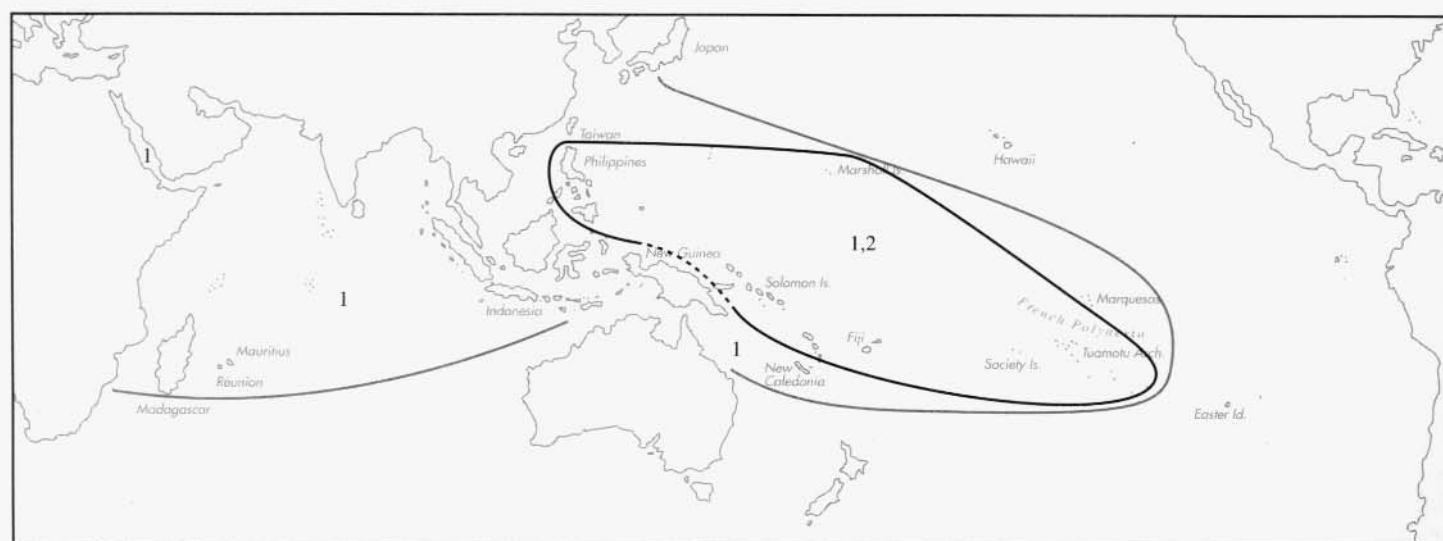
**Habitat and Habits:** In 1-30 m; on reef flats and coral reefs near dead and living corals, sand substrates or sometimes coral rubble. The habitat of *C. aulicus* is shared with *C. textile*, *C. canonicus*, *C. miles*, *C. maldivus* and *C. geographus* (Lorenz, pers. comm., 1990, 1993). Specimens described as *C. gracianus* are reported from greater depths at the offshore fringes of the "Grand Récif" at Tuléar (da Motta & Blöcher, 1982).

*C. aulicus* feeds on other gastropods but reportedly preys also on small fishes (Tirard, pers. comm., 1989). In the E. Indian Ocean, egg diameter of 326 µm predicts a minimum pelagic period of about 13 days (Perron & Kohn, 1985).

**Discussion:** *C. aulicus* is similar to *C. auratinus*, *C. magnificus*, *C. episcopatus* and *C. auricomus*. For comparison, see the Discussions of those species.

The conchological differences between *C. aulicus* and shells described as *C. gracianus* do not justify separation at the species level. The latter shells match subadults of *C. aulicus* in morphometry, sculpture and colouration. We therefore consider *C. gracianus* to represent a "dwarf" local form of *C. aulicus* from Madagascar. Specimens referred to as "var. *aurantia*" differ from typical *C. aulicus* in their colouration and smaller maximum size (to about 95 mm). This form is recorded from Maldives, Indonesia, Philippines, and Papua New Guinea. *C. a. propenudus* refers to a colour pattern form with reduced brown network pattern.

Map 125



1: *C. aulicus* 2: *C. auratinus*



***Conus auratinus* DA MOTTA, 1982**

(Plate 61, Figures 7-9; Map 125)

1834 *Conus aulicus* var. *roseus* Sowerby I, Conch. Ill.: Pt. 55, fig. 71 (non *C. roseus* Fischer, 1807)1982 *Conus auratinus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 1: 2-3, pl. figs. 2a, b**Types:** *C. a.* var. *roseus*: Lectotype (Kohn, 1992), figured in Sowerby I (1834: Pt 55, fig. 71) (88 x 33 mm); *C. auratinus*: Holotype in MHNG (82 x 29.5 mm).**Type Localities:** *C. a.* var. *roseus*: "ad Insulam Annaa" (Sowerby, 1834a); *C. auratinus*: "Fakarava Island, Tuamotu Archipelago."**Range:** Tuamotu Archipelago, Society and Marshall Is., Philippines, Vanuatu, and Solomon Is.**Description:** Moderately large to large, moderately solid to solid; relative weight of similarly sized specimens may vary by 40%. Last whorl narrowly ovate or narrowly cylindrical to ovate or cylindrical; outline slightly convex or straight and parallel-sided at adapical two-thirds; left side variably concave at basal fourth to third. Aperture wider at base than near shoulder. Shoulder indistinct. Spire of moderate height, outline straight. Teleoconch sutural ramps flat to slightly convex, with 1-2 spiral grooves grading into numerous spiral striae. Last whorl with closely spaced weak spiral ribs at base and weak spiral threads above.***C. auratinus* Shell Morphometry**

<b>L</b>	55 - 102 mm
<b>RW</b>	0.12 - 0.35 g/mm (L 55-90 mm)
<b>RD</b>	0.40 - 0.55
<b>PMD</b>	0.56 - 0.65
<b>RSH</b>	0.14 - 0.18

Ground colour white, usually suffused with pink. Last whorl overlaid with brown to reddish brown, leaving small to moderately large ground-colour tents. Brown areas interspersed with spiral rows of alternating darker brown dots or dashes and very small ground-colour markings. Larval whorls and about first 4 postnuclear sutural ramps immaculate white. Late ramps with connected radial blotches, streaks and lines matching last whorl pattern in colour. Aperture white, usually pale pink or yellow deep within.

Periostracum yellow, thin, translucent, smooth.

Dorsum of foot white, radially maculated with connected brown blotches and veins, darker marginally; anterior end light brown, with a median black blotch. Sole of foot white, with reticulated brown blotches and veins. Rostrum white, heavily mottled with brown except for the distal edge. Proboscis light orange, grading to orangish tan proximally. Tentacles white, tipped with brown. Siphon white, heavily mottled with brown, tipped with pink; a black

transverse band located about 1/3 of the length from the tip (Pearson, unpubl. observ.).

**Habitat and Habits:** Shallow subtidal. In Marshall Is., *C. auratinus* in 13-18 m on lagoon pinnacles and at the ocean-side of coral reefs, in caves and coral rubble.**Discussion:** *C. auratinus* had been considered a variety of *C. aulicus* by Sowerby I and was assigned to *C. auricomus* or referred to as *C. auratus* Hwass by subsequent authors. For the distinctions from *C. auricomus*, see the Discussion of the latter species. As *C. auratus* Hwass proved to be a synonym of *C. aulicus* (Kohn, 1968), da Motta redescribed *C. aulicus* var. *roseus* as *C. auratinus*.The shoulder of *C. aulicus* is more distinctly demarcated from the last whorl, its PMD is closer to the shoulder (0.63-0.75), and the spiral sculpture is more prominent on both its last whorl and its early teleoconch sutural ramps. At localities where both species live together, no intermediate specimens have been found.***Conus crocatus* LAMARCK, 1810**

(Plate 61, Figures 10-17; Map 126)

1810 *Conus crocatus* Lamarck, Ann. Mus. Hist. Nat. Paris, 15: 424-425, no. 1361978 *Conus thailandis* da Motta, Centre Thai Nat. Study: 7, 5, figs., Addenda1981 *Conus magister* Doiteau, Rossiniana (13): 3-5, text figs.**Types:** *C. crocatus*: Holotype in MHNG (44 x 20 mm); *C. thailandis*: Holotype in MHNG (68 x 41 mm)**Type Localities:** *C. crocatus*: "mers des grandes Indes"; *C. thailandis*: "off Raya Island, Phuket"; *C. magister*: "fairly close to Nouméa."**Range:** Pacific Ocean: Japan to Marshall Is., Samoa, Papua New Guinea, Solomon Is., Queensland, and New Caledonia; Indian Ocean: W. Thailand, Seychelles, Madagascar, Mozambique, and Mascarenes.**Description:** Medium-sized to large, moderately solid to heavy; typical form to moderately large and solid, form *magister* (Pl. 61, Fig. 12) larger than other forms. Last whorl conoid-cylindrical to conical or ventricosely conical in typical form, conical in form *magister*, and conical or ventricosely conical to broadly conical or broadly and ventricosely conical in form *thailandis* (Pl. 61, Figs. 15-17); outline convex at adapical fourth to third, straight below. Shoulder rounded to subangulate, to angulate in form *thailandis*. Spire of low to moderate height, usually low in form *magister*; outline straight in typical form, concave in other forms. Larval shell of about 3 whorls, maximum diameter about 0.8 mm. First 1-2 postnuclear whorls weakly tuberculate. Teleoconch sutural ramps slightly concave to convex, with 1-2 spiral grooves in earliest whorls increasing to numerous weak spiral striae in following whorls. Last whorl with closely spaced fine spiral ribs basally.

### *C. crocatus* Shell Morphometry

#### L

- typical form 40 - 82 mm
- form *thailandis* 50 - 84 mm
- form *magister* 70 - 110 mm

#### RW

- typical form 0.15 - 0.45 g/mm (L 40-64 mm)
- form *thailandis* 0.44 - 1.21 g/mm (L 50-84 mm)

#### RD

- typical form 0.51 - 0.64
- form *thailandis* 0.56 - 0.72
- form *magister* 0.55 - 0.64

#### PMD

0.81 - 0.91

#### RSH

0.07 - 0.12

Colour yellowish to orangish or reddish brown, with sparse to numerous white tents and flecks on last whorl and teleoconch spire; white markings evenly distributed or concentrated in spiral bands, sometimes fused into large blotches and flames. Last whorl with very fine, variably spaced, prominent to obsolete, darker brown spiral lines, sometimes articulated with very small white markings. Base dark violet-brown. Apex pinkish white to pinkish orange. Aperture white.

Periostracum yellow-grey, thin, translucent, smooth.

Dorsum of foot white, heavily mottled with brown or reddish brown, lightly mottled medially; anterior part with 2 lateral black blotches distally. Sole of foot more uniform brown. Rostrum tan to orange-brown. Tentacles white, mottled with brown; tip solid brown. Siphon white, mottled with brown, sparsely mottled centrally; tip grading to solid orange-brown, demarcated from the central zone by a dark brown to black ring (Richards, pers. comm., 1988; Pearson, unpubl. observ.).

Form *magister* differs in having heavier brown mottling of the foot; entire dorsum appears brown, sparsely mottled with white. Rostrum with dark brown longitudinal and transverse lines, sole of foot with dark brown longitudinal lines. Tentacles and siphon match those of typical form in colour pattern (Doiteau, 1981; Estival, unpubl. observ.).

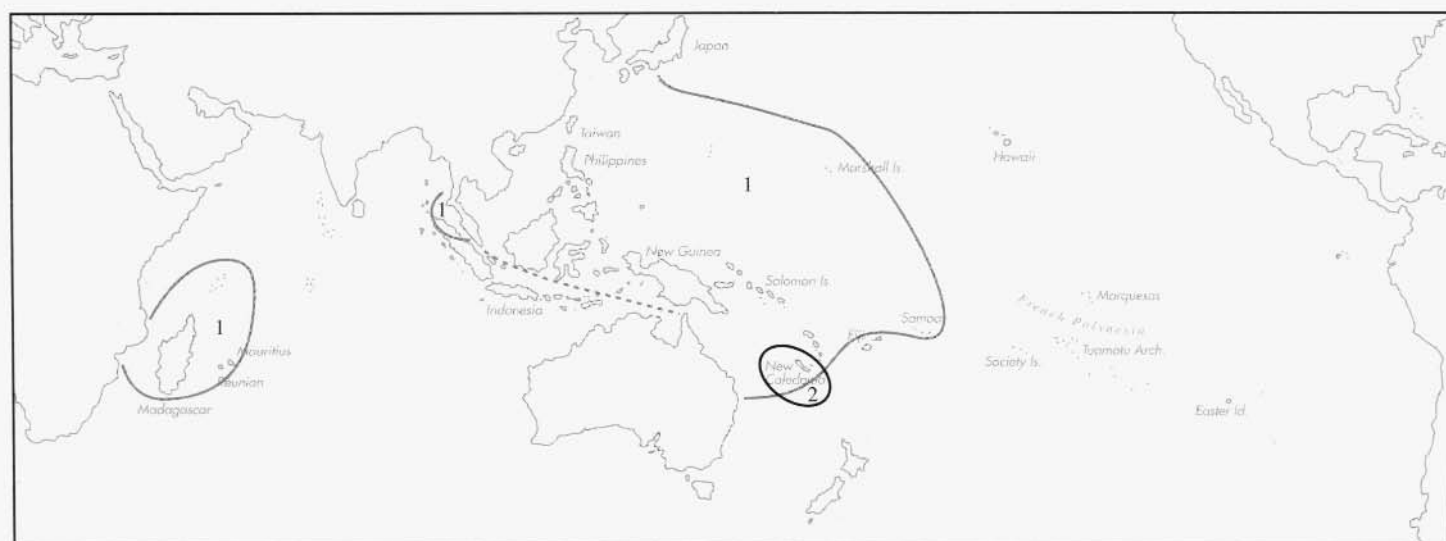
In form *thailandis*, radular teeth slender, with 2 opposed adapical barbs; long serration extending from the end of the second barb 2/3 of the length down the shaft, ending in a cusp (Rolán, 1993).

**Habitat and Habits:** In 1-80 m; on coral reef, from lagoon pinnacles to the outer slope of the reef, in sand, muddy sand and coral rubble. Form *thailandis* reported from 20-40 m, form *magister* from about 20 m (da Motta, 1978; Doiteau, 1981; Bayer, pers. comm., 1993).

**Discussion:** The typical form of *C. crocatus* was misidentified as *C. colubrinus* (Walls, [1979]); the latter actually is a synonym of *C. pennaceus* (Kohn, 1981; Tucker, 1984a; Coomans et al., 1985a); for comparison, see the Discussion *C. pennaceus*. *C. lamberti* is similar to *C. crocatus* form *magister*; for the distinctions, see the Discussion of the former species.

The conchological differences between typical *C. crocatus* and *C. thailandis* do not justify separation at the species level. Subadult shells of the latter may nearly match typical *C. crocatus* in shape, and intermediate specimens are known from New Britain, Solomon Is., Réunion, Seychelles (Pl. 61, Fig. 13), Madagascar, and St. Brandon (Pl. 61, Fig. 14). We therefore consider *C. thailandis* to represent the local form of *C. crocatus* from the W. Thailand area. Specimens described as *C. magister* correspond closely to typical *C. crocatus* in the colour pattern of the animal and to form *thailandis* in shell characters. We consider *C. magister* to represent a large local form of *C. crocatus* from the Nouméa area, New Caledonia.

Map 126



1: *C. crocatus* 2: *C. lamberti*

***Conus lamberti* SOUVERBIE, 1877**

(Plate 61, Figures 18-21; Map 126)

1877 *Conus lamberti* Souverbie, J. Conchyl. (Paris), 25: 71-72, pl. 1 fig. 1, pl. 2 fig. 7**Type:** Holotype in MHNH (107 x 53 mm).**Type Locality:** "Ins. Ouvea (Loyalty), archip. Caledon."**Range:** New Caledonia region.

**Description:** Moderately large to large, solid. Last whorl conical, outline convex below shoulder, slightly concave centrally, otherwise straight. Shoulder subangulate. Spire low, outline concave. First 5-6 postnuclear whorls tuberculate. Teleoconch sutural ramps concave, with 2 increasing to 3-5 spiral grooves, turning into striae in latest whorls. Last whorl with a few spiral ribs at base.

***C. lamberti* Shell Morphometry**

<b>L</b>	70 - 114 mm
<b>RW</b>	0.35 g/mm (L 73 mm)
<b>RD</b>	0.50 - 0.53
<b>PMD</b>	0.89 - 0.95
<b>RSH</b>	0.07 - 0.12

Colour light brown to reddish brown. Last whorl with small and medium-sized, separate or overlapping white tents and flecks, concentrated at centre, below shoulder and at base. Postnuclear sutural ramps with white radial streaks and blotches. Aperture white.

Periostracum yellowish white, very thin, translucent, smooth.

Dorsum of foot white, with connected brown blotches, flecks and veins medially and with variably spaced black radial streaks and blotches marginally. Sides of foot yellow, flecked with white. Sole of foot yellow. Rostrum orangish yellow. Tentacles white, mottled with brown proximally; tip orange-yellow. Siphon white, edged with yellow, with a black transverse band 1/3 of the length from the tip; proximal part mottled with brown dorsolaterally (Anonymous, 1984; Estival, unpubl. observ.).

**Habitat and Habits:** In 30-100 m; on sloping sand bottoms. *C. lamberti* was observed to feed on gastropods (Anonymous, 1984).

**Discussion:** *C. lamberti* is similar to the form *magister* of *C. crocatus*. The latter can be distinguished by its broader last whorl (RD 0.55-0.64), by having about 2 weakly tuberculate (instead of 5-6 distinctly tuberculate) postnuclear whorls, a convex rather than concave teleoconch sutural ramps, and a rounded rather than subangulate shoulder. The two species also differ in the colour pattern of their animals.

***Conus magnificus* REEVE, 1843**

(Plate 62, Figures 1-5; Plate 84, First row, left; Map 127)

1843 *Conus magnificus* Reeve, Conch. Icon., 1, *Conus*: Pl. 6 sp. 32**Type:** Lectotype (Lauer, 1990a) in BMNH (92 x 41 mm)**Type Locality:** "Matnog, Island of Luzon, Philippines."**Range:** Okinawa, Philippines, Solomon Is., Queensland (Low Is.), Tahiti, Marquesas, Samoa, and Marshall Is.

**Description:** Moderately large to large, solid. Last whorl usually conoid-cylindrical to ventricosely conical or conical; outline slightly convex to straight, convex below shoulder. Shoulder subangulate to rounded, sometimes indistinct. Spire of moderate height; outline slightly concave to straight, with domed early postnuclear whorls. Larval shell multispiral and projecting, maximum diameter 0.6-0.7 mm. Teleoconch sutural ramps flat, often slightly concave in late whorls, with numerous obsolete spiral striae. Last whorl with closely spaced, rather weak spiral ribs basally and spiral threads above; surface with a high gloss.

***C. magnificus* Shell Morphometry**

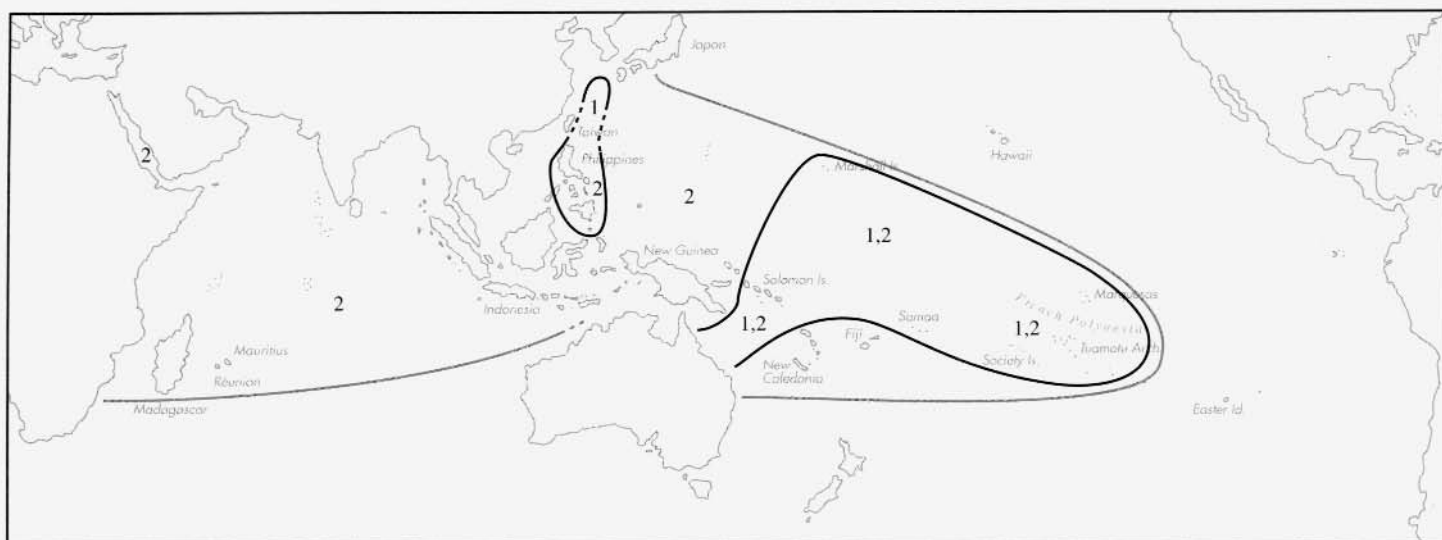
<b>L</b>	55 - 92 mm
<b>RW</b>	0.30 - 0.71 g/mm (L 55-76 mm)
<b>RD</b>	0.49 - 0.60
<b>PMD</b>	0.75 - 0.90
<b>RSH</b>	0.13 - 0.19

Ground colour white, suffused with red. Last whorl overlaid with brown to red-brown, leaving many tiny to medium-sized, separate or overlapping tentlike to rounded ground-colour markings; tents concentrated in 3-4 axial bands from base to shoulder, and in 3 spiral bands, below shoulder, below centre, and near base. Some shells with a rather regular network of brown lines and few small brown blotches. Brown zones interspersed with dark brown spiral lines articulated with small white dots or tents. Larval whorls and first postnuclear sutural ramps pinkish violet. Following ramps matching last whorl in colour pattern. Aperture white.

Periostracum pale yellow to brownish yellow, thin, translucent, smooth.

Dorsum of foot white, radially mottled with brown, with a black pre-marginal line ending in a lateral blotch anteriorly; latero-marginal zones with larger and darker brown to black radial markings; anterior part largely brown, with a median black blotch. Sole of foot mottled white and brown. Rostrum white, mottled with brown except for the distal edge. Tentacles white; tip red, with an orange-brown axial streak. Siphon white, mottled with brown, more





1: *C. magnificus* 2: *C. episcopus*

prominently mottled proximally, with a broad black ring at about 1/2 the length from the tip; anterior end grading to bright red (Pearson, unpubl. observ.) (Pl. 84, First row, left).

**Habitat and Habits:** In 5-50 m; on lagoon pinnacles, reef flats and the outer slope of reefs, in sand or rubble often beneath rocks, or in caves.

**Discussion:** *C. magnificus* is very similar to *C. episcopus*; for comparison, see the Discussion of the latter species. The absence of intermediates in places where both co-occur suggests separation at the species level. *C. aulicus* may also resemble *C. magnificus* but can be easily distinguished by its acute and pure white apex, and its narrower and cylindrical or ovate last whorl (RD 0.40-0.51; PMD 0.63 - 0.75).

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### *Conus episcopus* DA MOTTA, 1982

(Plate 62, Figures 6-13; Plate 76, Figure 63; Plate 84, First Row, right; Map 127)

- 1937 *Conus episcopus* var. *elongata* Adam & Leloup in Dautzenberg, Mém. Mus. Roy. Hist. Nat. Belg., 2: 100, pl. 3 fig. 7 (non *C. elongatus* Holten, 1802, *C. elongatus* Reeve, 1843, and *C. mediterraneus* var. *elongata* Bucquoy, Dautzenberg & Dollfus, 1882)
- 1942 *Conus episcopus* var. *oblongus* "Dautzenberg" Fenaux, Bull. Inst. Océan. (Monaco), 814: 2, fig. 1 (nom. nov. for *C. episcopus* var. *elongata*; non *C. mediterraneus oblongus* Bucquoy, Dautzenberg & Dollfus, 1882)
- 1982 *Conus episcopus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 1: 1-2, pl. 1 figs. 1a, b
- 1982 *Conus episcopus* «*pupillaris*» da Motta, La Conchiglia, 14 (158-159): 21, text figs. (nom. nov. for *C. episcopus* var. *elongata* and for *C. episcopus* var. *oblongus*)

- 1989 *Conus magnificus macilentus* Lauer, Publ. Ocas. Soc. Portuguesa, 14: 20-22, pl. figs. 5.1-5.4 (nom. nov. for *Conus episcopus* var. *elongata* Adam & Leloup)

**Types:** *C. episcopus* var. *elongata*: Original figures 44 x 17.5 and 42.5 x 16.5 mm; *C. episcopus* var. *oblongus*: Original figure 40 x 16.5 mm; *C. episcopus*: Holotype in MNHG (81.5 x 37.5 mm); *C. magnificus macilentus*: 2 syntypes (Lauer, 1989) figured in Dautzenberg (1937: Pl. 3 fig. 7) (44 x 17.5; 42.5 x 16.5 mm).

**Type Localities:** *C. episcopus* var. *elongata*: "Amboine"; *C. episcopus* var. *oblongus*: "Ile de Maurice"; *C. episcopus*: "Mahe Island, Seychelles"; *C. magnificus macilentus*: "Amboine (=Pulau Ambon) Sud Moluques, Indonésie."

**Range:** Indo-Pacific except for Hawaii.

**Description:** Moderately large to large, solid to heavy. Last whorl usually narrowly conoid-cylindrical to conoid-cylindrical, sometimes narrowly cylindrical; outline variably convex at adapical third, nearly straight below; left side sometimes slightly concave at base. Aperture somewhat wider at base than near shoulder. Shoulder angulate to almost indistinct. Spire of low to moderate height; outline slightly concave to slightly convex, with domed early post-nuclear whorls. Larval shell multispiral and projecting, maximum diameter 0.7-0.8 mm. About first 4 postnuclear whorls weakly tuberculate. Teleoconch sutural ramps flat to slightly concave, with 2-4 fine spiral grooves in first 3-4 whorls, turning into numerous obsolete spiral striae in following whorls. Last whorl with rather closely spaced, fine spiral ribs basally and fine to obsolete spiral threads above.

#### *C. episcopus* Shell Morphometry

L	55 - 114 mm
RW	0.30 - 1.05 g/mm (L 55-95 mm)
RD	0.42 - 0.58
PMD	0.71 - 0.84
RSH	0.09 - 0.15

Ground colour white, often suffused with pink in shells from Réunion and W. Thailand. Last whorl overlaid with light to dark brown, leaving numerous medium-sized to large, separate or overlapping tentlike ground-colour markings; tents concentrated in 3-4 axial bands from base to shoulder and in 3 spiral bands, below shoulder, below centre, and near base. Brown colour zones interspersed with spiral rows of alternating dark brown dashes and very small white markings. Small subadult specimens usually with alternating brown and white axial bands, the latter sparsely crossed by brown reticulated lines. Larval whorls and 1-2 adjacent postnuclear sutural ramps immaculate pinkish violet. Following ramps matching last whorl in colour pattern. Aperture white to bluish white, sometimes cream to yellow.

Periostracum yellowish brown, thin, translucent, smooth.

Dorsum of foot white, radially mottled with brown, brown markings larger and darker brown to black on lateral marginal zones; anterior part largely brown, with a median black blotch anterior to 2 lateral black blotches; posterior part with a black spot beneath the operculum; a brown pre-marginal line may be present. Sole of foot white, flecked with brown. Rostrum white, immaculate at distal edge, mottled and longitudinally streaked with brown behind. Proboscis blood red. Tentacles white; tip red to brown, with an orange-brown to black axial streak. Siphon white, mottled with brown, heavily mottled proximally, with a dark grey to black ring at about 1/2 of the length from the tip; tip red (Chaberman, pers. comm., 1981; Kohn, unpubl. observ.; Pearson, unpubl. observ.) (Pl. 76, Fig. 63; Pl. 84, First row, right).

Radular tooth morphology matches that of *C. pennaceus* (see Nybakken, 1990, as *C. episcopus*).

**Habitat and Habits:** In shallow water to 40 m; on the lagoon and ocean sides of coral reefs, in sand and coral rubble, often beneath coral rocks (Cernohorsky, 1964; Kohn & Nybakken, 1975; Richards, 1989; Grosch, pers. comm., 1989; Tirard, pers. comm., 1989). *C. episcopus* is known to feed on Cypraeidae (Kohn & Nybakken, 1975).

In the E. Indian Ocean, egg diameter of 400 µm predicts a short minimum planktonic period of about 7 days; in Palau, egg diameter is 275 µm and pelagic period about 15 days (Perron & Kohn, 1985).

**Discussion:** *C. episcopus* is so similar to *C. magnificus* in shell characters and body colouration that they cannot always be unequivocally distinguished and are often considered conspecific (Walls, [1979]; Richard, 1990). The latter species differs in having a finer reticulate pattern on the last whorl with a larger proportion of small ground-colour tents and in a usually higher spire (RSH 0.13-0.19). In the Pacific, where both species occur sympatrically, *C. episcopus* lacks pink shades in the ground colour and the surface of its shell has a lower gloss. We therefore provisionally favour the status of separate species. *C. aulicus* can be distinguished by its acute and pure white apex and by its cylindrical or ovate last whorl (PMD 0.63-0.75). For comparison with *C. omaria* and *C. pennaceus*, see the Discussions of those species.

For a long time, *C. episcopus* was referred to as *C. episcopus* Hwass, actually a synonym of *C. pennaceus* (Kohn, 1964). The name *C. episcopus* var. *oblongus* (based on a subadult specimen) was pre-occupied, and *C. episcopus* var. *elongata* is a *nomen nudum* (Coomans et al., 1986). Therefore *C. episcopus* is the first available name for this species.

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### *Conus omaria* HWASS in BRUGUIÈRE, 1792

(Plate 62, Figures 14-25; Plate 76, Figure 64;

Plate 84, Second row, Third row, left; Map 128)

- 1792 *Conus omaria* Hwass in Bruguière, Encycl. Méth., 1: 743-744, no. 137
- 1843 *Conus sindon* Reeve, Proc. Zool. Soc. London, 11: 175; 1844: Conch. Icon., 1, *Conus*: Pl. 43, sp. 233a-b
- 1858 *Conus convolutus* Sowerby II, Thes. Conch., 3: 44, no. 380, pl. 23 fig. 564
- 1900 *Conus omaria* var. *magoides* Melvill, J. Conchol. (London), 9: 310
- 1982 *Conus patonganus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 1: 7-8, pl. fig. 7
- 1986 *Conus viperinus* Lauer, La Conchiglia, 18 (212-213): 28-30, text figs. 1-4

**Types:** *C. omaria*: Lectotype (Kohn, 1968) figured in Tableau (1798: Pl. 344 fig. 3) (68 x 30 mm); *C. sindon*: Holotype in NMWC (35 x 19 mm); *C. convolutus*: Lectotype (Coomans et al., 1985a) in BMNH (59 x 24 mm); *C. o.* var. *magoides*: Holotype in NMWC (66.5 x 28.5 mm); *C. patonganus*: Holotype in MNHG (54 x 27 mm); *C. viperinus*: Holotype in MNHN (48 x 25 mm).

**Type Localities:** *C. omaria*: "l'Océan asiatique"; *C. patonganus*: "off Raya Island, Phuket, S. W. Thailand in the Andaman Sea"; *C. viperinus*: "Island of Bohol, in the southern Philippines."

**Range:** Indian Ocean except for Red Sea and India; Pacific Ocean except for French Polynesia and Hawaii.

**Description:** Medium-sized to large, moderately solid to solid. In Indian Ocean shells (Pl. 62, Figs. 22-25), last whorl narrowly conoid-cylindrical to conoid-cylindrical, also narrowly cylindrical to cylindrical or ventricosely conical in Pacific shells (Pl. 62, Figs. 14-21), conical in juvenile shells; outline straight and nearly parallel-sided to slightly convex or slightly concave centrally, variably convex above and slightly convex to straight below; left side sometimes concave above base. Aperture wider at base than near shoulder. Shoulder angulate to rounded. Spire usually low; outline concave to slightly convex in late whorls, domed to straight in early whorls. Larval shell multispiral, maximum diameter 0.7-0.8 mm. Teleoconch sutural ramps flat to slightly concave or slightly convex, with 2-4 fine spiral grooves in early whorls and numerous often very weak spiral striae in late whorls. Last whorl with fine spiral ribs or threads and a few narrow ribbons basally, obsolete toward shoulder.

### *Conus omaria* Shell Morphometry

<b>L</b>	45 - 86 mm
<b>RW</b>	0.19 - 0.56 g/mm (L 45-77 mm)
<b>RD</b>	
- Pacific Shells	0.47 - 0.60
- Indian Ocean Shells	0.45 - 0.56
<b>PMD</b>	
- Pacific Shells	0.71 - 0.83
- Indian Ocean Shells	0.75 - 0.83
<b>RSH</b>	0.06 - 0.13

Ground colour white, often suffused with pink to violet in Indian Ocean shells. Last whorl overlaid with yellowish or orangish brown to dark or reddish brown, leaving numerous very small to moderately large tentlike ground-colour markings. Tents edged with a darker brown line toward outer lip and usually concentrated in 3-4 axial bands as well as in 3 spiral bands, below shoulder, below centre and at base. Shells with 2 interrupted spiral bands of brown flecks and blotches intergrade with shells with a rather regular network of brown lines on entire last whorl; in some shells from Pacific localities (Philippines, Amami Is.), reticulated lines replaced by fine wavy axial lines (Pl. 62, Figs. 19, 20). Brown flecks and blotches with many very small, regularly arranged white spots, sparsely including larger solid zones, and interspersed with spiral rows of alternating darker brown and ground-colour dots. Larval whorls and first 2-4 postnuclear sutural ramps reddish violet. Following ramps matching last whorl in colour pattern. Aperture often yellow to pinkish orange, yellowish cream deep within.

Periostracum greyish to orangish yellow, thin, translucent, smooth.

Juvenile animal mottled white and pale red. Foot bright red at each end, both dorsally and ventrally; dorsum paler than sole. Tentacles largely white. Siphon red distally, with a black ring centrally (Pearson, unpubl. observ.).

In adults, dorsum of foot white, mottled with brown; lateral and posterior marginal zones with brown to black radial streaks and blotches as well as a black pre-marginal line ending in a lateral black blotch on anterior part; a median black blotch located at distal end of anterior part, sometimes fused with lateral blotches to a large trilobate black area. Anterior side of foot red-orange. Sole of foot white, mottled with brown. Rostrum white, with brown streaks and veins behind immaculate tip. Proboscis red, paler ventrally. Tentacles white, tipped with red or tan; base dorsally demarcated from the rostrum by a black blotch. Siphon white, edged with pale red, grading to dark coral red at tip, with sparse brown mottling distally and heavy mottling proximally; a broad black ring located 1/3 to 1/2 of the length from the tip (Chaberman, pers. comm., 1981; Pearson, unpubl. observ.) (Pl. 76, Fig. 64; Pl. 84, Second row, Third row, left).

Radular teeth with 2 opposed barbs adapically; long serration of strong denticles ending in a cusp near base (Endean & Rudkin, 1965). Juvenile specimens (L about 1.4

mm) with radular teeth very similar to those of similarly sized *C. magus* (Nybakken, 1990).

**Habitat and Habits:** Shallow subtidal to about 50 m, as deep as 100 m in W. Thailand; on coral reefs and in reef lagoons, in sand and rubble.

*C. omaria* feeds on gastropods including Cypraeidae, Olividae and Strombidae; venom does not affect mammals, fishes, and polychaetes (Pearson, unpubl. observ.; Endean & Rudkin, 1965). Ontogenetic change in radular tooth morphology suggests a shift in the diet from worms to molluscs (Nybakken, 1990).

In Fiji, egg capsules of about 16 x 7 mm deposited in clusters; egg diameter of 336 µm and pelagic period of 12 days observed in Palau (Cernohorsky, 1964; Perron & Kohn, 1985).

**Discussion:** *C. omaria* is similar to *C. magnificus*, *C. episcopatus*, *C. madagascariensis*, and *C. pennaceus*. *C. magnificus* has a higher spire (RSH 0.13-0.19), a white aperture, and largely solid rather than strongly interrupted brown flecks and blotches. Its early postnuclear whorls are consistently domed, and its ground colour is suffused with red, whereas sympatric *C. omaria* has a pure white ground colour. *C. episcopatus* is of larger mean size and has consistently domed early postnuclear whorls. It can be distinguished from *C. omaria* by its coarser pattern consisting of larger and more often axially elongate brown blotches, a much smaller portion of very small tents, and prominent axial bands of larger ground colour tents that are more often fused into axial white blotches. In addition, *C. episcopatus* lacks dark brown demarcation lines on the tents. For comparison with *C. madagascariensis* and *C. pennaceus*, see the Discussions of those species.

Indian Ocean shells of *C. omaria* differ from Pacific shells in their often pale pink to violet ground colour, more frequently straight-sided apices and in their strictly conoid-cylindrical last whorls. These differences do not justify separation at the species level; as they are not constant between regions of the species range, neither do they suggest subspecies status. *C. convolutus* refers to Indian Ocean specimens with straight-sided apices; *C. patonganus* from W. Thailand includes specimens with domed as well as straight-sided early postnuclear whorls. *C. magoides*, described as "pink," may be based on a specimen from the Indian Ocean with a convex apex. *C. viperinus* is a yellowish to orangish brown form from Philippines with domed to sometimes straight-sided early postnuclear whorls.

*C. sindon* has been considered to represent an individual variant of *C. pennaceus* with closely spaced axial lines (Walls, [1979]) or recognized as valid species separate from both *C. omaria* and *C. pennaceus* (da Motta, 1986; Richard, 1990). An axially lineate pattern occurs in various species (*C. omaria*; *C. pennaceus*; *C. madagascariensis*; *C. textile*; *C. victoriae*). In colour pattern, the holotype of *C. sindon* (Pl. 62, Fig. 21) is slightly closer to similar forms of *C. omaria* (Pl. 62, Fig. 19, 20) than to those of *C. pennaceus* (Pl. 64, Fig. 25; Lauer, 1990b, Fig. 96c); with respect to shell morphology, it cannot be unequivocally assigned to



either of these species. We provisionally place *C. sindon* in the synonymy of *C. omaria*.

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# *Conus madagascariensis* SOWERBY II, 1858

(Plate 62, Figures 26-28; Map 128)

1858 *Conus madagascariensis* Sowerby II, Thes. Conch., 3: 43, sp. 371, pl. 24 (210) fig. 582

**Type:** 3 syntypes in BMNH (44 x 22; 42 x 23.5; 38.5 x 20.5 mm).

**Type Locality:** "Madagascar."

**Range:** S. India.

**Description:** Medium-sized to moderately large, moderately solid to solid. Last whorl ventricosely conical to conoid-cylindrical; outline moderately convex at adapical third, less so to straight below; left side often slightly concave near base. Aperture somewhat wider at base than near shoulder. Shoulder angulate. Spire low, outline slightly concave to slightly sigmoid, with a straight-sided apex. Larval shell of about 2 whorls, maximum diameter about 0.9 mm. Teleoconch sutural ramps flat to slightly concave, with 3-4 weak to obsolete spiral grooves and many spiral striae in late whorls. Last whorl with weak spiral ribs on basal third.

Ground colour white, often variably tinged with violet, sometimes more prominently so at base. Last whorl with a rather fine and regular network of dark brown lines edging numerous tiny to medium-sized ground-colour tents. Overlying light brown to reddish brown spiral streaks, spots, flecks or blotches generally arranged in an interrupted spiral band on each side of centre and interspersed with spiral lines

of alternating darker brown and white markings. Larval shell white. Early postnuclear sutural ramps immaculate white to pink. Following ramps matching last whorl in colour pattern. Aperture white.

## *C. madagascariensis* Shell Morphometry

<b>L</b>	45 - 69 mm
<b>RW</b>	0.20 - 0.36 g/mm (L 45-57 mm)
<b>RD</b>	0.55 - 0.60
<b>PMD</b>	0.77 - 0.83
<b>RSH</b>	0.07 - 0.12

Periostracum yellow, thin, translucent, smooth.

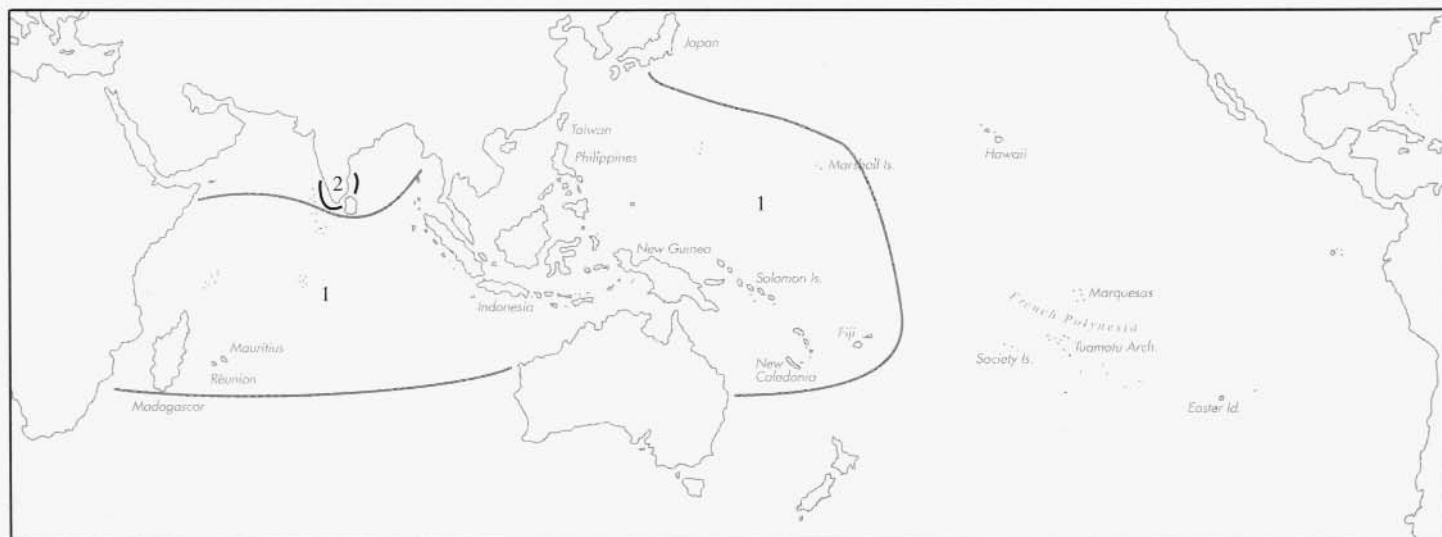
Dorsum of foot white with a few brown radial blotches, more prominent at lateral margins; anterior end edged with reddish pink, posterior end with a trilobate black blotch. Sole of foot brown, transversely mottled with buff. Rostrum brown proximally, tipped with pink. Tentacles white, tipped with pink. Siphon pink, mottled with brown proximally and tipped with red, with a black ring centrally (Kohn, 1978 & unpubl. observ.; referred to as *C. pennaceus*).

**Habitat and Habits:** From the infralittoral fringe to about 50 m, more common below 20 m; on shallow-subtidal reef flats, in coarse sand and rubble, often among sea-weed and beneath rocks. *C. madagascariensis* is known to feed on gastropods (e.g. Trochidae).

Spawn similar to that of *C. pennaceus*; egg diameter of 654 µm predicting a completely benthic development (Kohn, 1978; Perron & Kohn, 1985; referred to as *C. pennaceus*).

**Discussion:** *C. madagascariensis* resembles *C. omaria* and *C. pennaceus*. *C. omaria* has a reddish violet and

Map 128



1: *C. omaria* 2: *C. madagascariensis*

narrower larval shell (0.7-0.8 mm), its aperture is not pure white, and Indian Ocean shells differ additionally in their narrower and consistently conoid-cylindrical last whorls (RD 0.45-0.56). The status of *C. madagascariensis* and *C. omaria* as separate species is also suggested by the correlative differences in egg diameters (654 vs. 336  $\mu$ m) and types of development (benthic vs. planktonic). For comparison with *C. pennaceus*, see the Discussion of that species.

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### *Conus pennaceus* BORN, 1778

(Plate 63, Figures 1-29; Plate 64, Figures 1-19, 23-28; Map 129)

- 1778 *Conus pennaceus* Born, Index Mus. Vindob., 1:152; 1780 Testacea.: Pl. 7 fig. 14
- 1792 *Conus rubiginosus* Hwass in Bruguière, Encycl. Méth., 1: 744-745, no.138
- 1792 *Conus praelatus* Hwass in Bruguière, Encycl. Méth., 1: 746-747, no.140
- 1792 *Conus episcopus* Hwass in Bruguière, Encycl. Méth., 1: 748-749, no.142
- 1798 *Cucullus aureus* Röding, Mus. Bolten., 2: 49, no. 630/118 (non *C. aureus* Hwass in Bruguière, 1792)
- 1810 *Conus colubrinus* Lamarck, Ann. Mus. Hist. Nat. Paris, 15: 433, no.163
- 1845 *Conus elisae* Kiener, Coq. Vivant., 2: Pl.64 figs. 1, 1a; 1849-1850: 341-342
- 1845 *Conus stellatus* Kiener, Coq. Vivant., 2: Pl.99 fig. 3; 1849:225
- 1874 *Conus racemosus* Sowerby III, Proc. Zool. Soc. London, 1873: 721, pl. 59 fig. 11
- 1900 *Conus omaria* var. *marmoricolor* Melvill, J. Conchol. (London), 9: 310
- 1972 *Conus lohri* Kilburn, Ann. Natal Mus., 21 (2): 428-430, text figs. 8a, 14b-d
- 1982 *Conus quasimagnificus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 1: 3-4, pl. figs. 3a-b
- 1982 *Conus rubropennatus* da Motta, Publ. Ocas. Soc. Portuguesa Malac., 1: 6-7, pl. figs. 6a-b
- 1988 *Conus pennaceus bazarutensis* Fernandes & Monteiro, Publ. Ocas. Soc. Portuguesa Malac., 10: 19-22, pl. figs. AA'-BB'
- 1988 *Conus pennaceus ganensis* Delsaerd, Gloria Maris, 27(1): 1-5, figs. 1-9
- 1989 *Conus pennaceus behelokensis* Lauer, Rossiniana, (43): 13-14, text figs. 63a-c
- 1992 *Conus episcopus mauritiensis* Lauer, Publ. Ocas. Soc. Portuguesa Malac., 16: 54-56, pls. figs. 9a-d, 10A-B

**Types:** *C. pennaceus*: Lectotype (Kohn, 1964) in NMW (40 x 23 mm); *C. rubiginosus*: Lectotype (Kohn, 1968) in MHNG (66 x 35 mm); *C. praelatus*: Lectotype (Kohn, 1968) in MHNG (47 x 24 mm); *C. episcopus*: Lectotype (Kohn, 1968) in MHNG (58 x 33 mm); *C. aureus*: Lectotype (Walls, [1979]) figured in Martini (1773: Pl. 54 fig. 601) (37 x 19 mm); *C. colubrinus*: Lectotype (Kohn, 1981) in MNHN (53.5 x 24.5 mm); *C. elisae*: Original figure 53 x 26 mm; *C. stellatus*: Original figure 22 x 11 mm; *C. racemosus*: Holotype in NMWC (55 x 29 mm); *C. o.* var. *marmoricolor*: 2 syntypes in NMWC (51.5 x 26; 51 x 25.5 mm); *C. lohri*: Holotype in NM (40 x 23.5 mm); *C. quasimagnificus*:

Holotype in MHNG (69 x 38 mm); *C. rubropennatus*: Holotype in MHNG (40 x 21 mm); *C. p. bazarutensis*: Holotype in MNHN (46 x 26 mm); *C. p. ganensis*: Holotype in KBIN (47 x 26 mm); *C. p. behelokensis*: Holotype in MNHN (48.5 x 25 mm); *C. e. mauritiensis*: Holotype in MNHN (60 x 29 mm).

**Type Localities:** *C. pennaceus*: "China", corrected in "Coast of Mozambique" (Wils, 1986); *C. rubiginosus*: "Mindanao" (Kohn, 1968); *C. praelatus*: "les mers des grandes Indes"; *C. episcopus*: "les mers des grandes Indes"; *C. colubrinus*: "mers des Grandes Indes"; *C. racemosus*: "Sandwich Islands?"; *C. lohri*: "Baia dos Cocos, between Inhambane and Jangamo Beach (about 24°S.), Mozambique"; *C. quasimagnificus*: "in Khor Fakkau in the Gulf of Oman"; *C. rubropennatus*: "Réunion Island, Indian Ocean"; *C. bazarutensis*: "Bazaruto Islands, a small archipelago close to the southern Mocambique coast"; *C. p. ganensis*: "Gan Island, Maldives"; *C. p. behelokensis*: "Grand récif corailien de Beheloka, a une cinquantaine de kilomètres au sud de Tuléar, Madagascar, environ 23°50' sud"; *C. e. mauritiensis*: "Anse de Mahébourg, Ile Maurice."

**Range:** Indian Ocean except for India; Hawaii.

**Description:** Medium-sized to large, moderately solid to moderately heavy. Last whorl conoid-cylindrical or ventricosely conical to conical or ovate; outline variably convex at adapical fourth to third, occasionally two-thirds, nearly straight below. Aperture wider at base than near shoulder to uniformly broad. Shoulder angulate to rounded. Spire of low to moderate height; outline concave to convex in late whorls, usually slightly convex to domed in early whorls; apex often straight-sided in shells from S. Madagascar and occasionally in shells from N. Mozambique. In Hawaii, larval shell of about 1.75 whorls, maximum diameter 0.7-0.75 mm; in the Indian Ocean, maximum diameter about 0.8 mm. Teleoconch sutural ramps flat to slightly convex, usually slightly concave in latest whorls; middle ramps with 2 increasing to 3-5 weak spiral grooves, latest ramps usually with numerous spiral striae. Last whorl with weak to distinct ribs basally and with spiral striae from base to shoulder.

Ground colour white, often variably suffused with greyish blue to greyish violet, sometimes with yellowish to pinkish cream, orangish to light brown, or with pink to red or violet. Last whorl usually overlaid with yellow or orange to brown, red-brown or blackish brown, leaving many tiny to moderately large tentlike ground-colour markings. Tents separate or fused, edged with a darker line at the frontal sides and usually concentrated in 3 spiral bands, below shoulder, near centre and at base, usually also grouped in axial clusters to form 2-5 axial bands. Dark overlying spots, flecks, and blotches largely solid to sometimes perforated, often forming 2-3 interrupted to continuous spiral bands, and usually with closely spaced, dotted to solid darker spiral lines variably articulated with small ground-colour markings. Shells with a regularly arranged network of fine to coarse dark lines intergrade with shells 1) with a sparsely reticulated, fine or coarse, axially lineate pattern, 2) having last whorl solid dark except for scattered small groups of ground colour tents, and 3) lacking any overlying pattern elements. Basal part of columella white, occasionally violet.

Larval whorls and first 1-5 postnuclear sutural ramps pink to purple, sometimes also orange or white; all these colours sometimes occurring among the hatchlings of the

same egg capsule but usually one colour preponderant within a local population (Perron, 1981a). Following sutural ramps matching last whorl in colour pattern. Aperture white, to light blue, pink or light violet in some populations.

Periostracum greyish to brownish yellow, thin, translucent, and smooth; rather brown, thicker, less smooth, and opaque in form *lohri*.

Dorsum of foot white, mottled with brown. Sole of foot mottled light and darker brown. Tentacles white, mottled with brown. Siphon white, tipped with orange-red to red and mottled with brown proximally, with a black ring about 1/3 of the length from the tip (Indian Ocean: Kohn, unpubl. observ.; Fainzilber et al., 1992; Hawaii: Kohn, 1959a). In form *lohri*, animal white; foot mottled with interlaced brown to blackish brown markings; rostrum grading to beige distally, with blackish brown transverse lines; tentacles tipped with red; siphon matching those of other forms in colour pattern (Ramalho, unpubl. observ.). The colour photograph identified as *C. lohri* in Liltved and Millard (1989) seems to show an animal of the *C. planorbis/C. ferrugineus* complex.

Radular teeth with a laterally inflated adapical barb opposite a larger second barb; serration external, extending 1/3 of the length down the shaft; a distinct cusp located about 1/3 of the length from the base; waist and basal spur absent (James, 1980; Bandel, 1984; Nybakken, 1990). Form *lohri* with very similar radular teeth; serration of a double row of denticles terminating in a cusp (Kilburn, 1972). Subadult specimens (L 9.6 mm) have the same tooth morphology as adult animals. This is correlated with a similar diet (molluscs) in both stages (Nybakken, 1990).

**Habitat and Habits:** Indian Ocean: From the infralittoral fringe to about 50 m; most frequently on subtidal coral reef flats in 0.5-5 m of water, in coral rubble, sand and muddy sand, often under rocks and amongst or under living corals (Kohn, 1961b, 1968b; Kohn & Nybakken, 1975; Grosch, pers. comm., 1989 & 1990; Fainzilber et al., 1992; Lorenz, pers. comm., 1993). Form *lohri* reported from 30 m and deeper in Natal (Liltved & Millard, 1989); in S. Mozambique, this form in 2-20 m of water, on rocky ledges with algal turf (Kilburn, 1972; Ramalho, pers. comm., 1989). Hawaii: Rarely on intertidal benches, usually on subtidal reef flats to about 20 m, in sand, on reef rock and coral rubble; animals buried in sand under rocks during day, very often crawling on bare reef limestone at night (Kohn, 1959a, b).

*C. pennaceus* feeds on prosobranch and opisthobranch gastropods but has not been observed to prey on congeners (Kohn, 1959b; Kohn & Nybakken, 1975; Ramalho, pers. comm., 1989). In N. Mozambique, animals known to consume dead fishes, worms, octopods and shrimps (Grosch, pers. comm., 1989).

Egg capsules deposited in clusters attached to hard substrate by a few capsules; subsequent capsules affixed to the previously laid forming "arches and bridges". Clusters containing about 60 capsules of 14-17 x 10-11 mm in the Maldives and about 35 capsules of 8.5-13 x 7-10 mm in Hawaii. Observed number of eggs per capsule is 480-660

in Maldives and 25-250 in Hawaii. In the Indian Ocean, egg diameter of 375-407 µm predicts a minimum pelagic period of about 7 days; in Hawaii, egg diameter is 470-520 µm and hatchling is a veliconcha metamorphosing within one day (Ostergaard, 1950; Kohn, 1961a, b; Perron, 1981a, b, c, 1982; Perron & Kohn, 1985).

**Discussion:** *C. pennaceus* is similar to *C. magnificus*, *C. episcopatus*, *C. omaria*, *C. madagascariensis*, and *C. echo*. *C. magnificus* generally has a higher spire (RSH 0.13-0.19). Those forms of *C. pennaceus* with a similarly fine tentmark pattern can be distinguished by their more angulate shoulders and their usually broader last whorls (RD 0.57-0.68 vs. 0.49-0.60), with a conical to ventricosely conical rather than conoid-cylindrical shape. Those forms of *C. pennaceus* that are similar in shape differ in their coarser pattern with a smaller portion of very small ground-colour tents. Slight differences in the number of larval whorls and the colouration of the animals between *C. magnificus* from the Marshall Is. and *C. pennaceus* from Hawaii support the separation at the species level. *C. episcopatus* is a somewhat larger species that differs in having a generally narrower and more cylindrical last whorl (RD 0.42-0.58; PMD 0.71-0.84) as well as a coarser pattern with a prominent axial arrangement and without darker brown demarcation lines at the frontal sides of its usually larger tents. The distinctive dark and light axial zones of the last whorl pattern in subadult *C. episcopatus* excludes confusion with similarly sized *C. pennaceus*. *C. omaria* differs in having a generally narrower and rather cylindrical last whorl (RD 0.45-0.60 vs. 0.50-0.71) and a yellowish cream to yellow or pinkish orange aperture; the brown spots, flecks, and blotches of its last whorl pattern are interrupted rather than largely solid as in most specimens of *C. pennaceus*. *C. madagascariensis* can be distinguished by its consistently straight-sided apex and its rather uniformly reticulated pattern. The difference between *C. madagascariensis* and *C. pennaceus* in egg diameters (654 vs. 375-407 or 470-520 µm) strongly suggests separation at the species level, the more so because the greatest difference occurs between nearby populations (*C. madagascariensis* from S. India and *C. pennaceus* from Maldives). For comparison with *C. echo*, see the Discussion of that species.

*C. pennaceus* is so variable in shape and colour pattern that the many nominal species-group taxa do not cover the entire conchological divergence within and between local populations of this species. While most of the Indian Ocean populations are rather uniform in their respective shell characters, a wide range of variation exists in N. Mozambique and Hawaii. In Hawaii, variants differing in colour pattern, shape and solidity of the shell were found among the offspring of the same female (Perron, 1979). We provisionally regard the different local populations from the Indian Ocean as forms. The marginal population from Hawaii perhaps deserves subspecies status, based on the relative differences in egg diameter and development (benthic in Hawaii, planktonic in the Indian Ocean).

Geographical survey of the different forms of *C. pennaceus*:



### *C. pennaceus* Shell Morphometry

#### - N. Mozambique

<b>L</b>	48 - 70 mm
<b>RW</b>	0.12 - 0.54 g/mm
<b>RD</b>	0.50 - 0.64
<b>PMD</b>	0.78 - 0.86
<b>RSH</b>	0.08 - 0.16

#### - S. Mozambique

<b>L</b>	41 - 65 mm
<b>RW</b>	0.24 - 0.48 g/mm (L 41-57 mm)
<b>RD</b>	0.57 - 0.66
<b>PMD</b>	0.76 - 0.86
<b>RSH</b>	0.06 - 0.12

#### - Natal, S. Mozambique (form *lohr*)

<b>L</b>	40 - 80 mm
<b>RW</b>	0.12 - 0.40 g/mm (L 40-63 mm)
<b>RD</b>	0.53 - 0.64
<b>PMD</b>	0.78 - 0.87
<b>RSH</b>	0.06 - 0.08

#### - Tanzania, Kenya

<b>L</b>	53 - 76 mm
<b>RW</b>	0.28 - 0.62 g/mm
<b>RD</b>	0.55 - 0.65
<b>PMD</b>	0.76 - 0.86
<b>RSH</b>	0.09 - 0.14

#### - Red Sea

<b>L</b>	40 - 62 mm
<b>RW</b>	0.22 - 0.49 g/mm
<b>RD</b>	0.61 - 0.65
<b>PMD</b>	0.77 - 0.85
<b>RSH</b>	0.11 - 0.16

#### - S. Madagascar (form *behelokensis*)

<b>L</b>	45 - 61 mm
<b>RW</b>	0.22 - 0.37 g/mm
<b>RD</b>	0.56 - 0.62
<b>PMD</b>	0.75 - 0.84
<b>RSH</b>	0.08 - 0.15

#### - Réunion (form *rubropennatus*)

<b>L</b>	38 - 56 mm
<b>RW</b>	0.21 - 0.40 g/mm
<b>RD</b>	0.57 - 0.61
<b>PMD</b>	0.80 - 0.86
<b>RSH</b>	0.08 - 0.13

#### - Mauritius, Rodriguez Id. (form *episcopus*)

<b>L</b>	42 - 61 mm
<b>RW</b>	0.20 - 0.40 g/mm
<b>RD</b>	0.57 - 0.65
<b>PMD</b>	0.72 - 0.83
<b>RSH</b>	0.08 - 0.14

#### - Mauritius, St. Brandon (form *rubiginosus*)

<b>L</b>	41 - 66 mm
<b>RW</b>	0.19 - 0.30 g/mm (L 41-57 mm)
<b>RD</b>	0.53 - 0.61
<b>PMD</b>	0.78 - 0.85
<b>RSH</b>	0.10 - 0.15

#### - Seychelles, Saya de Malha

<b>L</b>	50 - 67 mm
<b>RW</b>	0.40 - 0.88 g/mm
<b>RD</b>	0.59 - 0.67
<b>PMD</b>	0.82 - 0.89
<b>RSH</b>	0.04 - 0.12

#### - Oman, Hormuz

<b>L</b>	50 - 83 mm
<b>RW</b>	0.38 - 1.00 g/mm
<b>RD</b>	0.59 - 0.68
<b>PMD</b>	0.81 - 0.88
<b>RSH</b>	0.09 - 0.16

#### - Maldives, Laccadives (form *ganensis*)

<b>L</b>	38 - 59 mm
<b>RW</b>	0.26 - 0.64 g/mm
<b>RD</b>	0.57 - 0.66
<b>PMD</b>	0.85 - 0.90
<b>RSH</b>	0.04 - 0.11

#### - Sri Lanka, Andaman Sea, Indonesia

<b>L</b>	54 - 70 mm
<b>RW</b>	0.33 - 0.67 g/mm
<b>RD</b>	0.59 - 0.64
<b>PMD</b>	0.82 - 0.87
<b>RSH</b>	0.05 - 0.12

#### - W. Australia (1 specimen from Ashmore Reef)

<b>L</b>	57 mm
<b>RW</b>	0.51 g/mm
<b>RD</b>	0.63
<b>PMD</b>	0.85
<b>RSH</b>	0.15

#### - Hawaii

<b>L</b>	40 - 86 mm
<b>RW</b>	0.16 - 0.83 g/mm (L 40-70 mm)
<b>RD</b>	0.57 - 0.71
<b>PMD</b>	0.72 - 0.87
<b>RSH</b>	0.08 - 0.15

N. Mozambique (Pl. 63, Figs. 4-12, 14-16): Shape and colouration covering nearly the entire range of variation observed in *C. pennaceus*. Shells with a fine reticulate pattern including rather small and strongly perforated colour zones intergrade with shells with a fine axially lineate pattern as well as with shells with axially fused ground-colour blotches. The lectotypes of *C. pennaceus* (Pl. 63, Fig. 1), *C. praelatus* (Pl. 63, Fig. 3), and the original figure of *C. elisae* (Pl. 63, Fig. 13) are matched by specimens from N. Mozambique (see Pl. 63, Figs. 4, 5, 11, 12). Shells corresponding with the lectotype of *C. elisae* in the fine dark axially lineate pattern occur in colonies that also include shells with a partially reticulate and partially lineate pattern. These colonies live sympatrically and sometimes almost syntopically with colonies of shells that have a rather typical pattern on a pale blue to pale violet ground (Pl. 63, Fig. 14; erroneously referred to as "*C. praelatus*"; Grosch, pers. comm., 1989 & 1990). The lectotype of *C. colubrinus* (Pl. 63, Fig. 2) may also be from this area.

S. Mozambique, Natal: In the local population of *C. pennaceus* from Bazaruto Is. (form *bazarutensis*; Pl. 63, Fig. 17), the last whorl is usually ventricosely conical and has a rather fine and sometimes reduced network of brown to blackish brown lines, spots and blotches on a greyish blue to greyish violet ground; the apex is slightly convex to domed in outline and usually white. Shells very similar in shape and pattern live farther south in the Massinga area. They have a pinkish cream ground colour, a narrow paler spiral band below centre, and a violet apex; their brown reticulate pattern may be more reduced than in form *bazarutensis* (Pl. 63, Figs. 18, 19). Specimens from Natal and S. Mozambique as far north as Inhambane were described as *C. lohri* (Pl. 63, Figs. 20-22) but cannot be separated from *C. pennaceus* from Bazaruto Is. and Massinga by shell morphology and sculpture, nor do they differ from *C. pennaceus* in body colouration or structure of radular teeth. The report of a multispiral larval shell in *C. lohri* (Kilburn, 1972) appears doubtful. The ground colour is orangish brown to brown or greyish blue to greyish violet, and sometimes all these colours merge on the same shell. The last whorl often has a broad darker spiral band on each side of centre and occasionally remnants of a brown to blackish brown pattern similar to that of form *bazarutensis*. The aperture is pale blue to pale violet, edged with a violet collabral band. The low spire has a sigmoid outline and a reddish violet to purple apex. The differences between *C. lohri* and *C. pennaceus* in colour, structure and translucency of the periostracum do not allow separation at the species level.

Tanzania, Kenya: Last whorl ventricosely conical to conical. Ground colour white or suffused with reddish pink. Shells with strongly perforated brown zones and a fine brown network between intergrade with shells with large solid brown zones and irregularly arranged ground-colour tents between (Pl. 64, Figs. 1-3).

Red Sea: Last whorl ventricosely conical to conical; spire usually of moderate height. Pattern consisting of brown to dark brown lines edging small to moderately large white tents; interspersed yellowish brown to dark brown spots and flecks solid but sparse (Pl. 64, Fig. 13).

S. Madagascar: In the local form described as *C. p. behelokensis*, last whorl ventricosely conical to sometimes conoid-cylindrical; early postnuclear whorls with straight to slightly convex sides. Ground colour greyish blue to greyish violet. Shells overlaid with olive, yellowish or orangish brown except for scattered groups of rather small ground-colour tents intergrade with shells with separate brown blotches and spirally as well as axially grouped tents between. Darker brown spiral lines prominent, dotted to solid, and variably articulated with small ground-colour markings (Pl. 64, Figs. 14, 15).

Réunion: In the local form described as *C. rubropennatus*, last whorl ventricosely conical to conoid-cylindrical or conical, ground colour red to reddish violet, and last whorl pattern generally composed of very small to small and regularly arranged ground-colour tents (Pl. 63, Fig. 17).

Mauritius, Rodriguez Id.: A local form described by Hwass as *C. episcopus* is characterized by a comparatively light shell with a ventricosely conical to ovate last whorl. The colour is brown to blackish brown, and the very small to moderately large white tents may be regularly arranged on the last whorl or have larger tents concentrated below shoulder, at centre and at base (Pl. 63, Figs. 23-25). Form *episcopus* occurs in less than 10 m.

Mauritius, St. Brandon: A local form described as *C. rubiginosus* by Hwass and as *C. episcopus mauritiensis* by Lauer has a comparatively light shell with a usually conoid-cylindrical to ventricosely conical last whorl. Its colour varies from orange to red-brown. Shells with small to medium-sized ground colour tents regularly arranged on the last whorl intergrade with shells with a coarse axially lineate pattern of larger tents grouped in axial bands or fused into narrow axially elongate blotches (Pl. 63, Figs. 26-29). The lectotypes of *C. episcopus* and *C. rubiginosus* are rather similar but specimens of both forms may also differ in shape and pattern. In Mauritius, form *rubiginosus* occurs in deeper water.

Seychelles, Saya de Malha: Shells comparatively solid, with a rather broad, conical to ventricosely conical last whorl. Colour brown to dark brown; pattern consisting of small to moderately large white tents partially grouped in axial and spiral bands (Pl. 64, Figs. 7-9). *C. omaria* var. *marmoricolor* (Pl. 64, Fig. 4) is based on a variant of *C. pennaceus* that may be from this area.

Oman, Hormuz: The Oman form described as *C. quasmagnificus* is comparatively large and heavy and has a rather broad and usually conical last whorl. Its ground colour varies from white to greyish blue. Shells with 2 nearly continuous, light to reddish or blackish brown spiral bands and 3 spiral zones of very small to small ground-colour tents on the last whorl intergrade with shells with separate brown flecks and blotches and spirally as well as axially grouped larger tents between (Pl. 64, Fig. 10, 11). Specimens from Hormuz (Pl. 64, Fig. 12) are somewhat smaller and more ventricose; their pattern has uniformly small and rather regularly arranged ground-colour tents.

Maldives, Laccadives: The local form was described as *C. p. ganensis*. It is characterized by a low spire, an angulate

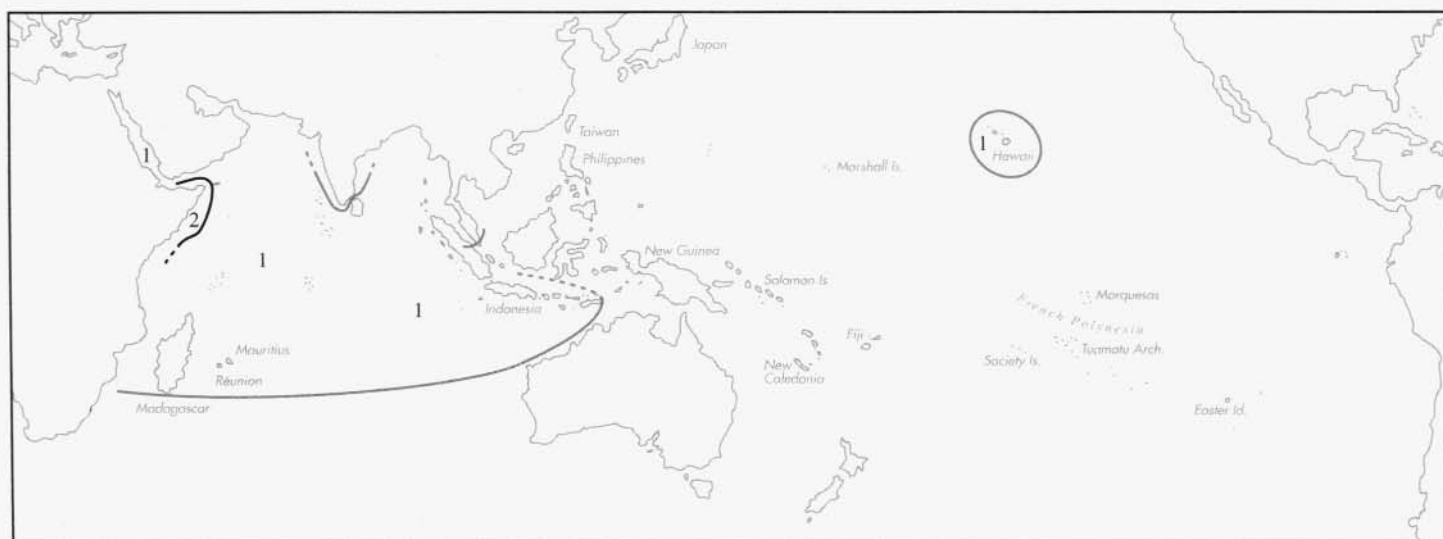
shoulder and a conical last whorl; its colour is yellowish brown to mostly reddish brown (Pl. 64, Fig. 18).

Sri Lanka, Andaman Sea, Indonesia: Shells from these marginal Indian Ocean populations have ventricosely conical to conical last whorls, low spires, and a dark reddish brown colour; their medium-sized to moderately large ground-colour tents are separate rather than prominently grouped (Pl. 64, Figs. 5-6, 19). They also may represent form *marmoricolor*.

W. Australia: We have seen 2 specimens from Ashmore reef, N. W. Australia; their last whorl is conical, their spire of moderate height, and their pattern includes large overlapping white tents (Pl. 64, Fig. 16).

Hawaii (Pl. 64, Figs. 25-28): Shells variable in shape and pattern between and within local populations, usually less variable in colour (various shades of brown). Largest and broadest specimens of *C. pennaceus* collected in Hawaii (Kohn & Weaver, 1962). Last whorl ventricosely conical to conical or ovate. Ground colour white to greyish blue. Shells with very small to moderately large ground-colour tents, regularly arranged or spirally and axially grouped, intergrade with shells with fine, closely spaced axial brown lines and usually 2 continuous brown spiral bands on the last whorl. Shells with an axially lineate pattern (Pl. 64, Figs. 25) represent an individual variant (Perron, 1979); they are often but probably erroneously referred to as "*C. sindon*" (see *C. omaria*, and Pl. 62, Figs. 19-21). Another taxon sometimes applied to the Hawaiian shells is *C. stellatus* Kiener. However, the original figure (Pl. 64, Fig. 24) shows a subadult shell that cannot be unequivocally assigned to a particular geographic region. The type locality of *C. racemosus* Sowerby III (Pl. 64, Fig. 23) is given as "Sandwich Islands?", and its holotype resembles Hawaiian specimens in shape. However, the colour pattern must be regarded as very unusual for this area and rather corresponds with that of form *behelokensis* from Madagascar.

Map 129



1: *C. pennaceus* 2: *C. echo*

## *Conus echo* LAUER, 1988

(Plate 64, Figures 20-22, 29; Map 129)

- 1988 *Conus pennaceus* forma *echo* Maccà, La Conchiglia, **14** (230-231): 12-13, text figs.
- 1988 *Conus pennaceus echo* "Maccà" Lauer, Rossiniana, (**45**): 9-10, text figs.
- 1991 *Cylinder (Darioconus) echo* Maccà, Studio Editoriale Programma, Padova: 1-5, text figs. 1-8

**Types:** *C. p. echo* Lauer: Holotype (as "Lectotype") in coll. Maccà (41.5 x 23 mm); *C. echo* Maccà: Holotype in MHNG (58.5 x 31.5 mm).

**Type Localities:** *C. p. echo* Lauer: "North Somalia"; *C. echo* Maccà: "from an unspecified locality at east of Bosaso (region of Bari, Somalia, Gulf of Aden coast)."

**Range:** Berbera (N. Somalia) to Kisimalo (E. Somalia).

**Description:** Medium-sized to moderately large, moderately solid to solid. Last whorl ventricosely conical to conical in adult specimens, rather ovate in subadults; outline convex adapically, straight (right side) to slightly concave (left side) below. Aperture wider at base than near shoulder. Shoulder angulate. Spire low, outline concave. Maximum diameter of larval shell 1.1-1.2 mm. Teleoconch sutural ramps almost flat, with 4 weak spiral grooves or obsolete spiral sculpture in late whorls. Last whorl nearly smooth.

### *C. echo* Shell Morphometry

<b>L</b>	40 - 69 mm
<b>RW</b>	0.21 - 0.48 g/mm
<b>RD</b>	0.58 - 0.61
<b>PMD</b>	0.75 - 0.86
<b>RSH</b>	0.05 - 0.11