

## The Conidae (Mollusca : Gastropoda) of India

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### Introduction

Analysis of prior literature has revealed that 37 species of the marine gastropod family Conidae have been reported to occur along the shores of the Indian subcontinent. This is considerably fewer than corresponding figures for the nearby continental island of Sri Lanka (70; Kohn, 1960) and the oceanic Maldive and Chagos Islands (64; Kohn & Robertson, 1968). In this report, I attempt to provide an up-to-date list of the species of *Conus* occurring in India and a guide to their identification, information on their habits and habitats, and a comparison of the species composition of continental shores and inshore waters with those of nearby islands, as well as of oceanic islands of the tropical Indo-West Pacific region (IWP). The results of these analyses are used to address several questions of more general interest:

- (1) Is the *Conus* fauna of India actually less diverse than those of continental and oceanic island shores in the same geographic region?
- (2) Are fewer different types of habitats available than in the neighbouring regions limiting the numbers of species found?
- (3) Are the available habitats less complex than, e.g., in Sri Lanka, and hence 'saturated' by a smaller number of species?
- (4) What are the geographic distributions of the Indian species of *Conus*?

Of particular interest is the extent of affinity with the widely distributed IWP species that have been studied particularly in coral reef habitats of more oceanic character (Kohn, 1959 a, 1968; Kohn & Nybakken, 1975).

### Methods and materials

This study is based primarily on analysis of prior taxonomic and faunistic literature, approximately 2 months of field work (January–February 1968), and study of collections of the museums listed below together with the abbreviations used for them hereafter in this report:

American Museum of Natural History	AMNH
Academy of Natural Sciences of Philadelphia	ANSP
British Museum (Natural History)	BM(NH)
Indian Museum, Calcutta	IM
Institut Royale des Sciences Naturelles de Belgique, Brussels	IRSN
Museum of Comparative Zoology, Harvard University	MCZ
Madras Government Museum	MGM
Muséum National d'Histoire Naturelle, Paris	MNHN
Naturhistorisches Museum Wien	NMW
United States National Museum	USNM
Universitetets Zoologiske Museum, Copenhagen	UZMC
Zoologiske Museum, Stockholm	ZMS

The most important collection of Indian *Conus* is that made by Ronald Winckworth (1884–1950) in the 1920's and 1930's, now in the BM(NH). Winckworth personally collected most of the specimens alive and provided accurate and reliable locality data. An older, smaller collection of importance was made by Dr. F. Stoliczka (1835–1874), palaeontologist of the Zoological Survey of India from 1862. Although the precise localities of the specimens are not known, Stoliczka's material, now in the NMW, includes several species of *Conus* not otherwise represented in collections by specimens from India. Specimens collected in India by the Novara Expedition are also in the NMW. However, at least some of the specimens obtained at Madras were purchased or received as gifts to the Expedition, and their locality data are therefore not reliable (Frauenfeld, 1867, 1869). Material collected by the author is indicated by the designation AJK. It has been deposited in the USNM.

The following section lists all species represented by at least one specimen known to have been collected alive on Indian shores or offshore waters, arbitrarily defined as within the 200 m depth contour.

In order to facilitate comparison and identification, morphometric and sculptural characteristics of the species are presented in Table 1 and colour patterns of the possibly sematic siphons are shown in a plate of diagrams. The descriptions of each species in the systematic section includes colour pattern of the shell and visible parts of the body where known, and details of the periostracum. These are less appropriate to tabular presentation.

The descriptive material is based primarily or exclusively on specimens from India, and the apertural view of at least one specimen of each species from India is illustrated photographically.

The geographic distribution of each species within India and its range elsewhere are also given, together with observations I was able to make on the habits and habitats of species observed alive.

### Species of *Conus* in India

#### *Conus achatinus* Gmelin

(Fig. 18)

*Conus achatinus* Gmelin, 1791, *Syst. Nat.*, ed. 13, p. 3386.

*Description.* Last whorl usually brown, clouded with irregular greyish or bluish white flammules and blotches; with transverse lines of dark chestnut dots and dashes, articulated with white on the white markings. Colour pattern of spire similar, except interrupted lines absent. Aperture bluish white, exterior colour pattern visible as a band along interior border of lip.

Periostracum moderately thick, with widely spaced transverse ridges; light olive brown.

In life, sole of foot mottled brown and buff, darker medially; side of foot mottled brown and dark brown on white. Siphon heavily mottled dark brown dorsally, white ventrolaterally. Rostrum buff, sparsely mottled with brown; tentacles white, tips tan (based on specimens from Singapore).

*Distribution.* Melvill & Abercrombie (1893) first reported *C. achatinus* from India as '*C. monachus* Linnaeus var. *achatinus* Chemnitz'. *C. monachus* is now considered a distinct species, and the name *achatinus* is validly attributed to Gmelin (Kohn, 1963, 1966).

*C. achatinus* has been reported from Bombay (Melvill & Abercrombie, 1893; Abercrombie, 1893; Hornell & Tomlin, 1951; Subrahmanyam *et al.*, 1952); and from Bombay southward to Goa (Melvill & Standen, 1901). It evidently occurs along much of the west coast of India; I found empty shells at Okha. Ray (1949) distinguished *C. achatinus* from *C. monachus* and cited two specimens from the Coromandel Coast. *C. achatinus* is widely distributed throughout the tropical Indian Ocean and as far east in the Pacific as Fiji.

***Conus aculeiformis* Reeve**

(Fig. 19)

*Conus aculeiformis* Reeve, 1844, *Conch. Icon.*, pl. 44, No. 240.

*Description.* Last whorl greyish white, with quadrangular light brown markings; in some specimens, larger, darker markings form interrupted transverse bands adapical and abapical of the centre. Colour pattern of spire similar to that of last whorl. Aperture white to tan.

*Distribution.* *C. aculeiformis* has not been reported previously from Indian waters. Two specimens trawled off Madras by P. Sukherwala in 1975 are in the AMNH (fig. 19). The *Galathea* expedition dredged empty and worn shells possibly referable to this species off Tranquebar (11° 10' N, 79° 59' E) in 75 m (UZMC). *C. aculeiformis* also occurs in the Red Sea and northern Arabian Sea and in the Pacific as far east as New Britain.

***Conus acutangulus* Lamarck**

(Fig. 20)

*Conus acutangulus* Lamarck, 1810, *Ann. Mus. Hist. Nat. Paris*, 15 : 286.

*Description.* Last whorl white to yellowish brown, with an irregular pattern of brown bands, markings and lines, often forming two poorly defined interrupted transverse bands either side of the centre. Rows of distantly spaced brown dots on the ridges mark the areas between and outside the bands. Spire marked by distantly spaced broad brown spots. Aperture white.

Periostracum very thin, smooth, translucent, brown.

In life, anterior portion of sole of foot buff, posterior half light purplish brown. Siphon buff at tip, darker tan proximally. Rostrum buff (Kohn & Weaver, 1962).

*Distribution.* *C. acutangulus* has been reported from India only by Melvill and Standen (1901) "about 125 miles [200 km] WSW of Bombay, 18° 43' N, 71° 30' to 71° 45' E, adhering to the cable of The Eastern Telegraph Co. at 45 fathoms [83 m]; abundantly, but dead". Nine specimens collected by F. W. Townsend 'off Bombay' and perhaps from the same source are in the BM(NH) (fig. 20). Specimens from the Malabar Coast at 51 m and the Coromandel Coast at 75 m are in the IM. The *Anton Bruun* collected empty shells in 58 m, 16 km S.E., and in 79 m, 29 km S.E. of Vizagapatam (ANSP, Nos. 294145, 294618). *C. acutangulus* is a widely distributed tropical Indo-West Pacific species occurring from the Red Sea to Hawaii.

Table 1

Morphometric and sculptural characteristics of shells of the Indian species of *Conus*

Species	Maximum length(a)	Shape of last whorl	100 × maximum diameter	Transverse sculpture of last whorl	100 × spire height	Shell length	Spire angle	Presence of spiral striae	Form of shoulder	Presence of coronation	Aperture length	Lip indentation at shoulder
<i>achatinus</i> Gmelin	75	Ovate	60-63	Inconspicuous lirae	85-100°	15-17	Yes	No	Rounded	No	7-8	Slight
<i>aculeiformis</i> Reeve	28	Very elongate conic	47-50	Cancellate striae	Acute	21-22	Yes (fine)	No	Angular	No	14-15	Deep
<i>acutangulus</i> Lamarek	25	Conic	85	Prominent ridges, punctate grooves	Acute	30-40	Yes + apical riblets	Yes	Angular	Yes	8-10	Deep
<i>amadis</i> Gmelin	94	Conic	57-63	Punctate	Obtuse	15-20	Yes (fine, wavy)	No	Angular	No	8	Deep
<i>araneosus</i> Solander in [Lightfoot]	63	Conic	62-68	Abapical striae(s,l)	Obtuse	7-15	No	Yes	Angular	Yes	12	Deep
<i>arenatus</i> Hwass in Bruguière	27	Conic to slightly ovate	65-71	Widely spaced abapical striae	Obtuse	17	Yes	Yes	Slightly rounded	Yes	9-12	Moderate
<i>australis</i> Holten	43	Subcylindric	60	Smooth or granular ridges, broad punctate striae	Acute	20-25	Yes	Yes	Slightly angular	Early whorls only	9	Slight
<i>bayani</i> Jousseaume	50	Elongate conic, slightly concave	62-66(WC) 55-57(M)	Abapical striae	Acuminate apex	17	No	No	Sharply angular	No	15	Deep
<i>betulinus</i> Linnaeus	90	Broadly conic	65-74	Abapical lirae and striae	Obtuse	10-12	No	No	Rounded	No	8	Deep
<i>bilibiosus</i> (Röding)	50	Conic	62-71	20-30 slightly elevated lirae	Obtuse	8-18	Yes	Yes	Angular to rounded	Yes	8	Slight
<i>boschi</i> Clover	28	Very elongate conic	64	Widely spaced cancellate striae	Obtuse	14-17	Yes	No	Angular	No	8-11	Slight
<i>catas</i> Hwass in Bruguière	45	Broadly conic	69-73	Striae and lirae obsolete adapically	Obtuse	10-15	Yes	Yes	Rounded	No	6-7	Slight

Table 1—continued

Species	Maximum length(a)	Shape of last whorl	100 × maximum diameter Length of last whorl	Transverse sculpture of last whorl	100 × spire height Shell length	Spire angle	Presence of spiral striae	Form of shoulder	Presence of coronation	Aperture	
										length	width
<i>ceylanensis</i> Hwass in Bruguière	20	Conic	74	Finely granular abapical lirae	9–13	Obtuse	Early whorls only	Angular	Yes	9–11	Deep
<i>coromandelicus</i> Smith	50	Pyriiform	60–67	21–26 broad nodulose lirae	30	Acute	Lirae + axial riblets	Very rounded	No	7	Deep
<i>coronatus</i> Gmelin	35	Conic(s,1) to ovate(s)	73–81	Widely spaced abapical lirae	15–20	Obtuse	Yes	Rounded to angular	Yes	8–13	Moderate
<i>ebraeus</i> Linnaeus	36	Conic	75	Granular abapical lirae	15–18	Obtuse	Yes	Angular to rounded	Yes	8–9	Moderate
<i>eburneus</i> Hwass in Bruguière	50	Conic to pyriform	65–70	Unequally spaced striae	7–10	Obtuse	Yes (deep)	Rounded	No	9–10	Slight
<i>extimus</i> Reeve	35	Conic	66	Widely spaced abapical striae	20	Slightly obtuse	Yes (very fine)	Sharply angular	No	11–13	Moderate
<i>figulinus</i> Linnaeus	60	Pyriiform	63–71	Abapical lirae and striae	10–13	Very obtuse	No	Broadly rounded	No	8–9	Slight
<i>frigidus</i> Reeve	55	Conic to slightly ovate	74	Fine adapical, granular abapical lirae	15–20	Obtuse	Yes	Slightly rounded	No	10	Moderate
<i>geographus</i> Linnaeus	63	Ovate-cylindric	48	Smooth		Obtuse	Obsolete	Angular	Yes	5–6(b)	Slight
<i>glans</i> Hwass in Bruguière	30	Ovate-cylindric	52–57	Sharply defined lirae	18	Slightly obtuse	Yes	Rounded	No	10(b)	Slight
<i>gubernator</i> Hwass in Bruguière	65	Ovate-cylindric	50	Adapical striae	12	Obtuse	Yes	Angular	No	9(b)	Moderate
<i>inscriptus</i> Reeve	57	Conic	57–63	Prominent cancellate adapical(s), abapical(s,1) striae	16–18(1), 22–36(s)	80–105°	Yes	Angular(s) to rounded(l)	No	9(b)	Slight
<i>lentiginosus</i> Reeve	40	Conic	53–62(GM) 63–68(WC)	Widely, evenly spaced punctate abapical striae	18–25	Acute (70–81°)	Yes (1–2)	Sharply angular	Early whorls only	9–10	Deep

Continued on next page

Table 1—continued

Species	Maximum length(a)	Shape of last whorl	100 × maximum diameter of last whorl	Transverse sculpture of last whorl	Shell length	Spire angle	Presence of spiral striae	Form of shoulder	Presence of coronation	Aperture length	Aperture width	Lip indentation at shoulder
<i>litteratus</i> Linnaeus	83	Conic	61	Smooth	1–8	Very obtuse	Obsolete or no	Sharply angular	No	15	Deep	
<i>lividus</i> Hwass in Bruguière	45	Conic	73	Granular abapical lirae	9–20	Obtuse	Yes	Angular	Yes	9–12	Slight	
<i>longurionis</i> Kiener	35	Very elongate conic; base recurved	74–76	Cancellate striae	27	Acute	Yes (one broad, cancellate)	Slightly angular	Early whorls only	18	Deep	
<i>loroisi</i> Kiener	93	Broadly conic to pyriform	71–75	Irregular abapical striae	5–8	Obtuse (> 130°)	No	Broadly rounded	No	6.5–9	Moderate	
<i>malacanus</i> Hwass in Bruguière	78	Broadly conic	64–74	Abapical striae	7–19	Very obtuse	Yes	Carinate	No	8–12	Deep	
<i>marmoratus</i> Linnaeus	70	Elongate conic	62–64	Striae	6–10	Obtuse	Obsolete or no	Angular	Yes (broad)	8–11	Deep	
<i>mitneadwardi</i> Jousseaume	120	Very elongate conic	44	Obsolete abapical striae	30–38	Acute (~40°)	Obsolete	Angular	First 9 whorls only	15–20	Slight	
<i>monile</i> Hwass in Bruguière	80	Elongate conic	57–60	Obsolete abapical striae	9–12	Very obtuse	No	Angular	No	13–16	Deep	
<i>musicus</i> Hwass in Bruguière	23	Conic	72–76	Granular abapical lirae	10–15	Obtuse	No	Angular	Yes	10–14	Deep	
<i>mutabilis</i> Reeve	80	Conic to pyriform	64–70	Abapical striae and lirae	12–17	Obtuse	Yes	Angular(s) to rounded(l)	No	6–9	Moderate	
<i>nussatella</i> Linnaeus	70	Cylindric	42–46	Closely spaced striae and lirae	14–19	Acute (70–85°)	Very fine	Broadly rounded	No	12–14 b)	Very slight	
<i>pennaceus</i> Born	70	Conic to pyriform	57–65	Closely spaced striae	7–10	Obtuse	Obsolete	Rounded	No	8–10(b)	Moderate	
<i>quercinus</i> Solander in [Lightfoot]	82	Pyriform to conic(s)	80(l)	Closely spaced abapical striae	10(l)–20(s)	Obtuse	Yes (fine)	Angular(s) to rounded(l)	No	8–9	Slight	
<i>rattus</i> Hwass in Bruguière	44	Conic to pyriform	75	Abapical striae	14	Obtuse	Yes	Bluntly angular	No	8	Moderate	

Table 1—continued

Species	Maximum length(a)	Shape of last whorl	100 × maximum diameter of last whorl	Transverse sculpture of last whorl	100 × spire height Shell length	Spire angle	Presence of spiral striae	Form of shoulder	Presence of coronation	Aperture	
										length	width
<i>striatellus</i> Link	54	Elongate conic	66	Adapical striae, granular lirae	18	Obtuse	Yes	Sharply angular	No	9(b)	Slight
<i>striatus</i> Linnaeus	76	Elongate ovate	56	Closely spaced fine striae	9	Obtuse	Yes	Sharply angular	No	8(b)	Deep
<i>sulcatus</i> Hwass in Bruguière	57	Conic	60	Broad cancellate abapical striae	9	Obtuse	Yes	Angular	Low, widely spaced	8	Deep
<i>terebra</i> Born	90	Elongate conic	51-56	Widely spaced lirae	12-18	70-100°	Obsolete or no	Rounded	No	9-11	Slight
<i>tessulatus</i> Born	70	Conic	66-70	Abapical striae	9-11	Obtuse	Yes	Angular	No	8-11	Moderate
<i>textile</i> Linnaeus	40	Ovate	54-63	Closely spaced fine striae	17-18	82-90°	Obsolete or no	Rounded	No	7-9(b)	Moderate
<i>vezillum</i> Gmelin	105	Broadly conic	65	Obsolete abapical striae and lirae	12-14	105-120°	Yes	Angular	No	8-9	Slight
<i>virgo</i> Linnaeus	118	Elongate conic	58-61	Obsolete adapical to conspicuous abapical striae and lirae	4-8	125-150°	Obsolete or no	Slightly angular	No	11-13	Slight
<i>zeylanicus</i> Gmelin	52	Subcylindric to conic	65-68	Abapical striae	6-8	Obtuse	Yes	Rounded to slightly angular	No	9-12	Moderate

NOTES: (a) Maximum shell length of specimens from India; may attain greater length elsewhere.

(b) Aperture noticeably broader abapically.

(l) Characteristic of larger specimens.

(s) Characteristic of smaller specimens.

(GM) Characteristic of specimens from Gulf of Mannar

(M) Characteristic of specimens from Madras.

(WC) Characteristic of specimens from West Coast.

*Conus amadis* Gmelin

(Figs. 6, 21)

*Conus amadis* Gmelin, 1791, *Syst. Nat.*, ed. 13, p. 3388.

*Description.* Colour pattern of last whorl very variable; irregular or zigzag markings of tan, orange, or orange-brown, often joined in two or three zones separated by white, or the white ground showing through as unequal triangular or heart-shaped scales. Spire marked with large brown and white spots. Aperture white.

Periostracum thin, translucent, buff, often present in living specimens only on spire and near growing edge of last whorl.

In life, sole of foot reddish brown, anterior and lateral margins edged with a buff line; lateral portion of foot bordered by an irregular black band about 1 mm wide (in specimen about 70 mm long), but broader anteriorly and extending several millimetres over the dorsal portion of the foot at anterior end. Siphon nearly white, with some fine tan transverse lines in some specimens, and a gray transverse stripe just behind the anterior edge (fig. 6).

*Distribution.* *Conus amadis* was first reported from India by Thurston (1890) from Rameswaram. Subsequent records are from Pamban (Thurston, 1895; Satyamurti, 1952), Krusadai ([Chennappayya], 1927, as *C. acuminatus*); Mandapam (Sundaram, 1969); and Madras (Melvill & Standen, 1898; Crichton, 1940, 1941; Gravely, 1942). I obtained specimens trawled off Porto Novo, and there are Museum records from Tuticorin (BM(NH)) and Tranquebar (UZMC). Its distribution in India thus appears restricted to the Gulf of Mannar and Coromandel Coast. Elsewhere, it occurs in Sri Lanka and the Andaman and Nicobar Islands, and there are literature records from Indonesia, China, Philippines, and New Caledonia (Dautzenberg, 1937).

*Ecological observations.* Satyamurti (1952) reported that "numerous specimens, both dead shells and live specimens, have been collected, particularly from the mud flats at Kundugal Point (Pamban Island) where they are often found half buried in sand at low tide". I, with three other collectors, searched this area on 21 February 1968, but we found only a single empty shell and no living specimens of *C. amadis*.

Four specimens trawled by a fishing-boat at a depth of 18 m off Porto Novo were isolated in vessels of sea water for 2-5 days in order to collect faecal matter for determination of the nature of the food. Two *C. amadis* radula teeth, but no faecal matter, were recovered. Dissection of the alimentary tracts of two preserved specimens also yielded only *C. amadis* radula teeth and soft, unidentifiable material. The nature of the food of *C. amadis* thus remains unknown.

*Conus araneosus* Solander in [Lightfoot]

(Figs. 7, 22)

*Conus araneosus* Solander in [Lightfoot], 1786, *Cat. Portland Mus.*, p. 76.

*Description.* Last whorl with a fine dark brown network on whitish ground, forming triangular meshes separated from each other by smaller and more numerous meshes; with two or three rather narrow transverse brown bands interrupted by white triangular markings. Aperture white, sometimes clouded with flesh.

In life, sole of foot buff, anterior edge yellow, sides and dorsum buff, mottled with brown and with a black longitudinal line continued as a broad band around the anterior dorsum. Tip of siphon orange, followed proximally by a narrow white stripe, broad grey stripe and broad stripe of buff heavily mottled with reddish brown (fig. 7). Rostrum buff; tentacles buff, anterior margins grey.

*Distribution.* The locality of one of the two specimens of *C. araneosus* listed in the Portland Catalogue was given as Coromandel ([Lightfoot], 1786). Mawe (1823) also recorded it from Tranquebar (as *C. arachnoideus*, a junior synonym). Satyamurti (1952) and Sundaram (1969) reported it from Pamban, Natarajan (1957) listed several localities in the Gulf of Mannar, and I collected specimens at Mandapan Camp (fig. 22) and Tuticorin. R. Robertson collected specimens at Hare Island (Musal Tivu) (ANSP No. 301508). Its distribution in India thus appears to be limited to the south-east coast. It also occurs in Sri Lanka, the Andaman (ZMS) and Nicobar (UZMC) Islands, and the Philippines (IRSN).

*Ecological observations.* *C. araneosus* was collected intertidally and slightly subtidally on limestone and sand substrates. The sand associated with a specimen collected at Hare Island (Pandyan Tivu), Tuticorin (see discussion of this habitat under *C. pennaceus*) consisted of 4% very coarse (1–2 mm), 12% coarse (0.5–1 mm), 32% medium (0.25–0.5 mm), 45% fine (0.125–0.25 mm) and 7% very fine (0.0625–0.125 mm) particles.

Four *C. araneosus* radula teeth, unidentifiable fleshy material, and several plates which may be buccal armature of a gastropod were recovered from one specimen, and two radula teeth from another collected at Pandyan Tivu. The alimentary tract of one specimen from Musal Tivu contained the radula and other remains of a columbellid, probably *Pyrene testudinaria* (Link).

Natarajan (1957) reported the breeding season as October–March and gave a detailed account of larval development.

### *Conus arenatus* Hwass in Bruguière

(Fig. 23)

*Conus arenatus* Hwass in Bruguière, 1792, *Enc. Méth. Vers.*, 1 : 621.

*Description.* Last whorl white, with closely spaced, interrupted rows of many small, dark brown dots. Spire predominantly white, with sparse small brown dots. Aperture white.

Periostracum of specimens from India thin, smooth, yellow, translucent.

*Distribution.* *Conus arenatus* is known in India only from two specimens collected at Tuticorin by R. Winckworth (BM(NH) Nos. 1953.3.10.320 and 321) (fig. 23), and one specimen labelled 'Bombay' in the NMW. The species is widely distributed throughout the tropical Indian Ocean and eastward in the Pacific to the Cook Islands.

### *Conus australis* Holten

(Fig. 24)

*Conus australis* Holten, 1802, *Enum. Syst. Conchyl. Chemnitzii*, p. 39.

*Description.* Last whorl white, with transverse rows of brown spots on the ridges, the markings often coalesced to form interrupted transverse bands

either side of centre. Spire white with arcuate brown markings extending over shoulder. Aperture lavender.

Periostracum thin, translucent, pale brown.

*Distribution.* *Conus australis* has been reported only once from Indian Seas; three specimens were dredged about 75 km WSW of Calicut, at 11° 05' 45" N, 75° 04' 08" E, in 66 m by the *Investigator* (Smith, 1894) (fig. 24). The *Galathea* Expedition dredged empty shells of *C. australis* off Tranquebar, at 11° 10' N, 79° 59' E, 50 m, and at 11° 06' N, 80° 05' E, 129 m (UZMC). The *Investigator* specimens represent the westernmost record of the species, which is also known from Indonesia, China and Japan, and Philippines.

### *Conus bayani* Jousseaume

(Figs. 25, 26)

*Conus bayani* Jousseaume, 1872, *Rev. Mag. Zool.*, **23** : 200.

*Description.* Last whorl white, with yellowish tan spots and axial flammules forming two transverse bands separated by a white band; with transverse lines of darker tan dots and dashes separated by white. Spire white, with irregular tan markings. Aperture violet.

Periostracum mostly absent from specimens examined, but appears to have been thin, slightly translucent and dark brown.

*Distribution.* *Conus bayani* is one of four species reported by Melvill and Standen (1901), adhering to the pitch on the Eastern Telegraph cable about 200 km WSW of Bombay (18° 43' N; 71° 30' to 71° 45' E) in 82 m. 'Many dead' specimens were present. Two of these (fig. 25) are in the BM(NH). F. B. Steiner (personal communication) obtained specimens trawled 29 km off Madras at depths of 33–46 m. These specimens are narrower (fig. 26, table 1). Similar specimens from 20–50 m south of Madras are in the AMNH.

The geographic distribution of *C. bayani* is poorly known. Jousseaume (1872) stated that the type specimen was in a collection made primarily at Bourbon (Réunion) and nearby islands; its label in the MNHN reads 'Bourbon? Madagascar?'

### *Conus betulinus* Linnaeus

(Fig. 27)

*Conus betulinus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 715.

*Description.* Last whorl yellow, often with lighter transverse bands, especially in smaller specimens; with widely spaced transverse rows of dark brown dots; the dots often variable in size and spacing. Spire yellow with arcuate brown spots. Aperture white, edge of lip yellow.

Periostracum rather thick, with prominent collabral growth lines; yellowish brown.

*Distribution.* *Conus betulinus* is known from India primarily in the vicinity of Madras (Melvill & Standen, 1898; Crichton, 1941; Gravely, 1942) (fig. 27). Specimens from Gopalpur and Tuticorin are in the BM(NH) and from Tranquebar in the UZMC. *Conus betulinus* is widely distributed throughout the tropical Indian Ocean and occurs in the western Pacific as far east as the Philippines and Japan.

*Ecological observations.* Examination of the alimentary tracts of 14 specimens of *C. betulinus* trawled by fishermen at depths of 11–18 m 5–8 km off shore from Madras, between Royapuram and Santhome revealed unidentified fleshy material without hard parts, perhaps the remains of unsegmented worms, in eight specimens. One contained setae and uncini of the capitellid polychaete *Dasybranchus caducus* Grube. Alimentary tracts of five specimens trawled off Porto Novo contained no identifiable food material.

***Conus biliosus* (Röding)**

(Fig. 28)

*Conus punctatus* Hwass in Bruguière, 1792, *Enc. Méth. Vers*, 1: 628 (non *C. punctatus* Gmelin, 1791).

*Cucullus biliosus* Röding, 1798, *Mus. Boltenianum*, p. 39.

*Description.* Last whorl pale grey, tan or pink, with transverse white bands at shoulder and centrally; spiral lirae with rows of reddish brown dots and/or dashes; some specimens with wavy, variably spaced axial flammules of the same colour. Base tan to dark brown. Spire white with irregular dark brown markings, primarily between the tubercles. Aperture white or bluish white, edged with tan.

Periostracum brown, slightly translucent, to thick and opaque, with about 20 tufted, transverse ridges irregularly spaced or in groups, and closely spaced collabral growth lines.

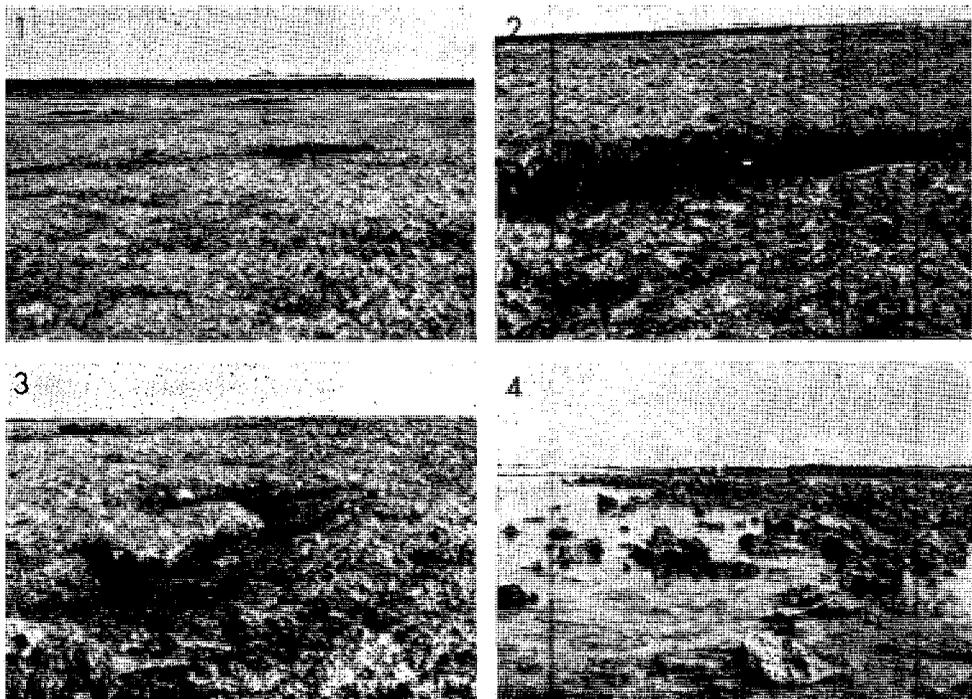
In life, sole and lateral edge of foot brick red, light reddish brown with very small white flecks above; anterior edge of foot red, anterior dorsum brown or black. Tip of siphon edged with a thin, pale red band; dorsum of siphon dark reddish brown or brick red. Distal 2 mm of rostrum red, proximal portion reddish brown; tentacles light brown, tipped with red.

*Distribution.* *Conus biliosus* was first reported from India by Mitchell (1867) from Vizagapatam, as '*C. punctatus* Chemnitz'. Thurston (1890, 1895) then recorded it from Rameswaram Island as *C. piperatus* Dillwyn. Kohn (1975) showed that the earliest available and hence correct name of the species is *C. biliosus* (Röding). It occurs on the east coast from Cape Comorin (specimen in BM(NH)), to the Gulf of Mannar (Satyamurti, 1952), Madras (Melvill & Standen, 1898 (as '*C. punctatus* Sowerby'), and Vizagapatam, and has also been reported to occur on the west coast from Bombay (Subrahmanyam, *et al.*, 1952) to Okha (Menon, *et al.*, 1961, as '*Conus punctatus* Chemnitz'). References to '*C. piperatus* Reeve' from Bombay (Melvill & Abercrombie, 1893; Hornell & Tomlin, 1951; Subrahmanyam, *et al.*, 1952) are undoubtedly to this species. Melvill & Standen's (1901) citation of *C. piperatus* Reeve appears to refer to *C. erythraeensis* Reeve, of which *C. piperatus* Reeve is a junior synonym. The distribution of *C. biliosus* outside India is uncertain. It probably occurs in Sabah (Gore, 1966, as *C. piperatus* Dillwyn, a junior synonym).

*Ecological observations.* On the terraced intertidal limestone bench just seaward of the marine laboratory of the State of Gujarat Department of Fisheries at Okha Point, *C. biliosus* occupies an unusually specialized microhabitat of small caves and associated tidal pools. These occur on the outermost portion of the bench that is exposed by a +0.7 m low tide. In this region

(fig. 1), the bench is of very dissected, rough limestone, with some sand-filled depressions 15–20 cm deep. The limestone overhangs that form the caves where *C. biliosus* occurs are mainly about 0.3 m above the associated tidal pools. Their long axes mainly trend east–west, with the pools on the south or shoreward side. At low tide, the pools contain water about 15 cm deep over a bottom of sand, gravel, and some small boulders (figs. 2, 3). Green (*Ulva?*), brown (*Sargassum?*), and filamentous red algae are prominent in the pools, often obscuring the *Conus*. Examination of the undersides of the cave roofs revealed a succession from photophilic to photophobic organisms. Encrusting, calcareous red algae occupy the outer portion and extend surprisingly far back. This must be because the openings face south, and light is reflected up and back. Farther in, a variety of encrusting animals, most prominently sponges and compound and solitary ascidians, replace the plants. Other molluscs associated with *C. biliosus* on the outer bench, named according to Menon, *et al.* (1961), are *Astraea semicostata* (Kiener), the commonest herbivore, *Murex virgineus* (Röding) on the tops of the limestone outcrops, and *Cantharus undosus* (Linnaeus), *Sinum cuvierianum* (Recluz), and the bivalve *Bequina variegata* Bruguière under rocks.

The specific substrate occupied by eight individuals of *C. biliosus* was recorded. Two were on bare rough limestone and two on a very thin layer of



FIGS. 1–4. 1, General view toward the north of truncated old reef limestone in the mid-to low-intertidal zone at Okha, showing several east–west trending overhangs that form caves inhabited by *Conus biliosus*. (2)–(3), Closer views of the habitat of *Conus biliosus* at Okha, showing the configuration of a cave and its tide pool. The vial is 105 × 40 mm. (4), Reef platform on east side of Krusadai Island at low tide, showing habitat of *Conus coronatus*. The substratum in the foreground is approximately at tidal datum. *C. catus* also occurs at this locality.

sand on limestone bench. The others were partly buried in gravel and sand, partly buried in sand (53% very coarse, 23% coarse, 9% medium, 13% fine, 2% very fine), on gravel and sand under a coral boulder and on sand (37% very coarse, 37% coarse, 23% medium, 2% fine and 1% very fine).

Examination of the alimentary tracts of 11 specimens of *C. biliosus* from Okha Point revealed remains of one specimen of the eunicid polychaete *Lysidice collaris* Grube and one unidentified nereid. The alimentary tract of one specimen collected at Shingle Island contained remains tentatively identified as of *Eunice rubra* Grube.

### *Conus boschi* Clover

(Fig. 29)

*Conus boschi* Clover, 1972, *Venus, Jap. J. Malacol.*, **31**: 117.

*Description.* Last whorl white, with about 14 rather evenly spaced fine transverse reddish brown lines, and irregular axial lines of the same colour; with transverse bands of rather evenly spaced reddish brown blotches abapically, medially, and at the shoulder. Colour pattern of last whorl continued on spire. Aperture lavender.

Periostracum smooth, light brown, translucent (Clover, 1972).

*Distribution.* *C. boschi* has not previously been reported from India, but R. Winckworth collected a specimen (BM(NH) No. 1953.3.13.120) at Tuticorin in 1932. P. Sukherwala has recently collected specimens at Tuticorin (fig. 29) and Rameswaram (AMNH). *C. boschi* has been reported previously only from Masirah Island and southeast Arabia (Clover, 1972).

### *Conus catus* Hwass in Bruguière

(Figs. 8, 9, 30)

*Conus catus* Hwass in Bruguière, 1972, *Enc. Méth. Vers.*, **1**: 707.

*Description.* Last whorl brown, reddish brown or brownish pink, with irregular white flecks or splotches. Colour pattern of spire similar to that of last whorl. Aperture white, last whorl colour pattern visible along interior edge of lip.

Periostracum smooth, somewhat translucent, brownish yellow.

In life, sole of foot buff, mottled with yellowish brown; dorsum of foot white, mottled with brown and sparse black blotches along lateral margins. Distal portion of siphon predominantly white, with brown dots and streaks; proximal portion predominantly buff to brown with darker brown mottling; ventral portion white, sparsely dotted with brown (figs. 8, 9). Rostrum pale buff, mottled with brown, more heavily so proximally; tentacles white.

*Distribution.* *Conus catus* has not been reported previously from India. However, R. Winckworth collected three specimens at Tuticorin (BM(NH) Nos. 1953.3.10.359 and 360; fig. 30), R. Robertson collected one specimen at Shingle Island (ANSP No. 301236), and I collected one specimen on the east side of Krusadai Island in January 1968. *C. catus* occurs throughout the tropical Indo-West Pacific region.

*Ecological observations.* The specimen from Krusadai was on sand (2% very coarse, 29% coarse, 67% medium, 2% very fine) under a large coral boulder at about the +0.2 m tide level on a raised area of mixed coral rubble,

sand, and dead coral boulders and stones. No identifiable food remains were recovered from its alimentary tract, but *C. catus* is known from other studies (e.g. Kohn & Nybakken, 1975) to prey on fishes.

*Conus ceylanensis* Hwass in Bruguière

(Fig. 31)

*Conus ceylanensis* Hwass in Bruguière, 1792, *Enc. Méth. Vers*, 1: 636.

*Description.* Last whorl white with a broad, pale blue transverse band occupying the central third, with a broad, interrupted transverse olive or reddish brown band centrally, and interrupted rows of dots or spots of the same colour adapical and abapical of it; base dark violet. Spire white with brown blotches between the tubercles. Aperture violet; interior tip of lip often white.

Periostracum smooth except for growth lines, brownish yellow, translucent.

In life, foot rose red, with white longitudinal mottling; extremities darker red. Siphon rose red with large, mainly longitudinal white markings; tip darker red (based on specimens from Thailand).

*Distribution.* *Conus ceylanensis* has been reported from India by Melvill & Standen (1898) and Hornell (1922, 1951) from South India, by Gravely (1942) from Madras, and by Hornell (1949) without locality. A specimen presumably collected alive, as it is preserved in alcohol (MGM), is labelled 'Madras (University Lab.) Dredged 10-11-36'. A specimen collected by F. Stoliczka and lacking precise locality data is shown in fig. 31. I collected one empty shell at Krusadai Island in 1968. *C. ceylanensis* is distributed throughout the tropical Indian Ocean and as far east in the Pacific as Niue Island.

*Conus coromandelicus* Smith

(Fig. 32)

*Conus coromandelicus* Smith, 1894, *Ann. Mag. nat. Hist.*, Ser. 6, 14: 159.

*Description.* Last whorl white, with transverse, greyish brown lines on the lirae. Spire greyish brown. Periostracum smooth except for growth lines, brown and opaque, appearing darker on the lirae than between them. Aperture white or pale brown.

*Distribution.* Described originally from off the Coromandel coast (14° 18' 25" N; 80° 18' 5" E, and 15° 14' 1" N; 80° 25' 1" E), 15 and 24 km from the coast and in 146-201 m and 234 m, respectively (Smith, 1894). *C. coromandelicus* has also been reported from the Gulf of Oman in 330 m and 375 m (Melvill, 1904). The BM(NH) contains a specimen from 311 m off the Coromandel coast, a specimen from the type locality that may be considered a paratype (No. 94.911.26) (fig. 32), and two specimens affixed to shells of *Xenophora pallidula* Reeve from off Negapatam (Nagapattinam) in 146 m (Nos. 1953.3.10. 234 and 235).

*Conus coronatus* Gmelin

(Figs. 10, 11, 33)

*Conus coronatus* Gmelin, 1791, *Syst. Nat.*, ed. 13, p. 3389.

*Description.* Last whorl white or pale grey, with two pale bluish grey or greyish tan transverse bands, a broad one on the adapical portion of the whorl and a narrower one abapically; the bands interrupted by axial, white, zigzag

lines; with about 15–20 transverse rows of short brown and white dashes, the abapical rows occurring on the lirae. A few large, irregular brown blotches sometimes present on adapical portion. Colour of spire white or pale grey with irregular brown markings, sometimes between the tubercles. Aperture brown or purplish brown with transverse white bands at shoulder and medially, and a white band along interior edge of outer lip; aperture paler in larger specimens.

Periostracum thin, smooth, translucent, brownish yellow.

Colour in life quite variable. Sole of foot chocolate brown to brownish yellow, with red anterior edge; side of foot similar but with a longitudinal black band on each side; dorsum of foot black anteriorly. Siphon with a narrow to broad red tip, proximal portion white with black dots and spots, sometimes with heavy black streaks dorsally (figs. 10, 11). Rostrum brown or pink; tentacles brown or pale buff.

*Distribution.* *Conus coronatus* has been reported from India by [Chennappayya] (1927) from Krusadai Island and by Satyamurti (1952) from Shingle Island. R. Winckworth collected three specimens (BM(NH)) at Tuticorin (fig. 33). During 1968, I collected specimens at Mandapam Camp, Krusadai, and Okha. Specimens from Purnagath, Ratnagiri District, are in the AMNH. *C. coronatus* is widely distributed throughout the tropical Indo-West Pacific region.

*Ecological observations.* At Okha, the single specimen of *C. coronatus* was collected on rough intertidal limestone bench, the same habitat occupied by *C. biliosus* (*q.v.* for fuller discussion). At Krusadai, most specimens were collected under or near small coral rocks, on rubble, or on or partly buried in sand, at about 0 m tide level, on a portion of reef characterized by large, dead coral blocks, sand, and some coral rubble (fig. 4). The sand associated with these specimens consisted of 63% very coarse, 33% coarse, and 4% medium particles.

Examination of alimentary tracts of ten specimens of *C. coronatus* collected on Gulf of Mannar islands revealed remains of *Eunice afra* Peters in four, together with remains of two additional eunicids that were not adequate to permit specific identification. *E. afra* is a secondary prey species of *C. coronatus* elsewhere (Kohn & Nybakken, 1975).

### *Conus ebraeus* Linnaeus

(Fig. 34)

*Conus ebraeus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 715.

*Description.* Last whorl white with three or sometimes four transverse rows of blackish brown trapezoidal blotches, with another row at the shoulder, forming the colour pattern of the spire. Aperture white with external pattern visible as clouded bands.

Periostracum thin, smooth, translucent, yellow.

In life, sole of foot black with a broad, central, longitudinal buff stripe; sides of foot black. Siphon and rostrum black, tipped with a narrow red margin (Kohn, 1959 b).

*Distribution.* India is the type locality of *C. ebraeus*, as it was cited by Linnaeus (1758) in the original description. All later records with more precise

locality data (Thurston, 1890; [Chennappayya], 1927; Satyamurti, 1952) are from the Gulf of Mannar. *C. ebraeus* occurs throughout the tropical Indo-West-Pacific region and eastward to Central America.

*Conus eburneus* Hwass in Bruguière

(Fig. 35)

*Conus eburneus* Hwass in Bruguière, 1792, *Enc. Méth. Vers.*, 1: 640.

*Description.* Last whorl white, often with two to four pale yellow transverse bands; with up to 15 transverse rows of brown quadrangular spots. Spire white with widely separated quadrangular brown spots.

Periostracum smooth, olive brown, translucent.

*Distribution.* I know of only four specimens of *Conus eburneus* having been collected in India. R. Winckworth collected one empty shell at Tuticorin (BM(NH) No. 1953.3.13.32), and three specimens collected alive at Tranquebar are in the UZMC (fig. 35). *C. eburneus* is widely distributed throughout the tropical Indo-West Pacific region.

*Conus eximius* Reeve

(Fig. 36)

*Conus eximius* Reeve, 1849, *Conch. Icon.*, Suppl., pl. 6, No. 256.

*Description.* Last whorl white, "blotched and variegated above and below with orange-chestnut, marked here and there with dots and narrow articulated fillets" (Reeve, 1849). Irregularly spaced wavy axial brown markings at the shoulder continue on the white spire to form its colour pattern.

*Distribution.* *C. eximius* has not previously been reported from India. The specimen shown in fig. 36 was trawled off Madras by P. Sukherwala (AMNH). F. B. Steiner obtained specimens trawled in 45 m on a mud bottom 30 km east of Aharangham, Madras (USNM). *C. eximius* is known to occur from Pakistan to the Malay Peninsula and Moluccas.

*Conus figulinus* Linnaeus

(Fig. 37)

*Conus figulinus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 715.

*Description.* Last whorl light brown, with many fine, dark, uninterrupted brown transverse lines, the basal ones on the lirae; often with a pale tan band at shoulder. Spire dark brown. Aperture white; external colour pattern visible as a marginal band.

Periostracum thick, opaque, dark brown, with raised transverse ridges corresponding in position to the dark transverse lines on the shell.

*Distribution.* Mitchell (1867) and Frauenfeld (1869) first reported *C. figulinus* from India, citing Madras. It is known to occur on the east coast from Gopalpur (19° 16' N; 84° 55' E) (BM(NH) specimens collected by R. Winckworth) to the Gulf of Mannar (Thurston, 1890 (Tuticorin), 1895 (Pamban); Sundaram, 1969). Subrahmanyam, *et al.* (1952) recorded *C. figulinus* from Bombay. Other known records from the west coast are Bombay (ANSP), Travancore (ZMS), and Malabar (NMW). *C. figulinus* occurs throughout the tropical Indian Ocean and as far eastward in the Pacific as Fiji.

***Conus frigidus* Reeve**

(Figs. 12, 38)

*Conus frigidus* Reeve, 1848, *Conch. Icon.*, Suppl., pl. 3, No. 284.

*Description.* Last whorl fawn to yellowish brown, often darker abapically, with paler transverse bands at shoulder and centre; base violet. Spire pale fawn. Aperture violet, with a pale median band; exterior colour pattern visible as a band along interior border of lip.

Periostracum thick, opaque, yellowish brown, with ridges corresponding to transverse lirae.

In life, sole of foot dark yellowish brown, anterior edge paler. Tip of siphon yellow, followed proximally by black, pale yellow and greyish black transverse bands, the last darker dorsally (fig. 12).

*Distribution.* This is the first report of *C. frigidus* from India. The IM contains a specimen from Dwarka and the BM(NH) a specimen collected at Tuticorin by R. Winckworth (fig. 38). I collected one specimen at Pulli Island. *C. frigidus* is widely distributed throughout the tropical Indo-West Pacific region.

*Ecological observations.* The specimen from Pulli Island was collected while ovipositing on the underside of a small coral rock at about the +0.2 m tide level. It defecated soft material and sand grains, suggesting it had eaten an unsegmented worm.

***Conus geographus* Linnaeus**

(Fig. 39)

*Conus geographus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 718.

*Description.* Last whorl light to dark brown, with irregular small triangular or rhomboidal white or pale flesh blotches forming two to four irregular transverse zones. Colour pattern of spire similar. Aperture bluish white.

Periostracum thin, almost opaque, yellowish brown, with transverse rows of widely spaced tufts of bristles, often arranged in widely spaced groups of three closely spaced rows. Periostracum of spire with many fine spiral striae.

*Distribution.* Thurston (1895) first reported *C. geographus* from India, having collected the specimen at Tuticorin. Satyamurti (1952) lists it from Krusadai and Sundaram (1969) from Rameswaram. The MGM contains a specimen from Tuticorin (fig. 39), and an unlabelled specimen is in the small museum on Krusadai Island. The distribution in India is probably restricted to the Gulf of Mannar and Palk Bay. *C. geographus* occurs throughout the tropical Indian Ocean and in the Pacific eastward to the Line Islands.

***Conus glans* Hwass in Bruguière**

(Fig. 40)

*Conus glans* Hwass in Bruguière, 1792, *Enc. Méth. Vers*, 1: 735.

*Description.* Last whorl chestnut, dark purplish, or violet brown, with a median transverse bluish white band and a fainter band at shoulder; sometimes with axial, pale violet streaks. Spire violet with axial white markings. Aperture purple, or white with interior edge of lip purple.

Periostracum thin, opaque, smooth except for fine transverse ridges, dark greyish brown (Cernohorsky, 1964).

In life, foot dark red, lighter at anterior tip. Rostrum red, tentacles white (based on specimens from Sri Lanka).

*Distribution.* Thurston (1895) first reported *C. glans* from India, citing Pamban. Satyamurti (1952) reported that shells of this species frequently wash up on the beach at Shingle Island. I collected empty shells there, as did R. Robertson (ANSP No. 301310); R. Winckworth collected dead specimens at Krusadai and Pamban (BM(NH)) (fig. 40). Although all known Indian records are thus from empty shells washed up on beaches, they are sufficiently numerous to permit the conclusion that living specimens occur in the Gulf of Mannar islands, probably along the reef slope. *C. glans* is widely distributed throughout the tropical Indo-West Pacific region.

### *Conus gubernator* Hwass in Bruguière

(Fig. 41)

*Conus gubernator* Hwass in Bruguière, 1792, *Enc. Méth. Vers*, 1: 727.

*Description.* Last whorl white, or tinged with pale rose, variably variegated with irregular orangish to purplish brown markings sometimes concentrated in two or more interrupted transverse bands. Spire white with widely spaced irregular markings of the same colour as on last whorl.

Periostracum rather thin, smooth, yellow to brown, translucent to opaque.

*Distribution.* Melvill & Standen (1898) first reported *C. gubernator* from the Indian east coast, and Satyamurti (1952) recorded it from Pamban (specimen in MGM). Melvill & Standen (1901) reported *C. magus* Linnaeus from Angrias Bank, stating that "only juvenile examples" were dredged. Examination of the one specimen from this material present in the BM(NH) (No. 1974148, 22.5 × 9.5 mm) reveals it to be most probably a juvenile *C. gubernator*. Two specimens of *C. gubernator* collected by F. Stoliczka are in the NMW (fig. 41). This species occurs throughout the tropical Indian Ocean.

### *Conus inscriptus* Reeve

(Figs. 42–44)

*Conus inscriptus* Reeve, 1843, *Conch. Icon.*, pl. 29, No. 164.

*Description.* Last whorl white, encircled with 15–20 transverse rows of quadrangular orange brown (in smaller specimens) to brownish yellow (in larger specimens) spots, often partially fused to form two interrupted transverse bands, adapical and abapical of centre; the spots in the row at shoulder sometimes larger and extending on the spire to form its colour pattern. Aperture white or pale violet.

Periostracum brown, smooth, thin, translucent.

*Distribution.* Smith (1894) first reported *C. inscriptus* (as *C. planiliratus* Sowerby, a junior synonym) from off Calicut in 82 m. Melvill & Standen (1901) recorded it (also as *C. planiliratus*) 200 km WSW of Bombay, also in 82 m. The specimens of both records are in the BM(NH). Juvenile specimens from this location tentatively referred to *C. inscriptus* have relatively higher spires and the cancellate striae are broader and extend over the entire last whorl

(table 1, fig. 42). The MCZ contains specimens dredged by the Anton Bruun off the Gujarat coast between 22° 32' N, 68° 07' E and 20° 49' N, 69° 52' E in 51–82 m, and off Ratnagiri at 17° 54' N, 72° 27' E, in 50 m. I obtained specimens trawled off Porto Novo by the Centre of Advanced Studies in Marine Biology (fig. 43). The *Galathea* Expedition dredged an empty juvenile shell off Tranquebar (11° 06' N, 80° 05' E; 94 m) (UZMC). F. B. Steiner (personal communication) obtained specimens trawled 29 km east of Madras at a depth of 64 m and 32 km SE of Madras in 46 m (fig. 44). P. Sukherwala trawled specimens off Cape Comorin (AMNH). *C. inscriptus* is distributed around the periphery of the Bay of Bengal, Arabian Sea and Red Sea.

### *Conus lentiginosus* Reeve

(Figs. 45–48)

*Conus lentiginosus* Reeve, 1844, *Conch. Icon.*, pl. 44, No. 245.

*Description.* Last whorl white, “freckled and dotted with light brown” (Reeve, 1844); typically with transverse rows of small yellowish or reddish brown and white rectangular dots and dashes, and wavy axial flammules of the same colour; the latter may continue above the shoulder, providing the colour pattern of the spire, or the spire may bear regularly spaced brown markings unrelated to the pattern of the last whorl. Aperture white to pale violet.

Periostracum rather thin, brown, translucent, smooth except for collabral growth lines.

*Distribution.* Although Reeve did not indicate the origin of the three specimens (now in the BM(NH)) on which he based the original description, they are labelled ‘India west coast’. Abercrombie (1893), Melvill & Abercrombie (1893), and Melvill & Standen (1901) early reported *C. lentiginosus* from Bombay, as did Hornell & Tomlin (1951) and Subrahmanyam, *et al.* (1952) later (figs. 45, 46).

Specimens from the Gulf of Mannar (AMNH No. 183985; BM(NH) Nos. 1953.3.13.364–366; ANSP Nos. 301057, 302262; figs. 47, 48) are narrower as noted in table 1, and the punctate transverse striae extend over most or all of the last whorl in specimens as large as 25 mm. Colour pattern and sculpture are otherwise essentially similar to west coast specimens as described above, except that the base is pinkish tan. A specimen of this form dredged off Vizagapatam in 37 m is in the IM.

*C. lentiginosus* is also known to occur in Sri Lanka and Malaya. One specimen labelled Karachi is in the IRSN.

### *Conus litteratus* Linnaeus

(Fig. 49)

*Conus litteratus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 712.

*Description.* Last whorl white, often with several broad yellowish or brownish pink transverse bands, and 15–20 rows of dark brown quadrangular spots, the adapical rows typically continued over the shoulder as collabral flammules on the spire. Ventral side of base blue. Aperture white or pale brownish pink, base edged in brownish blue.

Periostracum thick, brown, opaque, generally smooth except for collabral growth lines.

*Distribution.* Thurston (1895) reported *C. litteratus* from Tuticorin. The specimen presently in the MGM was presumably collected by Thurston. Hornell (1922, 1951) also reported *C. litteratus* from south India. A specimen in the NMW collected in India (specific locality unknown) by F. Stoliczka is shown in fig. 49. *C. litteratus* is widely distributed throughout the tropical Indo-West Pacific region.

### *Conus lividus* Hwass in Bruguière

(Fig. 50)

*Conus lividus* Hwass in Bruguière, 1792, *Enc. Méth. Vers.*, 1: 360.

*Description.* Last whorl olive to brownish yellow, with a pale or white transverse band centrally and a white band at the shoulder; base dark violet brown. Spire typically white, sometimes with paler ground colour of last whorl between tubercles. Interior of aperture dark violet, lightening to white within, except for the white transverse bands referred to above; with a yellow band along interior border of lip.

Periostracum yellowish brown, opaque, smooth except for collabral growth lines.

In life, foot, rostrum and siphon black, finely mottled with more or less red, appearing reddish black (Kohn, 1959 b).

*Distribution.* *Conus lividus* has been reported from India only by Satyamurti (1952), who collected it at Shingle Island. The species is also known from Tranquebar (UZMC) (fig. 50). *C. lividus* is widely distributed throughout the tropical Indo-West Pacific region.

### *Conus longurionis* Kiener

(Fig. 51)

*Conus longurionis* Kiener, 1849–1850, *Spec. Gén. Icon. Coq. Viv.*, p. 308, pl. 92, fig. 6.

*Description.* Last whorl greyish, white, with quadrangular light brown markings; with larger, darker markings forming interrupted transverse bands adapical and abapical of the centre. Colour pattern of last whorl continued on spire. Aperture pale lavender.

*Distribution.* Thurston (1895) reported *C. longurionis* from the Gulf of Mannar, but no specimens are in the MGM. A single specimen trawled alive off Madras by P. Sukherwala is in the AMNH (fig. 51). The *Galathea* Expedition dredged several empty, worn shells of this species off Tranquebar (11° 10' N, 79° 59' E; 50 and 75 m) (UZMC). These specimens are all assigned to *C. longurionis* rather tentatively, as it has not been possible to locate Kiener's original specimens for comparative study. *C. longurionis* is also known from the Persian Gulf (Melvill & Standen, 1901), Sri Lanka (see Kohn, 1960), and Mozambique (AMNH).

### *Conus lotoisii* Kiener

(Figs. 13, 52)

*Conus lotoisii* Kiener, 1845, *Icon. Coq. Viv.*, 2, pl. 65, p. 91.

*Description.* Last whorl ash, brownish or greenish grey, often with transverse fawn bands at shoulder and medially. Usually with fine transverse darker

brown lines variably positioned on whorl, the lines interrupted or broken by collabral growth lines which are also sometimes dark brown. Spire grey or tan, with arcuate collabral brown lines. Aperture white with a tan band along interior border of lip.

Periostracum thick, opaque, brown, with raised transverse ridges corresponding in position to the larger dark transverse lines on the shell.

In life, sole of foot dark chocolate brown, dorsum somewhat lighter. Distal part of siphon with broad longitudinal black or dark grey dorsal and lateral bands separated by buff, proximal part buff mottled with grey, ventral margin buff (fig. 13).

*Distribution.* India is the type locality of *C. leroisii* (Kiener, 1847). Subsequent authors have not recorded it from India, probably because they considered it conspecific with *C. figulinus*. It ranges on the east coast of India at least from Madras to Porto Novo. The BM(NH) contains a specimen (No. 1967362, 93 × 62 mm) labelled as having been collected at Bombay. Elsewhere, *C. leroisii* is known from Thailand (AMNH), Sri Lanka, (AMNH) the Nicobar Islands (UZMC) and Indonesia (Oostingh, 1931).

*Ecological Observations.* Examination of alimentary tracts of 19 specimens of *C. leroisii* trawled by fishermen 5–8 km offshore from Madras, between Royapuram and Santhome, in 9–18 m of water, revealed remains of two specimens of *Glycera subaenea* Grube and one of *Dasybranchus caducus* (Grube). Other gastropods associated with these *C. leroisii* included *Turritella* sp., *Architectonica perspectiva* (Linnaeus), *Rapana bulbosa* Solander, *Hemifusus* sp., and *Babylonia spirata* Lamarck. No food remains were recovered from six specimens collected by trawling at Porto Novo.

Several of the specimens collected off Madras had one or more sea anemones (probably of the family Hormathiidae) on the dorsal portion of the shell, an association apparently hitherto unknown in living *Conus*.

### *Conus malacanus* Hwass in Bruguière

(Figs. 53, 54)

*Conus malacanus* Hwass in Bruguière, *Enc. Méth. Vers.*, 1 : 645.

*Description.* Last whorl white with two transverse yellowish tan bands of very variable width, adapical and abapical of centre, the latter typically the wider. Elsewhere, the white ground variably marked with brown, usually as interrupted narrow transverse bands or lines and/or wavy axial flammules, the pattern at the shoulder often continued onto the spire to form an irregular pattern of brown markings; spire otherwise white.

Periostracum thin, smooth, yellow, translucent.

*Distribution.* The specimen referred by Gravely (1942) to '*Conus voluminalis* Hinds' from Madras is actually *C. malacanus* (fig. 53). This species is also known from specimens collected off Ennore, Madras (fig. 54), at Karikal (IRSN) and Tranquebar (UZMC). The known distribution in India is thus quite restricted along the east coast. The species was described from 'near the Strait of Malacca' and is also known from the Nicobar Islands (Frauenfeld, 1869; UZMC).

*Ecological observations.* One specimen trawled in about 9 m off Porto Novo on a mainly sandy bottom with patches of clay and broken shell had no

identifiable food remains in its alimentary tract. Two specimens from Ennore were trawled 29–32 km offshore in 37–55 m on mud and sand (F. B. Steiner, personal communication).

*Conus marmoreus* Linnaeus

(Fig. 55)

*Conus marmoreus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 712.

*Description.* Last whorl and spire dark brown, marked throughout with rounded triangular white spots, the apices directed adapical, abapical and toward the outer lip. Outer portion of aperture white, often pale pink within.

Periostracum thin, smooth, yellow, translucent.

In life, foot tan, siphon banded proximally from the tip with red, white and black (Kohn, 1959 b).

*Distribution.* Frauenfeld (1869) first reported *C. marmoreus* from India, citing Madras. The specimen, collected by the *Novara* Expedition, is in the NMW. However, Frauenfeld stated that some of the specimens obtained in Madras were donated to the Expedition. Hence the locality record is questionable. Thurston (1890, 1895) recorded it from Pamban, as did Satyamurti (1952). Weinkauff (1875) recorded *C. marmoreus* from the Malabar coast. A specimen labelled Madras from the MGM is shown in fig. 55. *C. marmoreus* is widely distributed throughout the tropical Indo-West Pacific region.

*Conus milneedwardsi* Jousseaume

(Fig. 56)

*Conus milneedwardsi* Jousseaume, 1894, *Bull. Soc. Philom. Paris*, 6 : 99.

*Description.* Last whorl white, with two or three yellowish or reddish brown transverse bands and "coarse, widely spread reticulations (of the same colour) enclosing oblong, obtusely triangular, or trapezoid (white) spaces of varying dimensions" (Melvill & Standen, 1899); similar white spaces also interrupting the transverse bands. Spire white, with broad collabral or irregular yellowish or reddish brown markings.

*Distribution.* Melvill & Standen (1899) described *Conus clytospira* as a new species from a depth of 82 m about 200 km WSW of Bombay (18° 43' N, 71° 30' to 71° 45' E), unaware that Jousseaume had described the same species as *C. milneedwardsi* from Aden in 1894. The two specimens described by Melvill & Standen (1899, 1901), one of which is shown in fig. 56 (BM(NH) No. 1900.11.10.56), were collected adhering to a telegraph cable and are the only ones recorded from the vicinity of India. The species occurs around the margin of the Arabian Sea and western Indian Ocean, and is known also from Mauritius and Réunion.

*Conus monile* Hwass in Bruguière

(Fig. 57)

*Conus monile* Hwass in Bruguière, 1792, *Enc. Méth. Vers.*, 1 : 646.

*Description.* Last whorl white or light reddish tan with transverse white bands at shoulder, medially, and at base; with up to 15 transverse rows of brown or reddish brown dots of unequal size and spacing; sometimes also with

wavy axial markings of the same colour; base dark tan. Spire white or light reddish tan with irregular or collabral brown or reddish brown markings.

Periostracum smooth, yellowish brown, thick, opaque.

*Distribution.* Gravely (1942) first reported *C. monile* from India, citing Madras. Hornell (1949) listed it from India without precise locality. Subrahmanyam, *et al.* (1952) recorded it from Bombay. A specimen dredged off Madras is present in the MGM, and R. Winckworth collected two specimens at Tuticorin (BM(NH)) (fig. 57). Elsewhere *C. monile* occurs in Sri Lanka and the Andaman (IM, ZMS) and Nicobar (UZMC) Islands.

*Ecological observations.* Two specimens were trawled in 9 m off Porto Novo on a mostly sand bottom with patches of clay and broken shell.

### *Conus musicus* Hwass in Bruguière

(Figs. 15, 58)

*Conus musicus* Hwass in Bruguière, 1792, *Enc. Méth. Vers.*, 1 : 629.

*Description.* Specimens from India are of the Indian Ocean form of *C. musicus* as discussed by Kohn (1968 : 1049, fig. 3). Last whorl white or with abapical two-thirds pale blue; encircled with up to 15 rather equally spaced transverse rows of reddish brown quadrangular dots; some specimens with a less regular row on the shoulder between the tubercles, forming the colour pattern of the spire. Base very dark violet. Aperture dark violet within, with white inner margin of lip and white transverse bands at shoulder and medially.

Periostracum thin, smooth, yellow, translucent.

In life, sole of foot bright white, with duller white longitudinal streaks, anterior and posterior edges pinkish red; dorsum of foot white, streaked with brown. Siphon bright white with white streaks, tipped with red. Rostrum red; tentacles white.

*Distribution.* Melvill & Standen's (1898) report of '*C. pusillus* Chemnitz' from the east coast of India probably refers to this species. It is known from Shingle Island (ANSP No. 301277) (fig. 57), where I also collected a specimen. This form of *C. musicus* occurs throughout the tropical Indian Ocean (Kohn, 1968).

*Ecological observations.* The specimen at Shingle Island was found on reef limestone under a coral rock. No food remains were found in its alimentary tract.

### *Conus mutabilis* Reeve

(Figs. 15, 59, 60)

*Conus mutabilis* Reeve, 1844, *Conch. Icon.*, pl. 45, No. 249.

*Description.* Colour pattern of last whorl quite variable: "light brown, often very pale in the middle, irregularly streaked with brown, and encircled with interrupted brown lines" (Reeve, 1844). The last whorl may range from pale orange (fig. 59) to dark brown (fig. 60) and the interrupted transverse lines may be absent. Colour pattern of spire also variable: tan or white, with light to dark brown axial flammules, sometimes extending on to last whorl in small specimens. Aperture white, with external pattern visible along inner border of lip of small specimens.

Periostracum moderately thick, opaque, yellowish brown, with marked collabral growth lines and 10–18 widely and nearly equally spaced transverse ridges, including one at the shoulder.

In life, sole of foot greyish brown, streaked with darker grey; sides of foot also greyish brown, but more brown than sole. Dorsum of siphon black distally, lighter proximally; sides black at tip, grey proximally (fig. 15). Rostrum pale reddish brown, buff proximally. Tentacles opaque white with a grey dorsal streak.

*Distribution.* Abercrombie (1893) and Melvill & Abercrombie (1893) first reported *C. mutabilis* from Bombay; the latter authors noted that it was 'the common species' of the genus there (fig. 59). Melvill & Standen (1901) recorded its occurrence 'southwards to Goa and Panjim'. A specimen trawled in 4 m at Karwar is shown in fig. 60. Melvill & Standen (1898) provided the only record known to me of its occurrence on the east coast. *C. mutabilis* has only been reported from India, but specimens from Sri Lanka and Borneo are in the BM(NH), and from Hong Kong in the AMNH.

*Ecological observations.* The nature of the substrate utilized by *C. mutabilis* was recorded for 12 specimens collected in the low intertidal zone in the vicinity of Bombay. Six of these were partly buried in sand, one of them under a boulder, and three were on sand under boulders. The others occurred on a thin layer of sand in a rock crevice, on rock, and on gravel and pebble under a rock. Most of the specimens were collected at about the +0.8–+1 m tide level at Madh Island, in a habitat of boulders, many covered with the brown algae *Padina* and *Sargassum*, lying on fine sand to coarse gravel. The heterogeneity of the sand fraction at this locality is illustrated by the following analyses of four samples of sand associated with *C. mutabilis*:

<i>C. mutabilis</i> No.	Very coarse	Coarse	Medium	Fine	Very fine
7312	0	0	12%	82%	6%
7315	17%	52%	15%	11%	5%
7318	3%	7%	10%	37%	43%
7323–7325	0	0	5%	32%	63%

Dissection of alimentary tracts of 15 specimens revealed that *C. mutabilis* preys on at least seven species of errant polychaetes, of which the predominant prey organism was *Diopatra cuprea* (table 2). Members of the eunicid subfamily Onuphinae are typically rarely preyed on by *Conus* (Kohn 1959 a, 1968; Kohn & Nybakken, 1975). Only one other case of an onuphine as the major prey of *Conus* is known, that of *C. miliaris* Hwass in Bruguère at Easter Island, where a species of *Onuphis* constitutes 40% of the diet (Kohn, in preparation).

### *Conus nussatella* Linnaeus

(Fig. 61)

*Conus nussatella* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 716.

*Description.* Last whorl white, clouded irregularly with orange brown to light purplish brown blotches; with up to about 40 transverse rows of numerous small dark purplish brown or orange brown spots, the row at the shoulder forming the colour pattern of the spire.

Table 2

Prey organisms consumed in nature by *Conus mutabilis* in the vicinity of Bombay, primarily Madh Island.

Prey species	Number of prey individuals
NEREIDAE	
<i>Nereis</i> sp. cf. <i>N. persica</i> Fauvel	1
Nereid sp. 7315	1
Nereid sp. 7316	1
Nereid sp. 7320	1
	—
Total Nereidae	4
	—
EUNICIDAE : EUNICINAE	
<i>Marphysa macintoshi</i> Crossland	1
EUNICIDAE : ONUPHINAE	
<i>Diopatra cuprea</i> Bosc	10
EUNICIDAE : LUMBRINERINAE	
<i>Lumbrineris heteropoda</i> Marenzeller	3
	—
Total Eunicidae	14
	—
Total POLYCHAETES	18
Number of <i>C. mutabilis</i> examined	15

Periostracum smooth, brownish yellow, translucent.

*Distribution.* Melvill & Standen (1898) reported 'small typically marked specimens' of *C. nussatella* from Madras, and Satyamurti (1952) recorded the species as being rare at Shingle Island. I collected one empty shell at Okha, and one specimen (fig. 61) in the ANSP was according to its label 'trawled off South India by fishermen'. *C. nussatella* occurs throughout the tropical Indo-West Pacific region.

### *Conus pennaceus* Born

(Figs. 16, 62)

*Conus pennaceus* Born, 1778, *Ind. Rer. Nat. Mus. Caes. Vind.*, p. 152.

*Description.* Last whorl reddish to orange brown; with many narrow, closely spaced transverse darker lines, finely dotted with white; and with subtrigonal white blotches of unequal size, often grouped together like scales, sometimes forming transverse bands centrally, at shoulder, and at base. Colour pattern of last whorl continued on spire. Aperture white or bluish white.

Periostracum thin, smooth, yellow, translucent.

In life, sole of foot light brown with lighter buff streaks; anterior edge reddish pink; dorsum of foot white with some brown blotches, dark brown posteriorly near operculum. Tip of siphon vermillion, grading to pink proximally, then black and pale pink bands; most proximal portion mottled light brown. Tip of rostrum pink, proximal portion brown; tentacles white, terminal portion pink.

*Distribution.* *Conus pennaceus* has not been reported previously from India. R. Winckworth collected a specimen at Tuticorin (BM(NH)), and I collected three specimens there (fig. 62). The species is widely distributed throughout the tropical Indo-West Pacific region.

*Ecological observations.* The habitat of the three specimens collected at Hare Island, Tuticorin, was a complex, mainly dead, subtidal reef flat, with a

surface mainly of coral rubble and coarse sand, with widely scattered larger living and dead coral heads. In some areas, patches of sea grass bind finer sand; some of these have accumulated sufficient sand to emerge at low tide.

One of the *C. pennaceus*, a male, was found on sand and rubble under a dead coral head. The other two were found ovipositing on the undersides of coral heads (fig. 5). The mean composition of the sand of these microhabitats was 22% very coarse, 24% coarse, 32% medium, 19% fine, and 3% very fine.

No food remains were recovered from the two female specimens, but the alimentary tract of the male contained fleshy remains, operculum, and radula of an unidentified species of *Trochus*. This is consistent with results of prior studies of the diet of *C. pennaceus* elsewhere (Kohn, 1959 a, 1968; Kohn & Nybakken, 1975), which showed *C. pennaceus* to prey exclusively on gastropods.

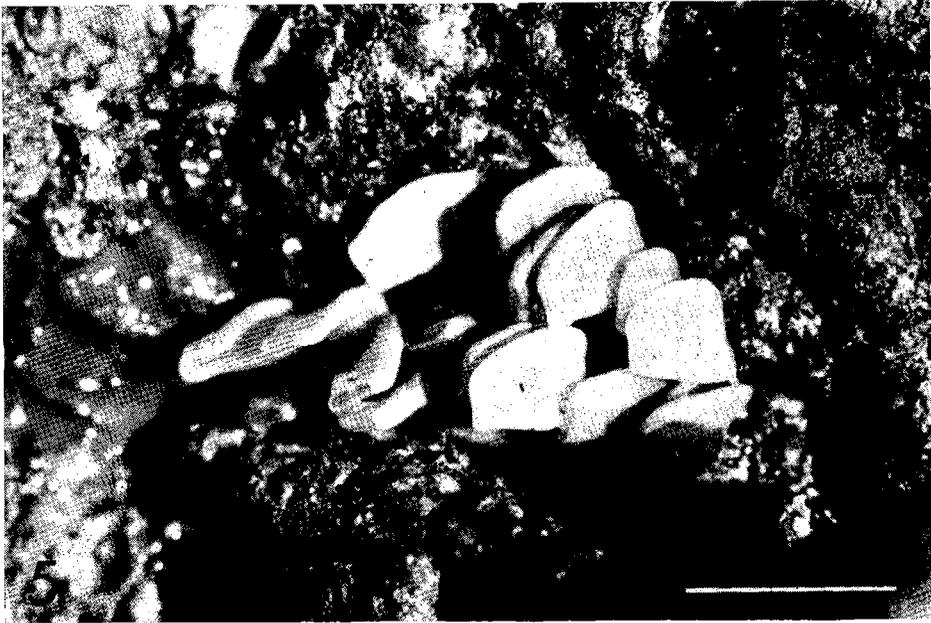


FIG. 5. Egg capsules of *Conus pennaceus* *in situ* on the underside of a coral head, probably of *Favia* sp. Hare Island, Pandyan Tivu, Tuticorin. The shell of the mother measured 52 × 27 mm. Scale line: 5 mm.

### *Conus quercinus* Solander in [Lightfoot]

(Fig. 63)

*Conus quercinus* Solander in [Lightfoot], 1786, *Cat. Portland Mus.*, p. 67.

*Description.* Last whorl light yellow, encircled with numerous closely spaced transverse thread-like yellowish brown lines, which may be lacking in larger specimens. Spire usually paler yellow. Interior of aperture white.

Periostracum thick, brown, opaque, with deep collabral growth lines. In life, foot and siphon brownish grey, heavily speckled with black (Kohn, 1959 b).

*Distribution.* Melvill & Standen (1898) reported *C. quercinus* from the east coast of India (as '*C. ponderosus* Beck'): "Our specimens are old and heavy, without the revolving lines." A specimen collected by R. Winckworth

at Tuticorin is in the BM(NH) (fig. 63). *C. quercinus* is widely distributed throughout the tropical Indo-West Pacific region.

***Conus rattus* Hwass in Bruguière**

(Fig. 64)

*Conus rattus* Hwass in Bruguière, 1792, *Enc. Méth. Vers*, 1 : 700.

*Description.* Last whorl orangish to violet brown, with large bluish white maculations forming an interrupted transverse band at the shoulder, and smaller spots and flecks of the same colour forming a less well-defined band medially; also with small flecks of bluish white elsewhere on the shell. Spire with alternate white and violet brown blotches, continuous with those of the band at the shoulder. Aperture violet within; inner border of lip violet brown.

Periostracum moderately thick, smooth, yellowish brown, somewhat translucent.

In life, foot, siphon and rostrum olive green mottled, with black (Kohn, 1959 b).

*Distribution.* *Conus rattus* has not been hitherto reported from India, and it is known from a single specimen, collected by R. Winckworth at Krusadai Island on 1 May 1934 (fig. 64). As the specimen is known to have been collected alive (the operculum is present), and the collection data are reliable, it is considered a valid member of the Indian fauna. *C. rattus* is widely distributed throughout the tropical Indo-West Pacific region.

***Conus striatellus* Link**

(Fig. 65)

*Conus striatellus* Link, 1807, *Beschr. Nat.-Samml. Univ. Rostock*, Part 3, p. 103.

*Description.* Last whorl "white, stained with orange-brown and with numerous transverse thread-like lines in such a manner as to leave three bands of very irregular white spots" (Reeve, 1843). Base white or tan. Spire arcuately tessellated with brown and white. Interior of aperture white.

Periostracum thick, grayish brown, opaque, with prominent collabral growth lines; with prominent transverse striae in smaller specimens.

*Distribution.* Chemnitz (1788) first reported this species from Tranquebar, but his work did not provide valid binomina. Nevertheless the species was next recorded from the Indian east coast by Melville & Standen (1898) as '*C. lineatus* Chemnitz'. Satyamurti (1952) also recorded it as '*C. lineatus*' from Pamban, based on an empty shell. R. Winckworth collected a living specimen at Tuticorin (fig. 65). *C. striatellus* occurs throughout the tropical Indian Ocean and in the Pacific as far east as the Caroline Islands and Fiji.

***Conus striatus* Linnaeus**

(Fig. 66)

*Conus striatus* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 716.

*Description.* Last whorl pinkish white, irregularly clouded with purplish brown blotches composed of very closely spaced transverse lines. Spire white, tessellated with lighter brown, roughly collabral markings. Interior of aperture white.

Periostracum yellowish brown, moderately thin, partially translucent.

In life, foot, siphon and rostrum tan mottled with brown (Kohn, 1959 b).

*Distribution.* Thurston (1890, 1895) first reported *C. striatus* from Tuticorin. Sundaram (1969) recorded it from the Palk Bay side of Rameswaram Island. The species is also known from Krusadai Island (MGM), Hare Island (Musal Tivu) (ANSP No. 301510), and Shingle Island (AJK). *C. striatus* occurs throughout the tropical Indo-West Pacific region.

### *Conus sulcatus* Hwass in Bruguière

(Fig. 67)

*Conus sulcatus* Hwass in Bruguière, 1792, *Enc. Méth. Vers.*, 1: 618.

*Description.* Last whorl mainly light brown, with irregularly spaced transverse darker brown lines of varying width, with a narrow white band at shoulder and a broader white band at base. Spire white with light brown collabral lines. Aperture white.

*Distribution.* *C. sulcatus* has not been previously reported from India. A living specimen now in the AMNH (No. 183977) was recently trawled off Madras by P. Sukherwala (fig. 67). A specimen labelled as having been collected at Madras but without further documentation is in the UZMC. *C. sulcatus* also occurs along the east Asian coast from Burma to Hong Kong, Taiwan, and Philippines.

### *Conus terebra* Born

(Fig. 68)

*Conus terebra* Born, 1778, *Ind. Rer. Nat. Mus. Caes. Vind.*, p. 131.

*Description.* Last whorl white with broad transverse yellow or pale yellowish to purplish grey bands adapical of centre and at base; spire of the same colour as bands on last whorl. Base light violet near aperture. Aperture white or pale violet; external colour pattern often visible along inner margin of outer lip.

Periostracum thick, brown, opaque, with irregular collabral growth lines.

*Distribution.* *Conus terebra* has not been previously reported from India. R. Winckworth recorded in his notes collecting one specimen at Tuticorin, but the specimen is not in the BM(NH). I collected an empty shell at Krusadai Island and F. B. Steiner collected one at Madras (fig. 68). *C. terebra* is widely distributed throughout the tropical Indo-West Pacific region.

### *Conus tessulatus* Born

(Fig. 69)

*Conus tessulatus* Born, 1778, *Ind. Rer. Nat. Mus. Caes. Vind.*, p. 131.

*Description.* Last whorl white, encircled by 15–25 rows of quadrangular pinkish orange spots, usually crowded to form two transverse bands, adapical and abapical of centre. Base pale violet. Spire white, tessellated with pinkish orange. Aperture white or pale violet.

Periostracum brown, smooth, rather thin, but opaque.

In life, "yellowish white, foot mottled with brownish buff, anteriorly spotted with black; creeping disk buff yellow with darker veins; siphon creamy yellow tinged with brown, edged with yellow, with a transverse black spot at the anterior end" (Garrett, 1878).

*Distribution.* Bruguière (1792) first recorded *C. tessulatus* from the Malabar coast. Dautzenberg (1937) noted a specimen from Madras in his own collection; it is in the IRSN. Other specimens are known from Tuticorin BM(NH) No. 403.1953.3.10) and Tranquebar (UZMC). Dr. F. Stoliczka collected three specimens in India (fig. 69). Dr. H. G. Kewalramani possesses a specimen dredged off the west coast of India. *C. tessulatus* is widely distributed throughout the entire tropical Indo-West Pacific region and reaches the west coast of Mexico (Hanna & Strong, 1949).

### *Conus textile* Linnaeus

(Figs. 70, 71)

*Conus textile* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 717.

*Description.* Last whorl white with undulating axial brown lines interrupted by white triangles arranged as scales and usually (fig. 66) broad orange brown maculations usually disposed to form two or three interrupted transverse bands, the maculations streaked axially with wavy darker brown lines. Spire similarly marked. Aperture white.

Periostracum thin, smooth, yellow, translucent.

In life, "foot mottled brown on white. Tip of siphon reddish orange, followed proximally by bands of white and black; remainder of siphon white with closely spaced narrow brown bands" (Kohn, 1959 b).

*Distribution.* *Conus textile* is known from Madras (Frauenfeld, 1869; Gravely, 1942) (figs. 70, 71) to Tuticorin (Thurston, 1890, 1895) on the east coast, and from Okha (AJK) to Bombay (Melvill & Abercrombie, 1893; Hornell & Tomlin, 1951; Subrahmanyam *et al.*, 1952). It is widely distributed throughout the tropical Indo-West Pacific region.

### *Conus vexillum* Gmelin

(Fig. 72)

*Conus vexillum* Gmelin, 1791, *Syst. Nat.*, ed. 13, p. 3397.

*Description.* Last whorl white, broadly banded with yellowish brown adapical and abapical of centre; base darker brown; with or without thin wavy axial brown lines. Spire white with yellow apex and broad brown tessellated markings often forming radiating bands that may continue over the shoulder on to the last whorl. Aperture white.

Periostracum greenish or yellowish brown, smooth, rather thick, opaque.

In life, foot and siphon greenish black (Kohn, 1959 b).

*Distribution.* Bruguière (1792), Mawe (1823), and Melvill & Standen (1898) reported *C. vexillum* from the Malabar coast. It is known to occur at Tuticorin (IM, MGM (fig. 72)), and an unlabelled specimen is in the small museum on Krusadai Island. *C. vexillum* occurs throughout the tropical Indo-West Pacific region.

*Conus virgo* Linnaeus

(Fig. 73)

*Conus virgo* Linnaeus, 1758, *Syst. Nat.*, ed. 10, p. 713.

*Description.* Last whorl pale yellow, somewhat darker abapically, sometimes with several slightly darker transverse bands varying in width and position. Base deep bluish violet.

Periostracum brown, smooth except for collabral growth lines, thick, opaque.

*Distribution.* Melvill and Standen first reported *C. virgo* from the Indian east coast, and Sundaram (1969) recorded it from Mandapam. It is known to occur from Pondicherry (MNHN) to Tuticorin (IM, MGM (fig. 73), R. Winckworth, unpub.), and a specimen in the UZMC is labelled as from Bombay. *C. virgo* is widely distributed in the tropical Indo-West Pacific region.

*Conus zeylanicus* Gmelin

(Figs. 17, 74)

*Conus zeylanicus* Gmelin, 1791, *Syst. Nat.*, ed. 13, p. 3389.

*Description.* Last whorl white shaded with pale rose; with transverse rows of purplish brown spots and dashes, and irregular wavy axial blotches in two interrupted transverse bands, adapical and abapical of centre. Spire similarly marked. Base white or pale rose. Aperture white or pale violet.

Periostracum yellowish brown, smooth, thin, translucent.

In life, sole and sides of foot brown. Tip of siphon dark pink, shading lighter proximally, followed proximally by white, brown and white bands (fig. 17). Rostrum light brown.

*Distribution.* *Conus zeylanicus* has not previously been reported from India, and I know of no specimens in museum collections. I collected one living specimen at Tuticorin (fig. 24). No food remains were present in its alimentary tract. F. B. Steiner (pers. comm.) obtained two specimens trawled 8 and 29 km NE of Ennore, Madras, the latter at a depth of 33 m on mud and sand. *C. zeylanicus* is known to occur throughout the tropical Indian Ocean.

**Unverified records**

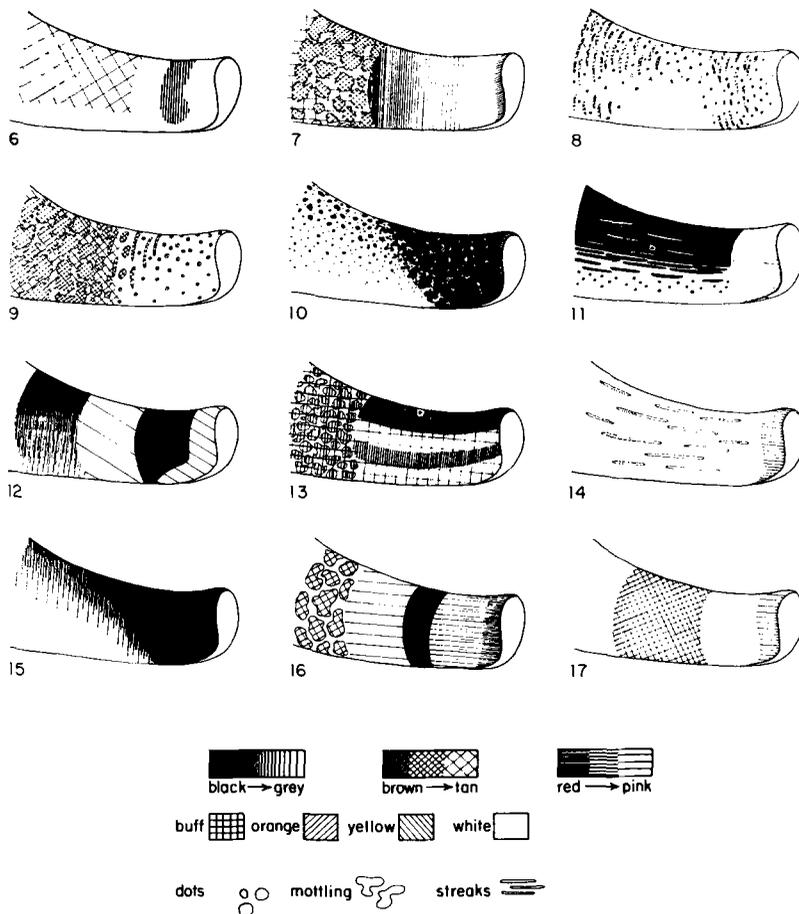
Seven species, *Conus adansonii* Lamarck, *C. capitaneus* Linnaeus, *C. chaldaeus* (Röding) (listed as '*C. vermiculatus* Lamarck'), *C. lithoglyphus* Hwass in Bruguière (listed as '*C. lithoglyphus* Meuschen'), *C. mustelinus* Hwass in Bruguière, *C. omaria* Hwass in Bruguière, and *C. planorbis* Born (listed as '*C. senator* Linnaeus', a rejected name), have been recorded from India only by Melvill & Standen (1898). The specimens on which their paper was based were obtained by J. R. Henderson and purportedly dredged from the Madras area or Pamban Passage between Port Lorne and Rameswaram. However, I know of no other records of any of these species in the literature or museums and consider them all unverified.

*Conus dispar* Sowerby is a *nomen dubium*. The species was not described but is based on the name and accompanying figure in Sowerby (1833: pt. 37, fig. 57). This figure cannot be unequivocally identified with any species of

*Conus*. Thurston (1895) and Satyamurti (1952) reported *C. dispar* from Pamban and Krusadai, respectively. A specimen so labelled from Pamban in the MGM is here considered to be that of the east coast form of *C. lentiginosus* Reeve (*q.v.*).

*Conus fuscatus* Born (= *C. imperialis* Linnaeus) was recorded by Mawe (1823) from Tranquebar; this was cited by several subsequent authors (see Dautzenberg, 1937). I know of no other records nor any specimens of this species from India.

*Conus generalis* Linnaeus. Linnaeus (1767 : p. 1166) gave the locality of *C. generalis* as 'India orientali' in his original description. Melvill & Standen (1898) list it from the east coast (see first paragraph above), and Favanne and



FIGS. 6-17. Semidiagrammatic lateral views of the siphons of ten species of *Conus* from India, showing colour patterns in life. 6, *Conus amadis* Gmelin. Off Porto Novo. 7, *Conus araneosus* Solander in [Lightfoot]. Hare Island, Pandyan Tivu, Tuticorin. 8 and 9, *Conus catus* Hwass in Bruguière. Krusadai Island. 10, *Conus coronatus* Gmelin. Shingle Island. 11, *Conus coronatus* Gmelin. Krusadai Island. 12, *Conus frigidus* Reeve. Pulli Island. 13, *Conus lotoisii* Kiener. 6 km east of Madras, 16 m. 14, *Conus musicus* Hwass in Bruguière. Pulli Island. 15, *Conus mutabilis* Reeve. Cuffe Parade, Bombay. 16, *Conus pennaceus* Born. Hare Island, Pandyan Tivu, Tuticorin. 17, *Conus zeylanicus* Gmelin. Hare Island, Pandyan Tivu, Tuticorin.

Favanne (1700 : p. 613) cite the Malabar coast, a record cited by several later authors. One specimen in the IM, an empty shell, is labelled as having been dredged off the Malabar coast in about 50 m. I know of no certain record of a living specimen from Indian waters, although *C. generalis* is known to occur on the pearl banks of Mannar, Sri Lanka (BM(NH)).

*Conus insculptus* Kiener. Melvill & Abercrombie (1893) reported this species from Bombay "only in young condition". Melvill & Standen (1901) repeated this record, citing Abercrombie as its source. Hornell & Tomlin (1951) and Subrahmanyam *et al.* (1952) also listed this species from the Bombay area. All of these records probably refer to juvenile or small specimens of *C. lentiginosus* Reeve. This is particularly true of Subrahmanyam *et al.* (1952), whose brief description of the colour pattern (lacking in *C. insculptus*) points to *C. lentiginosus*. However, empty, worn and broken shells probably referable to *C. insculptus* Kiener were dredged by the *Galathea* Expedition off Tranquebar (11° 10' N, 79° 59' E; 140 m) (UZMC).

*Conus magus* Linnaeus. Melvill & Standen (1898, 1901) reported 'typical' specimens from the east coast and from Angria Bank, respectively. The latter specimen (BM(NH) No. 1974148) is probably *C. gubernator* Hwass in Bruguière (*q.v.*). I can find no other references nor any specimens of *C. magus* from Indian waters in museums.

*Conus miles* Linnaeus. Linnaeus (1758) gave the locality of *C. miles* as India in his original description. I know of no specimens nor subsequent records of this species from India.

*Conus monachus* Linnaeus. Citations of this species from India as *C. monachus* var. *achatinus* (Melvill & Abercrombie, 1893; Hornell & Tomlin, 1951) refer to *C. achatinus* Gmelin as described in this paper. Presumably Abercrombie's (1893) citation of *C. monachus* refers to the same species. Melvill & Standen (1901) cited *C. monachus* from Bombay, stating that it is 'nearly allied to' *C. achatinus*, which was cited separately. Finally, Subrahmanyam, *et al.* (1952) cited *C. monachus* 'and its variety *achatinus*' from Bombay, their description supporting their view that only one species was present. While *C. monachus* and *C. achatinus* are very similar, I have concluded that they are distinct species (Kohn, 1963, 1966). *C. monachus*, which to my knowledge does not occur in India, may be distinguished by its lack of transverse, usually interrupted, dark chestnut lines characteristic of the last whorl of *C. achatinus*.

*Conus mucronatus* Reeve. This species has not been recorded from India, but a single specimen is in the AMNH (No. 183984) (fig. 75). It was trawled off Mahalipuram by P. Sukherwala. It is the only known record of the species from India, the identification is tentative, and the precise locality and depth are unknown. It is therefore considered an unverified record.

*Conus pulicarius* Hwass in Bruguière. Frauenfeld (1869) cited this species from Madras. The two specimens collected by the Novara Expedition on which this record was based are in the NMW. However, because some of the shells acquired by the Expedition in Madras were purchased there (Frauenfeld, 1869 : p. 853), and I know of no other specimens from India, I consider it an unverified record.

*Conus radiatus* Gmelin. Gravely (1942) reported *C. radiatus* from Madras. As no other reports and no specimens from India are known to me, I consider it an unverified record.

**Zoogeography**

The Indian species of *Conus* may be categorized in two major bathymetric groups and according to two major patterns of geographic distribution (table 3). Of the 48 species, ten are known only from dredging in depths greater than 20 m off the east and west coasts. The remaining 38 occur intertidally and/or in shallow subtidal depths along the continental shores and the Gulf of Mannar

Table 3

Known range of occurrence of the Indian species of *Conus*

	Widely distributed Indo-West Pacific species			Species with more restricted distribution	
	Indo-West Pacific generally		Throughout Indian Ocean and Western Pacific	India, Indonesia, Malaysia	Indian Ocean only
Intertidal and shallow subtidal inshore species	<i>arenatus</i>	<i>nussatella</i>	<i>achatinus</i>	<i>amadis</i> <sup>1</sup>	<i>boschi</i>
	GM	O, GM	W, E?	M-GM	GM
	<i>catus</i>	<i>pennaceus</i>	<i>betulinus</i>	<i>araneosus</i> <sup>1</sup>	<i>gubernator</i>
	GM	GM	M-GM	T-GM	AB, GM
	<i>coronatus</i>	<i>quercinus</i>	<i>ceylanensis</i>	<i>bilius</i>	<i>zeylanicus</i>
	O-R, GM	GM	M-GM	O-B, E	M-GM
	<i>ebraeus</i>	<i>rattus</i>	<i>figulinus</i>	<i>lentiginosus</i>	
	GM	GM	W, E	B, E	
	<i>eburneus</i>	<i>striatus</i>	<i>musicus</i>	<i>loroisii</i>	
	T-GM	GM	GM	M-PN	
	<i>frigidus</i>	<i>terebra</i>	<i>striatellus</i>	<i>malacanus</i>	
	O, GM	M?, GM	T-GM	M-K	
	<i>geographus</i>	<i>tessulatus</i>		<i>monile</i>	
	GM	W, M-GM		B, M-GM	
	<i>glans</i>	<i>textile</i>		<i>mutabilis</i> <sup>2</sup>	
	GM	O-B, GM		B-Kw	
	<i>litteratus</i>	<i>vexillum</i>			
GM	W?, GM				
<i>lividus</i>	<i>virgo</i>				
T-GM	W?, P-GM				
<i>marmoreus</i>					
GM, M?					
Deeper water (> 20 m) offshore species	<i>acutangulus</i>		<i>aculeiformis</i>	<i>australis</i>	<i>bayani</i>
	W, E		E	W, E	W, E
				<i>eximius</i>	<i>coromandelicus</i>
				M	E
				<i>sulcatus</i> <sup>1, 2</sup>	<i>inscriptus</i>
			M	W, E	
				<i>longurionis</i>	
				T-M	
				<i>milneedwardsi</i>	
				W	

Beneath each species name the known distribution in India is summarized, with west coast localities on the left, east coast localities on the right, coded as follows:

AB, Angria Bank	O, Okha region (including Dwarka)	E, East coast generally
B, Bombay	P, Pondicherry	W, West coast generally
K, Karikal	PN, Porto Novo	<sup>1</sup> , also recorded from Philippines
Kw, Karwar	R, Ratnagiri region	<sup>2</sup> , also recorded from Hong Kong
M, Madras	T, Tranquebar	?, uncertain record
GM, Gulf of Mannar (including Palk Bay side of Rameswaram Island)		

islands; a few of these have also been found at greater depths. The shallow water species fit into geographic groups as follows:

(1) *Widely distributed in the tropical Indo-West Pacific region (27 species)*

Most (21) of these occur throughout all or most of the IWP region; the remainder occur throughout the Indian Ocean but extend only into the western Pacific. Fourteen species are known in India with certainty only from the northern Gulf of Mannar, inhabiting the coral reefs that fringe parts of the mainland coast and form a discontinuous barrier reef with intertidal reef platforms and sand cays offshore (Stoddart & Fosberg, 1972; Pillai, 1977). Seven species occur in the Gulf of Mannar and extend northward to Madras, and in one case (*C. figulinus*, not a coral reef species) to Gopalpur. Most of the remaining species are similarly distributed on the east coast but also occur in the Okha region and/or the Malabar coast. In other parts of their ranges these species are, with few exceptions, also restricted or nearly so to coral reef habitats.

(2) *Restricted or nearly so to the northeastern Indian Ocean (11 species)*

This group includes two species that occur on coral reefs (*C. araneosus*, *C. zeylanicus*), three species characteristic of other types of rocky shores (*C. biliosus*, *C. lentiginosus*, *C. mutabilis*), three species occurring on broad expanses of sand bottom in the shallow subtidal region (5–15 m) (*C. amadis*, *C. laroisii*, *C. malacanus*), and three whose habitats are uncertain (*C. boschi*, *C. gubernator*, *C. monile*). These species are characteristic of continental shores, and except for *C. gubernator* they are typically not found on oceanic island shores and reefs.

The ranges of the shallow water species are thus more likely to be determined by the availability of suitable adult habitat than directly by physical hydrographic conditions. Equatorial water is considered to penetrate the western continental shelf only as far north as Goa and to generate a zoogeographic boundary there (Neyman, *et al.*, 1973). However, five of the seven widely distributed tropical Indo-West Pacific species of *Conus*, known with certainty to occur along the west coast of India, extend as far north as Okha. They will likely be found to occur in India wherever coral reef-associated habitats provide a suitable environment. The four more restricted west coast species are not known to occur farther south than this boundary (table 3), but two of them (*C. lentiginosus* and *C. biliosus*) range extensively along the east coast.

The offshore species are in general known from too few specimens and localities to determine distribution patterns. However, existing collection records suggest that they may be broadly distributed along the continental shelf of the Indian subcontinent. Four of the ten species are known to occur off both east and west coasts. Most of these are single records from each coast, but *C. inscriptus* has been dredged off the west coast from Okha to Ratnagiri.

### Conclusions

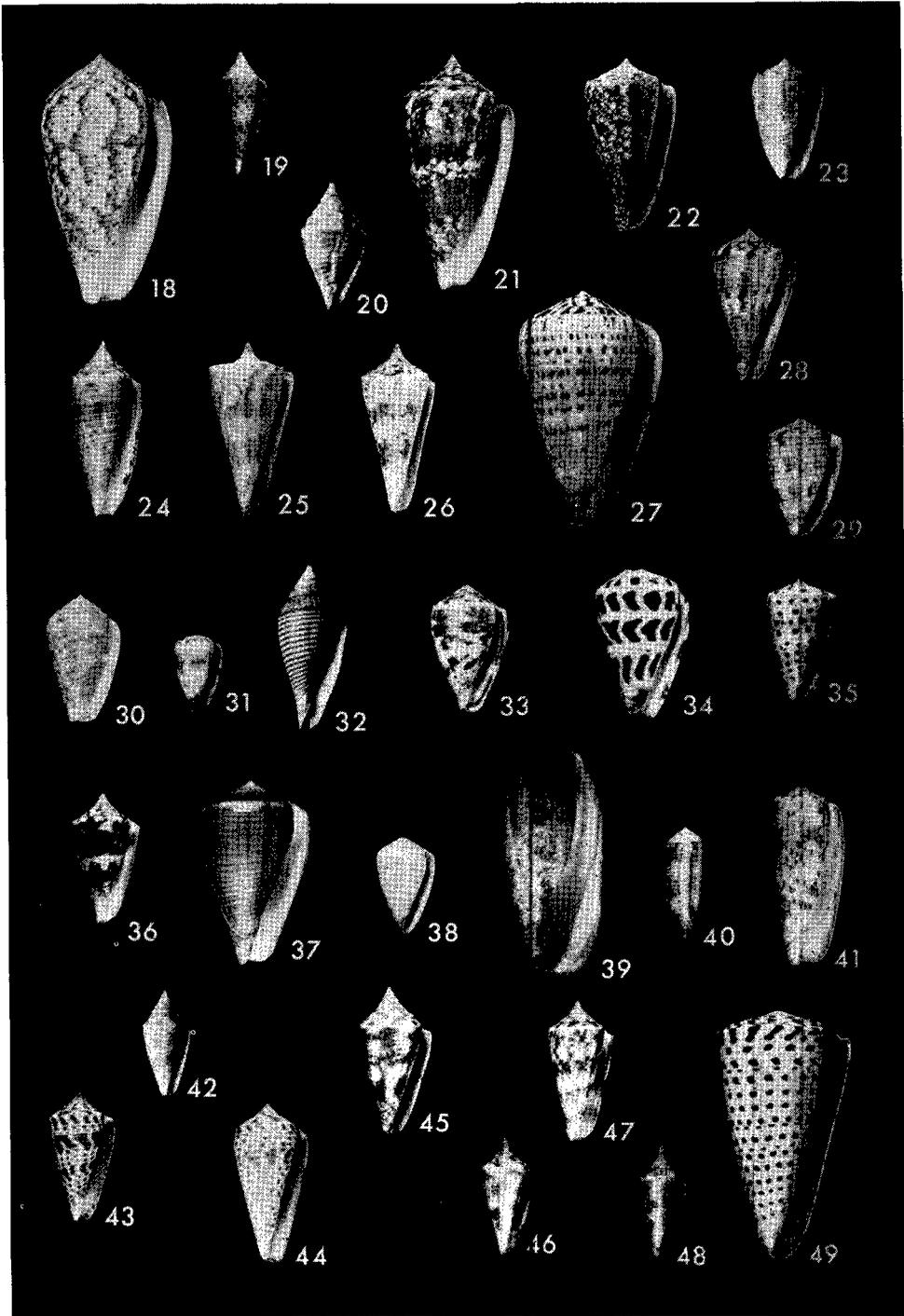
Forty-eight species of *Conus* are now recognized as occurring in Indian waters, from the intertidal zone to 200-m depths. I distinguish two bathymetric groups, those occurring in the intertidal and shallow subtidal (38 species) and those known only from the continental shelf in depths greater than 20 m

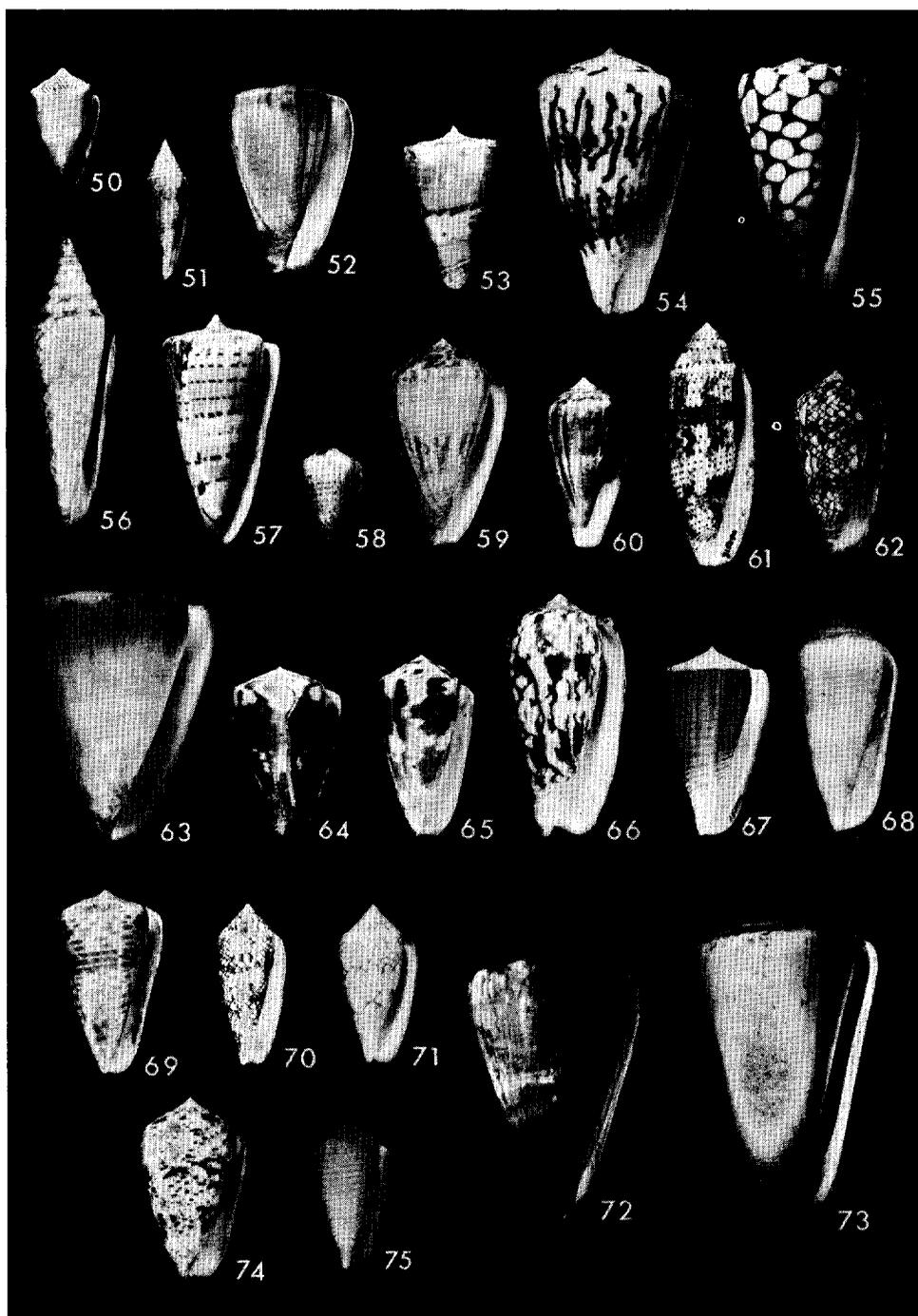
(ten species). The conclusion from prior literature that fewer species of *Conus* occur along the shores of the Indian subcontinent than on offshore islands in the same geographic region is confirmed, although some Indian shore regions have not been carefully explored and some species doubtless remain to be discovered. Almost twice as many shallow-water species are known from Sri Lanka, and the same is probably true of the Maldive Islands (Kohn, 1960; Kohn & Robertson, 1968). The marine fauna of the continental shores of the remainder of the Arabian Sea and Bay of Bengal is insufficiently known to permit comparison with India.

Most (27) of the intertidal and shallow subtidal species occur throughout all or most of the tropical Indo-West Pacific region. Within India, however, their distribution is characteristically rather limited, mainly to habitats associated with coral reefs. Twenty-four species occur only in south-east India (the gulf of Mannar and in some cases north to Madras). Although only very limited ecological data were obtained, as far as can be determined Indian populations of these species occupy similar microhabitats and eat similar prey organisms as elsewhere in their ranges. The 11 more narrowly distributed species are typically not confined to coral reef habitats. Ecologically they remain poorly known, but two, *C. biliosus* and *C. mutabilis*, prey predominantly on eunicid polychaetes, *C. leroisii* eats glycerid and capitellid polychaetes, and *C. araneosus* eats other gastropods. This is the first report of the nature of the food of these four species, as well as of *C. betulinus*, one of which had eaten a capitellid polychaete. The ten species known from deeper water are even more poorly known; they are probably fairly widely distributed along the Indian subcontinental shelf.

All but four of the 38 shallow-water species occur in the Gulf of Mannar, where they inhabit coral reef platforms along the coast and offshore. These are the most extensive coral reef habitats in India, and they are in close proximity to Sri Lanka. All but one (*C. boschi*) of the 34 species of *Conus* found on the Indian side of the Gulf of Mannar also occur in Sri Lanka (Kohn, 1960). Why many species occurring in reef-associated habitats in Sri Lanka do not occur on Indian reefs cannot be determined at present. Most of these (Kohn, 1960: table 1) are widely distributed tropical Indo-West Pacific species, whose planktonic veliger larvae should reach Indian shores. Coral reefs in India are in close proximity to a subcontinental land mass with a monsoonal climate. They are thus more subject to terrestrial influences (e.g. freshwater and silt) than are more offshore reefs or those associated with oceanic islands. However, at present one can only speculate that these conditions limit the species richness of marine benthic invertebrates, either directly by imposing physical conditions exceeding tolerance limits, or indirectly by limiting biogenic habitat complexity and thus adversely affecting required resources such as food and shelter.

Elsewhere in India, most of the east coast north of the Gulf of Mannar is sandy, with only a few rocky points (e.g. Mahabalipur and in the vicinity of Vizagapatam) (Hydrographic Department, 1921). On the west side of India, most of the Malabar coast is also sandy; from Calicut northward rocky shores and headlands are common (Hydrographic Department, 1926). The distribution of rocky shores thus does not coincide with the hydrographic boundary discussed in the previous section.





FIGS. 18-75. Captions on next page.

- FIGS. 18-75. 18, *Conus achatinus* Gmelin. 75×40 mm. Bombay. BM(NH) No. 1967435. H. O. N. Shaw coll. 19, *Conus aculeiformis* Reeve. 28×10.5 mm. Madras. AMNH No. 183990. P. Sukherwala coll. 20, *Conus acutangulus* Lamarek. 18×10 mm. 200 km WSW of Bombay. BM(NH) No. 1974156. F. W. Townsend coll. 21, *Conus amadis* Gmelin. 77×39 mm. Madras. BM(NH) No. 1953.3.13.320. R. Winckworth coll. 22, *Conus araneosus* Solander in [Lightfoot]. 52×28 mm. Mandapam Camp. USNM No. 752450. A. J. Kohn coll. 23, *Conus arenatus* Hwass in Bruguière. 27×16 mm. Tuticorin. BM(NH) No. 1953.3.10.320. R. Winckworth coll. 24, *Conus australis* Holten. 42×19 mm. 75 km WSW of Calicut. BM(NH) No. 94.911.16. Investigator coll. 25, *Conus bayani* Jousseaume. 48×25 mm. 200 km WSW of Bombay. BM(NH) No. 99.10.25.2. F. W. Townsend coll. 26, *Conus bayani* Jousseaume. 53.5×24 mm. 29 km E of Madras. USNM No. 766731. F. B. Steiner coll. 27, *Conus betulinus* Linnaeus. 69×43 mm. 6 km E of Madras. USNM No. 766725. A. J. Kohn coll. 28, *Conus biliosus* (Röding). 37×22 mm. Bombay. BM(NH) No. 1974150. V. W. MacAndrew coll. 29, *Conus boschi* Clover. 26.5×17 mm. Tuticorin. AMNH No. 183987. P. Sukherwala coll. 30, *Conus catus* Hwass in Bruguière. 29×17 mm. Tuticorin. BM(NH) No. 1953.3.10.360. R. Winckworth coll. 31, *Conus ceylanensis* Hwass in Bruguière. 11×6 mm. Krusadai I. USNM No. 766734. A. J. Kohn coll. 32, *Conus coromandelicus* Smith. 42.5×18 mm. Coromandel Coast, 311 m. BM(NH) No. 1974157. R. Winckworth coll. 33, *Conus coronatus* Gmelin. 27×16 mm. Tuticorin. BM(NH) No. 1953.3.16.243. R. Winckworth coll. 34, *Conus ebraeus* Linnaeus. 37.5×25 mm. Tuticorin. BM(NH) No. 1953.3.16.183. R. Winckworth coll. 35, *Conus eburneus* Hwass in Bruguière. 27×16 mm. Tranquebar. UZMC. 36, *Conus eximius* Reeve. 34.7×18 mm. Madras. AMNH No. 183983. P. Sukherwala coll. 37, *Conus figulinus* Linnaeus. 49×30.5 mm. Madras. BM(NH) No. 1974149. R. Winckworth coll. 38, *Conus frigidus* Reeve. 21×13 mm. Tuticorin. BM(NH) No. 1974155. R. Winckworth coll. 39, *Conus geographus* Linnaeus. 63×30 mm. Tuticorin. MGM. 40, *Conus glans* Hwass in Bruguière. 20.5×9.5 mm. Krusadai I. BM(NH) No. 1974154. R. Winckworth coll. (The shell is eroded on the ventral side.) 41, *Conus gubernator* Hwass in Bruguière. 52×22.5 mm. NMW. F. Stoliczka coll. 42, *Conus inscriptus* Reeve. Tentatively identified juvenile. 14×7 mm. 200 km WSW of Bombay. BM(NH) No. 74.12.11.280. F. W. Townsend coll. 43, *Conus inscriptus* Reeve. 28×14 mm. Porto Novo. USNM No. 766730. A. J. Kohn coll. 44, *Conus inscriptus* Reeve. 41.5×20 mm. Madras. USNM No. 766733. F. B. Steiner coll. 45, *Conus lentiginosus* Reeve. 38.5×20 mm. Bombay. BM(NH) No. 1953.3.13.405. R. Winckworth coll. 46, *Conus lentiginosus* Reeve. 25×12 mm. Bombay. BM(NH) No. 1953.3.13.379. R. Winckworth coll. 47, *Conus lentiginosus* Reeve. 37.5×18 mm. Rameswaram. AMNH No. 183985. P. Sukherwala coll. 48, *Conus lentiginosus* Reeve. 23.5×10 mm. Tuticorin. BM(NH) No. 1953.3.13.364. R. Winckworth coll. 49, *Conus litteratus* Linnaeus. 82.5×45 mm. NMW. F. Stoliczka coll. 50, *Conus lividus* Hwass in Bruguière. 25.5×14.5 mm. NMW. F. Stoliczka coll. 51, *Conus longurionis* Kiener. 35×10.5 mm. Off Madras. AMNH No. 183991. P. Sukherwala coll. 52, *Conus lotoisii* Kiener. 57×37 mm. 8 km E. of Madras. USNM No. 766727. A. J. Kohn coll. 53, *Conus malacanus* Hwass in Bruguière. 41×24 mm. Madras. MGM. 54, *Conus malacanus* Hwass in Bruguière. 78×45 mm. 24 km SE of Madras. USNM No. 766732. F. B. Steiner coll. 55, *Conus marmoreus* Linnaeus. Madras(?). 80×42 mm. MGM. 56, *Conus milneedwardsi* Jousseaume. 107×32 mm. 200 km WSW of Bombay. BM(NH) No. 1900.11.10.56. F. W. Townsend coll. 57, *Conus monile* Hwass in Bruguière. 79×41 mm. Tuticorin. BM(NH) No. 1975639. 58, *Conus musicus* Hwass in Bruguière. 20×13 mm. Shingle I. ANSP No. 301277. R. Robertson coll. 59, *Conus mutabilis* Reeve. 60×34 mm. Bombay. BM(NH) No. 1953.3.10.399. R. Winckworth coll. 60, *Conus mutabilis* Reeve. 44×24 mm. Karwar. USNM No. 766728. P. Clover coll. 61, *Conus nussatella* Linnaeus. 70×25.5 mm. Off S. India. ANSP No. 315292. 62, *Conus pennaceus* Born. 52×27 mm. Tuticorin. USNM No. 766726. A. J. Kohn coll. 63, *Conus quercinus* Solander in [Lightfoot]. 82×59 mm. Tuticorin. BM(NH) No. 1974153. R. Winckworth coll. 64, *Conus rattrus* Hwass in Bruguière. 43.5×28 mm. Krusadai I. BM(NH) No. 1953.3.13.272. R. Winckworth coll. 65, *Conus striatellus* Link. 53.5×29 mm. Tuticorin. BM(NH) No. 1953.3.13.121. R. Winckworth coll. 66, *Conus striatus* Linnaeus. 76×39 mm. Tuticorin. BM(NH) No. 1974151. R. Winckworth coll. 67, *Conus sulcatus* Hwass in Bruguière. 56.5×31 mm. Off Madras. AMNH No. 183977. P. Sukherwala coll. 68, *Conus terebra* Born. 64×29 mm. Madras (dead on beach). USNM No. 766729. F. B. Steiner coll. 69, *Conus tessulatus* Born. 54×32 mm. NMW. F. Stoliczka coll. 70, *Conus textile* Linnaeus. 39×17.5 mm. Madras. BM(NH) No. 1953.3.16.487. R. Winckworth coll. 71, *Conus textile* Linnaeus. 38.5×20 mm. Madras. BM(NH) No. 1963.3.16.487. R. Winckworth coll. 72, *Conus vexillum* Gmelin. 105×65 mm. Tuticorin. MGM. 73, *Conus virgo* Linnaeus. 118×65 mm. Tuticorin. MGM. 74, *Conus zeylanicus* Gmelin. 52×30.5 mm. Tuticorin. USNM No. 766724. A. J. Kohn coll. 75, *Conus mucronatus* Reeve (?) 38×16 mm. Mahalipuram. AMNH No. 183984. P. Sukherwala coll.

Where the biogenic habitat complexity of coral reefs is lacking, few species of *Conus* co-occur, for example the limestone platform at Okha, the mixed sand and rocky shores near Bombay, and the shallow subtidal sand habitats in the Madras vicinity (table 3). However, the present very limited knowledge of the natural history of *Conus* in India provides only rather weak evidence in favour of the hypothesis that the unexpectedly low number of species is attributable to the limited habitat heterogeneity of the Indian coasts.

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