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Diversity and Distribution of Conidae from the TamilNadu Coast of India (Mollusca: Caenogastropoda: Conidae)

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Abstract

A survey of the marine gastropod genus *Conus* Linnaeus was conducted along the TamilNadu Coast of India to explore the regional geographic distribution and diversity. The 60 species observed increased the number of Indian Conidae from 77 to 81. *Conus imperialis* Linné, *C. mitratus* Hwass in Bruguière, *C. striolatus* Kiener and *C. violaceus* Gmelin are newly recorded from the study area. *Conus amadis* Gmelin was the most widely distributed species. The highest diversity (48 species) occurred in the Gulf of Mannar, followed by 22 species from northern, six from southern, and five from the Palk Bay regions. We suggest that the rich diversity recorded in the Gulf of Mannar reflects the physical conditions, microhabitats and required resources such as food and shelter that favour the occurrence of the large number of *Conus* species.

Key words: Cone snails, Marine biodiversity, Gastropod, *Conus*, Vallapoo

Introduction

History of Indian Conidae

The taxonomy and distribution of Conidae in India were studied as early as the latter half of the 19th century by Ferdinand Stoliczka (1867, 1868) & Ronald Winckworth (1943, 1945) and the diversity of cone snails in Indian Coastal waters is fairly well documented (Kohn 1978). Various studies on the taxonomy and distribution of Conidae along the Indian Coasts carried out during 1835–2007 have recorded about 77 species. Most of these were reported from the TamilNadu Coast (Thurston 1895; Melvill & Standen 1898, 1899a, 1901; Melvill 1904; Gravely 1942; Satyamurti 1952; Kohn 1960, 1978, 2001; Röckel *et al.* 1995; Hylleberg & Kilburn 2002; Franklin *et al.* 2007). The known diversity of cone snails in the neighbouring islands such as Srilanka (Kohn 1960), Maldives and Chagos (Kohn & Robertson 1968) is comparable to that of the mainland with 70 and 64 species respectively. The *Manual of the Living Conidae* (Röckel *et al.* 1995) provides a recent,

detailed, and concise summary of 316 valid species along with several subspecies and forms from the tropical Indo-Pacific region. Due to lack of sufficient information, 16 of the identified species found off the coast of India are currently placed in the list of unverified species (Kohn 1978). Species such as *C. generalis* and *C. litoglyphus* which were earlier considered as unverified species have since been confirmed as species native to the Indian Coastal waters (Röckel *et al.* 1995; Kohn 2001). Thus, the diversity and distribution of Conidae found in the coastal waters of India, particularly of TamilNadu, in the southeast part of the country, has been well documented. However, these studies were mainly based on sporadic samplings. Since there has been no long-term study on the Indian Conidae particularly to the TamilNadu Coast, the present study was planned to observe the species of *Conus* of this region.

Vallapoo

The local fisherfolk of TamilNadu refer to cone snails by the term 'Vallapoo,' which in Tamil language is the descriptive name for the banana (*Musa musa*) flower. This simple but elegant term comes from the striking resemblance in the shape of cone snail with that of the flower. They further ascribed an identifier to each cone snail based on colour patterns (Colour vallapoo; *C. amadis*, Pulli vallapoo; *C. betulinus*), place (Irumeni vallapoo, Oolakuda vallapoo; *C. araneosus*, Madras vallapoo; *C. inscriptus*), shape (Rani (queen) vallapoo; *C. milneedwardsii*, Kal (stone) vallapoo; *C. loroisii*, Pambaram (spinning top) vallapoo; *C. inscriptus*, Oosi (needle) vallapoo; *C. acutangulus*), and at times other general names (Kootu (net) vallapoo; *C. striatus*).

Importance of *Conus* biodiversity study

The cone shells have fascinated biologists from time immemorial. Recently, these snails captivated a new set of admirers among biochemists and pharmacologists with their unique venoms. The venom of some species is powerful enough to kill a human being (Rumphius 1705). The crude venom of cone snails is a cocktail of different peptides termed as 'conotoxins' (Olivera *et al.* 1985, 1991; Olivera & Cruz 2001). The venom of each species of *Conus* has estimated to comprise between 100–200 peptide components (Myers *et al.* 1993; Alonso *et al.* 2003; Olivera 2006). Conotoxins have proved to be a valuable probe in physiological and pharmacological studies of ion channels and other receptors (Olivera & Teichert 2007). To date, only 100 out of a potential 50,000 toxins have been extracted and analysed (Wright *et al.* 2002). Since a single species of *Conus* can yield 100–200 peptides with potential therapeutic uses, it is hoped that discovery of new species of cone snails would add to the knowledge of extant species as well as to the chemical diversity of pharmacologically active peptides.

Objectives

The major aim of this investigation is to explore the geographic distribution and species assemblage of the genus *Conus* along the TamilNadu Coast. In addition, it is expected that this study will contribute to understand the relationship between this fauna and certain habitats of this study area. We have also generated regional distribution maps that will help in the development of effective conservation plan for the genus *Conus*.

Materials and methods

Time, location and scheme of sampling

Trawl samples were collected from September 2001 to October 2004 at 27 stations from Madras to Kanyakumari (Figure 1) at depths of 8 to 200 m. At times, nylon gill nets, crab nets and lobster traps were operated from a small boat to collect samples. Opportunistic sampling by other means such as skin diving, trash sampling and beach washed shells were also made. Table 1 shows the exact location of the stations.

TABLE 1. Summary of the stations followed by regions, predominant substrates, depth of fishing in each stations and localization.

Stations	Station codes	Major regions	Predominant substrates (m-meters)	Depth of fishing (meters)	Coordinates
Madras	S01	Northern - Bottom usually a vast sandy stretch and exposed directly to Bay of Bengal	sandy	10-200	13° 36'N, 80° 38'E
Pondicherry	S02		sandy with coral	10-80	11° 54'N, 79° 48'E
Cuddalore	S03		sandy with coral	08-150	11° 42'N, 79° 48'E
Peryakuppam	S04		< 8 m fine sand; >8 m sand, mud and sand rocks	05-25	11° 29'N, 79° 47'E
Mudasalodai	S05		muddy with silt	05-20	11° 29'N, 79° 44'E
Palayar	S06		<15 m sandy mud; >15 m muddy	30-150	11° 26'N, 79° 59'E
Tranquebar	S07		< 8 m sandy; >8 m muddy	10-80	11° 10'N, 79° 59'E
Nagapattinam	S08		muddy-sand	10-200	10° 45'N, 79° 50'E
Kodikkarai	S09	Palk Bay - Almost enclosed water body connected to Bay of Bengal through the narrow Palk straight. Due to land drainage through rivers, the water is generally turbid over bottom. Generally bottom is muddy and muddy sand.	<8 m sandy with sea grass beds; >8m muddy	05-25	10° 18'N, 79° 51'E
Malipattinam	S10		<10 m sandy; >10 m muddy	05-50	10° 19'N, 79° 42'E
Kottapattinam	S11		<15 m sandy; <15 m muddy	08-65	10° 16'N, 79° 39'E
Thondi	S12		<10 m sandy with rock outcrops; >10 m sandy mud	10-80	09° 45'N, 78° 04'E
Devipattinam	S13		sandy with sea grass beds	05-40	09° 48'N, 78° 09'E
Rameswaram	S14		sandy over the rocky core underneath	05-180	09° 18'N, 79° 18'E
Pamban	S15		sandy with coral rubbles	05-40	09° 24'N, 79° 14'E
Mandapam	S16		<15 m coral rubble on coarse sand and gravel; > 15 m with fringing reefs	05-80	09° 17'N, 79° 08'E
Vedhalai	S17	Gulf of Mannar - Protected from the waters of Bay of Bengal by Sri Lanka. Several coral islands are located. Generally bottom is sandy with coral and coral rubble.	sandy with sea grass beds	05-25	09° 16'N, 79° 06'E
Yerwadi	S18		sandy with interrupted rocky cover	08-80	09° 16'N, 78° 53'E
Keelakarai	S19		sandy with rocky cover	05-50	09° 14'N, 78° 50'E
Vembar	S20		shallow and mainly sandy	05-30	09° 04'N, 78° 24'E
Vellapatti	S21		sandy with coral rubble and gastropod shells	05-30	08° 50'N, 78° 14'E
Tuticorin	S22		sandy, strewn with coral rubbles	10-200	08° 48'N, 78° 12'E
Punnakayal	S23		sandy	05-40	08° 37'N, 78° 07'E
Thiruchendur	S24		sandy with rocky cover	05-80	08° 30'N, 78° 11'E
Manapad	S25		sand and coarse sand grains broken up by multitudes of rocky out crops	05-30	08° 25'N, 78° 04'E
Uvari	S26		sandy with rocky platforms	05-40	08° 14'N, 77° 52'E
Kanyakumari	S27	sandy shore is strewn with high rocky boulders	10-200	08° 06'N, 77° 36'E	

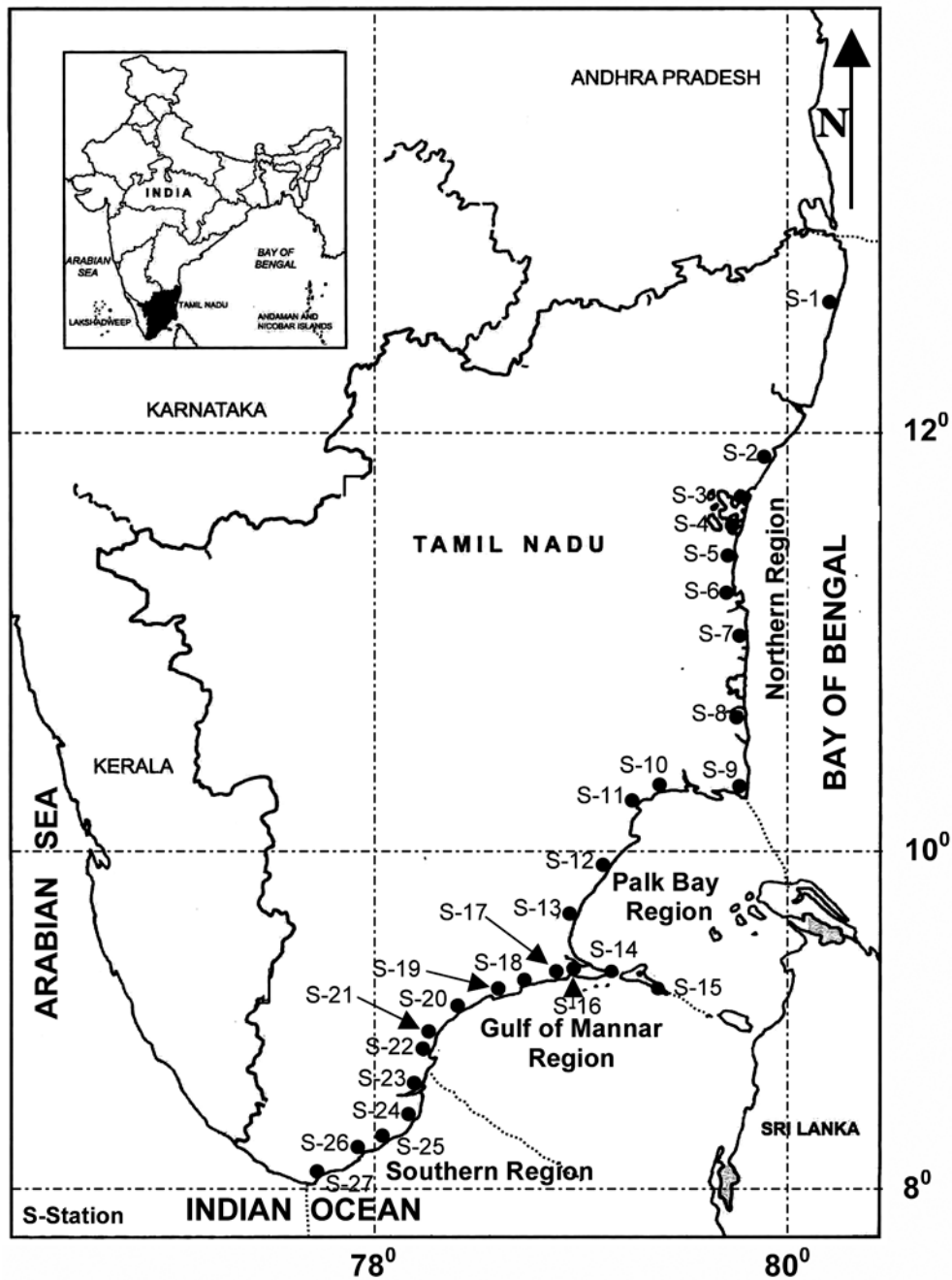


FIGURE 1. Study area. The solid dots indicate the sampled stations (see Table 1); dotted lines indicate the boundaries of the regions.

Selection of stations

The TamilNadu Coast has been divided into 4 major regions (Table 1): Northern (sandy), Palk Bay (muddy), Gulf of Mannar (coral) and Southern (rocky), based on the predominant benthic substrates that occur in each region (Kohn 1978; Ramaiyan & Adiyatham 1985; Asir Ramesh *et al.* 1997; Yazhini 2004). The 27 stations were selected based on the extent of fishing activity all through the year, involving different fishing crafts (Table 2) and fishing gears (Table 3) and also to ensure that a wide range of environmental conditions were assessed.

TABLE 2. Types of crafts.

Sl. no	Types of crafts	Vernacular name	Length
1	Traditional boats—Non-motorised	Catamaran, Vallam	6 – 8 meters
	—Motorised	Dingi (Larger sized catamaran)	7 – 11meters
2	Trawl—Motorised—Small trawlers —Large trawlers	Launch	7– 9 meters (45–67 hp engines) 13 meters (83 hp engines)

TABLE 3. Types of gears.

Sl.no	Types of Gear	Vernacular name	Mesh size (millimeters)	Dimensions Length/Breadth (meters)
1	Gill net (Drift-net)	a. Choodai valai	10	50–60/3
		b. Kumala valai	50–55	70–75/3.5–4
2	Crab net (Bottom set)	Nandu valai	40–50	80–100/1–2
3	Shrimp trawl-net	Iraal valai	20–30	70–90/3
4	Fish trawl-net	Mathi valai, etc...	20–40	80–100/3
5	Lobster net	Singi Valai or Kalral valai	30–50	70–80/3
6	Shore seine	Karai Valai or illu valai	4	40–100/1.5–2
7	Chank trawl-net	Chanku valai	10	80–90/3–4

All stations were visited regularly. PortoNovo served as the base. Pondicherry (S-2), Cuddalore (S-3), Periyakuppam (S-4), Mudasalodai (S-5) and Palayar (S-6) represented sandy substrates and being close to the Marine Station of PortoNovo were visited twice a week. The stations in the Gulf of Mannar and the Southern region represented coral reefs and rocky substrata respectively, and were sampled monthly. Collections were made twice in each season (Pre-monsoon: Jul-Sep, Monsoon: Oct-Dec, Post-monsoon: Jan-Mar and Summer: Apr-Jun) at all the other stations. In addition to the TamilNadu Coast, species diversity was also explored off Bombay in the west coast of India. Here sampling was restricted to one station, Colaba.

Species accounts

The identification guide and taxonomic lists of Röckel *et al.* (1995) and Kohn (1978, 2001) were used for species identification. Synonyms of type-species that have not been cited were adopted from Rockel *et al.* 1995. Specimens of individual species are documented photographically (Figures 2 to 61). Earlier distributional records within India and remarks for each species are presented. Abbreviations of the museums mentioned in distribution part are given in Table 4. The abbreviations used for some terms in this section are shell length as SL, shell width as SW, and for station(s) as S.

TABLE 4. List of abbreviations of Conidae type specimens depositories.

Institutions	Acronym
American Museum of Natural History, New York, USA	AMNH
Australian Museum, Sydney, Australia	AMS
Academy of Natural Sciences, Philadelphia, USA	ANSP
The Natural History Museum, London, UK	BMNH
Delaware Museum of Natural History, Wilmington, USA	DMNH
Geological Institute, Yokohama National University, Japan	GIYU
Institut Royale des Sciences Naturelles de Belgique, Brussels, Belgium	IRSN
Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels, Belgium	KBIN
Kanagawa Prefectural Museum, Japan	KPM
Löbbecke-Museum, Düsseldorf, Germany	LMD
Linnaean Collection, Linnaean Society, London, England, Great Britain	LSL
Museum of Comparative Zoology, Harvard University, USA	MCZ
Muséum d' Histoire Naturelle, Geneva, Switzerland	MHNG
Manchester Museum, England	MM
Madras Government Museum, India	MGM
Museum National d' Histoire Naturelle, Paris, France	MNHN
Museo de Storia Naturale, Università de Pisa, Italy	MSNP
Museu Zoologico da Universidade de Coimbra, Portugal	MZUC
Naturhistorisches Museum Wien, Austria	NMW
National Museum of Wales, Cardiff, Wales, Great Britain	NMWC
National Science Museum, Tokyo, Japan	NSMT
South Africa Museum, Cape Town, South Africa	SAMC
Staatliches Museum für Naturkunde, Stuttgart, Germany	SMNS
Senckenberg Museum, Frankfurt, Germany	SMF
National Museum of Natural History, Washington, D.C., USA	USNM
Zoological Museum, University of Amsterdam, The Netherlands	ZMA
Zoologisk Museum, Copenhagen, Denmark	ZMUC
Zoologiske Museum, Stockholm, Sweden	ZMS
Zoological Survey of India, Calcutta, India	ZSI

Shell characters and character states used in species description

The terminologies used in species description, the measurements to describe the shell characters and character states in detail follow Röckel *et al.* (1995). The terminologies used herein the description part are given below with its typical measurements.

Shell length (SL):

Very small	<15 mm
Small	5–25 mm
Moderately small	25–35 mm
Medium-sized	35–55 mm

Moderately large 55–80 mm
 Large >80 mm

Relative weight (RW= absolute weight/shell length; grams/millimeter of shell length):

Light <0.06 g/mm
 Moderately light 0.06–0.10 g/mm
 Moderately solid 0.10–0.30 g/mm
 Solid 0.30–0.80 g/mm
 Moderately heavy 0.80–1.10 g/mm
 Heavy >1.10 g/mm

Relative height of spire (RSH) [(Shell length-Aperture height)/Shell length]:

Low <0.12 mm
 Moderate 0.12–0.23 mm
 High >0.23 mm

Repositories

Voucher specimens of all the species (one of each species) are deposited in the Marine Biological Museum of Annamalai University (MBMAU), PortoNovo 608502, TamilNadu, India, with the catalog numbers from MBMAU 101 to MBMAU 160 (Table 5).

TABLE 5. List of *Conus* species with voucher number followed by shell size, maximum depth and feeding mode. P—Piscivorous, M—Molluscivorous, V—Vermivorous. MBMAU—Marine Biological Museum of Annamalai University.

Sl.no	<i>Conus</i> species	Voucher number	Shell size (millimeters) (Shell Length x Shell Width)		Max. Depth (meters)	Feeding mode
			Minimum	Maximum		
1	<i>C. achatinus</i>	MBMAU101	35x17	65x32	20	P
2	<i>C. aculeiformis</i>	MBMAU102	35x11	41x15	40	V
3	<i>C. acutangulus</i>	MBMAU103	32x15	38x17	55	V
4	<i>C. amadis</i>	MBMAU104	35x17	112x54	30	M
5	<i>C. araneosus</i>	MBMAU105	24x15	105x63	30	M
6	<i>C. arenatus</i>	MBMAU106	25x12	42x18	40	V
7	<i>C. asiaticus</i>	MBMAU107	35x16	50x22	15	V
8	<i>C. augur</i>	MBMAU108	16x24	36x50	15	V
9	<i>C. aulicus</i>	MBMAU109	110x52	148x74	50	M
10	<i>C. australis</i>	MBMAU110	-	40x15	60	V
11	<i>C. bayani</i>	MBMAU111	43x20	72x36	50	V
12	<i>C. bengalensis</i>	MBMAU112	92x46	112x56	80	M
13	<i>C. betulinus</i>	MBMAU113	110x09	148x15	50	V
14	<i>C. biliosus</i>	MBMAU114	36x15	52x24	30	V
15	<i>C. characteristicus</i>	MBMAU115	36x16	68x36	20	V
16	<i>C. consors</i>	MBMAU116	42x25	66x48	50	P
17	<i>C. coronatus</i>	MBMAU117	-	37x26	12	V
18	<i>C. dictator</i>	MBMAU118	22x08	46x28	50	V
19	<i>C. ebraeus</i>	MBMAU119	25x13	32x15	15	V

.....continued

TABLE 5 (continued)

Sl.no	Conus species	Voucher number	Shell size (millimeters)		Max. Depth (meters)	Feeding mode
			(Shell Length x Shell Width)			
			Minimum	Maximum		
20	<i>C. eburneus</i>	MBMAU120	35x22	40x25	not known	V
21	<i>C. eucoronatus</i>	MBMAU121	32x18	35x20	200	V
22	<i>C. eximius</i>	MBMAU122	35x20	55x36	15	V
23	<i>C. figulinus</i>	MBMAU123	22x14	84x46	50	V
24	<i>C. frigidus</i>	MBMAU124	38x15	42x20	50	V
25	<i>C. geographus</i>	MBMAU125	60x28	120x48	30	P
26	<i>C. gubernator</i>	MBMAU126	-	43x18	not known	V
27	<i>C. hyaena</i>	MBMAU127	36x17	68x32	50	V
28	<i>C. imperialis</i>	MBMAU128	42x18	48x24	80	V
29	<i>C. inscriptus</i>	MBMAU129	23x11	68x33	80	V
30	<i>C. lentiginosus</i>	MBMAU130	32x16	36x18	30	V
31	<i>C. leopardus</i>	MBMAU131	60x32	147x90	40	V
32	<i>C. litoglyphus</i>	MBMAU132	-	46x24	30	V
33	<i>C. lividus</i>	MBMAU133	24x12	48x29	30	V
34	<i>C. longurionis</i>	MBMAU134	-	37x12	not known	V
35	<i>C. lorosisii</i>	MBMAU135	30x16	92x56	50	V
36	<i>C. madagascariensis</i>	MBMAU136	42x18	08x29	40	M
37	<i>C. malacanus</i>	MBMAU137	42x22	68x36	50	V
38	<i>C. marmoreus</i>	MBMAU138	62x30	85x42	80	M
39	<i>C. miles</i>	MBMAU139	-	45x24	20	V
40	<i>C. milneedwardsi</i>	MBMAU140	85x24	120x35	80	M
41	<i>C. mitratus</i>	MBMAU141	-	41x13	30	V
42	<i>C. monile</i>	MBMAU142	66x35	120x42	20	V
43	<i>C. nussatella</i>	MBMAU143	-	54x20	not known	V
44	<i>C. pertusus</i>	MBMAU144	40x25	45x28	20	V
45	<i>C. praecellens</i>	MBMAU145	-	38x16	40	V
46	<i>C. pretiosus</i>	MBMAU146	48x21	80x33	120	V
47	<i>C. quercinus</i>	MBMAU147	44x32	53x34	30	V
48	<i>C. rattus</i>	MBMAU148	28x13	56x25	50	V
49	<i>C. striatus</i>	MBMAU149	52x28	110x56	50	P
50	<i>C. striolatus</i>	MBMAU150	22x14	24x14	40	P
51	<i>C. suratensis</i>	MBMAU151	75x38	92x43	15	V
52	<i>C. terebra</i>	MBMAU152	58x24	92x40	50	V
53	<i>C. tessulatus</i>	MBMAU153	32x26	70x45	80	V
54	<i>C. textile</i>	MBMAU154	35x11	104x42	80	M
55	<i>C. tuticorinensis</i>	MBMAU155	-	24x14	not known	V
56	<i>C. vexillum</i>	MBMAU156	40x22	108x52	40	V
57	<i>C. vimineus</i>	MBMAU157	-	36x12	not known	V
58	<i>C. violaceus</i>	MBMAU158	48x18	55x20	20	V
59	<i>C. virgo</i>	MBMAU159	50x28	110x52	20	V
60	<i>C. zeylanicus</i>	MBMAU160	42x25	56x38	50	V

Distribution mapping

Each study location was geo coded and a species presence/absence matrix was used to generate distribution maps for each species using standard GIS software (Map info professional 5.0). Herein, we have presented the distribution of each species in the TamilNadu map with photographs of shells (see figures 2 to 61).

Data analysis

The data were analysed to assess the biodiversity value and characteristics of the different environment types in terms of two main biotic attributes: (1) species richness and (2) assemblage type. We considered alpha (α) diversity as a synonym of *Conus* species richness. Richness was measured as the number of species recorded in a given sampling station. Beta diversity (β) is a measure of species turnover between site pairs, and is a reflection of the heterogeneity of the different communities regarding their species composition (Magurran 1988). In order to complement the β diversity analysis we calculated Jaccard's index of similarity (Magurran 2003). Diversity was analysed using the software PAST.

Results

We collected 2266 individuals of *Conus* comprising 60 species representing 47 vermivorous, 8 molluscivorous and 5 piscivorous species (Table 5).

Species accounts

1. *Conus achatinus* Gmelin, 1791 (Figure 2)

Conus achatinus Gmelin, 1791: 3388, no. 25 (representation of lectotype, Chemnitz 1788: pl. 142, fig. 1317 (74 x 42 mm) (Kohn 1966); "Oceano americano", corrected to "Java" (Coomans *et al.* 1979b)).

Conus achatinus Hwass in Bruguière, 1792: 671–673, no. 66 (lectotype, MHNG (68.5 x 40.5 mm) (Kohn 1968); "Océan asiatique").

Conus ranunculus Hwass in Bruguière, 1792: 671, no. 65 (holotype, MHNG (45 x 23 mm) (Kohn 1968); "Océan Amériquin").

Cucullus ventricosus Röding, 1798: 49, no. 623/114.

Conus achatinus var. *infumata* Dautzenberg, 1937: 12 (representation of lectotype, Chemnitz 1788: pl. 142, fig. 1320 (60 x 31 mm) (Walls 1979)).

Material examined: MBMCS 101, 5 specimens, SL 35–65 mm; SW 17–32 mm.

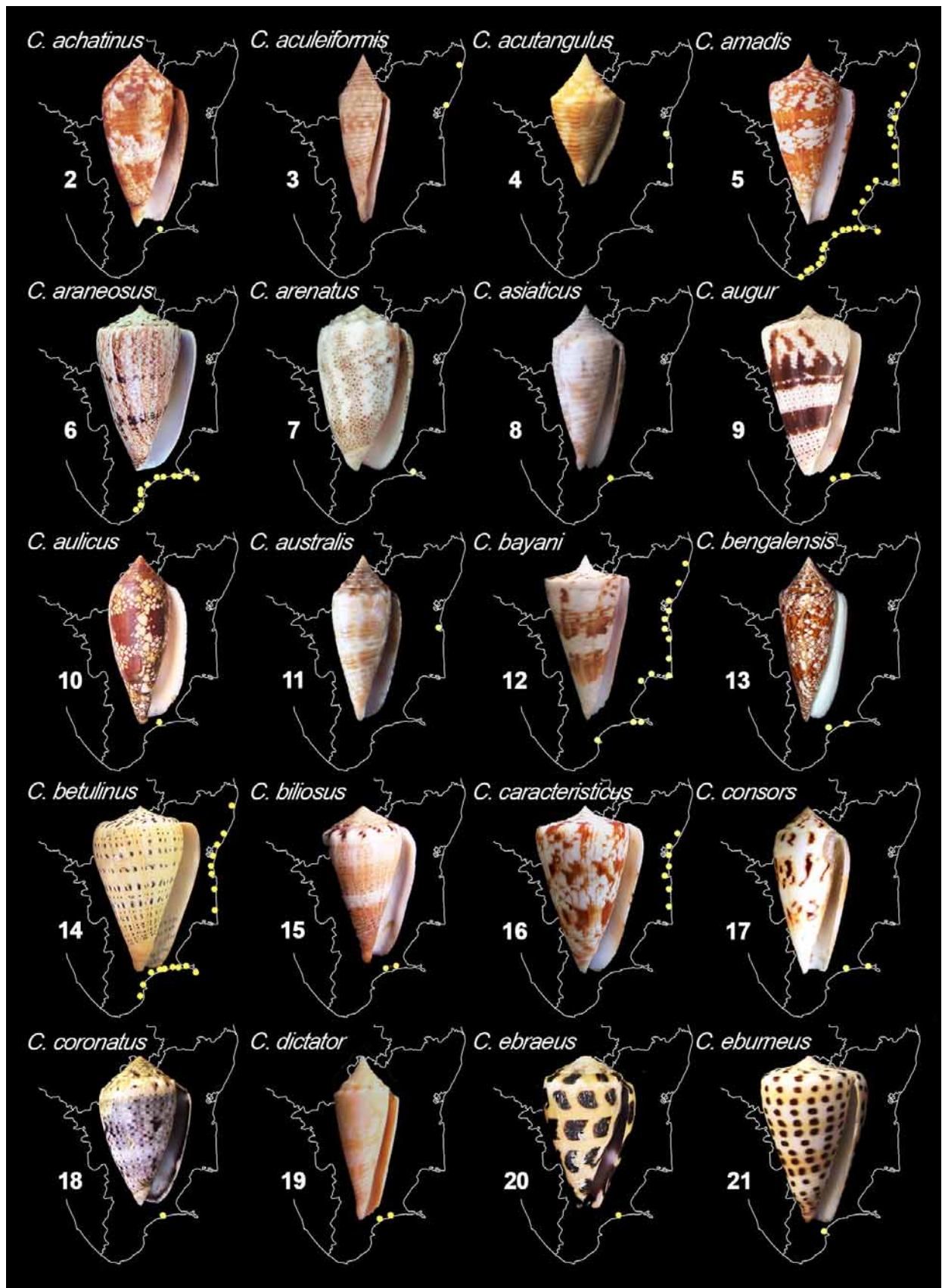
Description. Shell moderately solid, outline convex. Aperture wider at base than near shoulder. Spire of moderate height. Colour of body whorl olive or orange red to blackish brown, clouded with scattered white to dull yellowish flammules and blotches; broad band at centre with similar pattern. Spiral uniform thin lines of dark brown interrupted by white dots and dashes run from shoulder to base. Aperture bluish white; exterior dark colour pattern visible as a band along interior border of lip. Periostracum brown and opaque. End of siphon dark brown, proboscis deep orange to red.

Distribution. Melvill & Abercrombie (1893) first reported *C. achatinus* from India as '*C. monachus* Linnaeus var. *achatinus* Chemnitz'. *C. achatinus* was reported to be widely distributed along northwest coast from Okha southward to Goa (Melvill & Abercrombie 1893; Abercrombie 1893; Melvill & Standen 1901; Hornell & Tomlin 1951; Subrahmanyam *et al.* 1952; Kohn 1978). Ray (1949) reported two specimens from the east coast.

The specimens reported herein were collected from Keelakarai (Table 6) by trawling in 5–20 m and by diving in 10 m. Fifty-eight specimens from Colaba, Bombay were collected by hand at low tide.

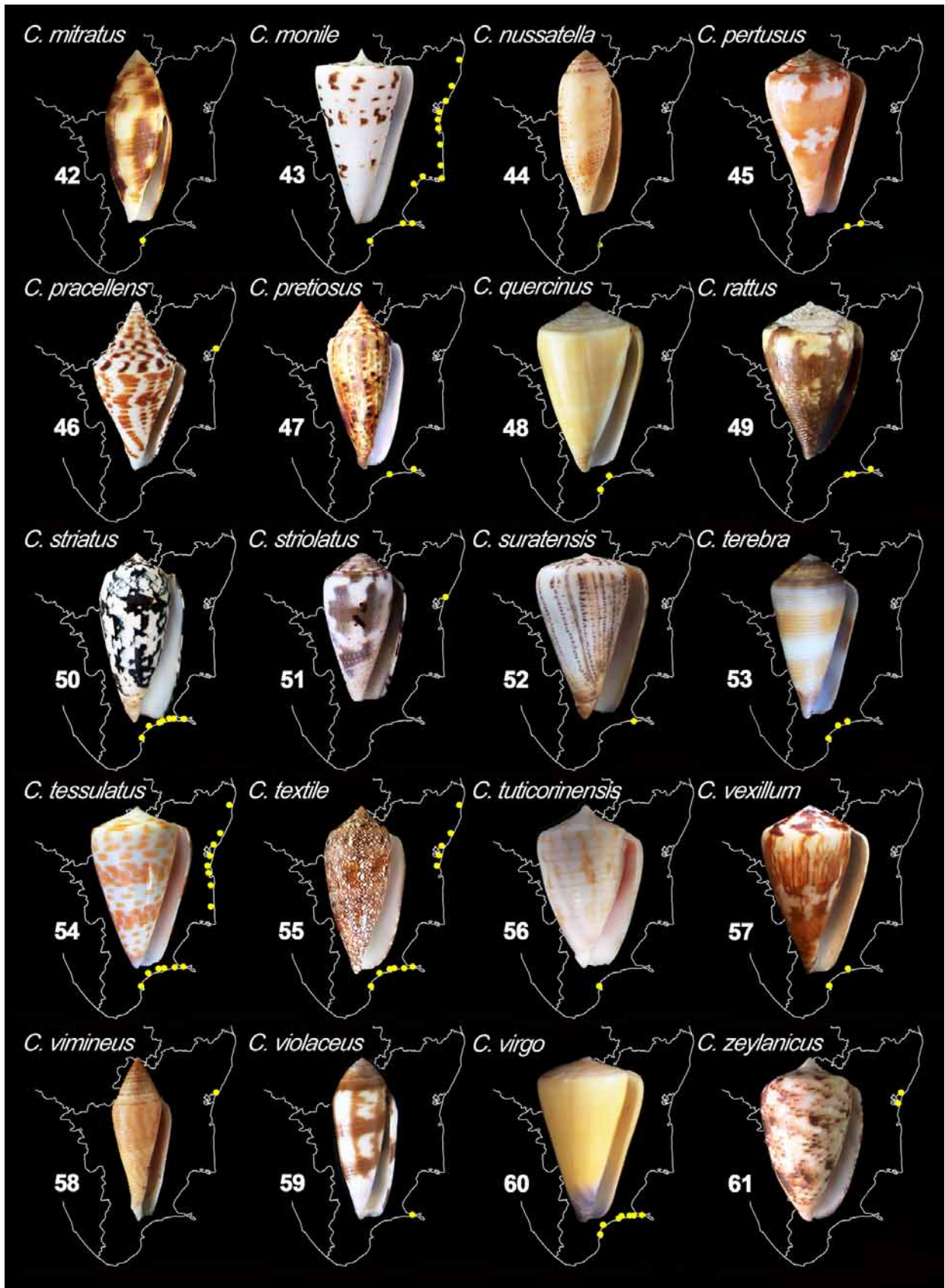
TABLE 6. Presence (■) of *Conus* species and total number of species per sampling site.

<i>Conus</i> species	Major regions																											Number of specimens	
	Northern (22 species)							Palk Bay (5 species)					Gulf of Mannar (48 species)								Southern (6 species)								
	Stations																												
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
<i>C. amadis</i>	■																											290	
<i>C. betulinus</i>	■																											228	
<i>C. monile</i>	■																											157	
<i>C. tessulatus</i>	■																											36	
<i>C. inscriptus</i>	■																											315	
<i>C. textile</i>	■																											26	
<i>C. figulinus</i>	■																											142	
<i>C. lorosisii</i>	■																											142	
<i>C. malacanus</i>	■																											81	
<i>C. araneosus</i>	■																											122	
<i>C. leopardus</i>	■																											48	
<i>C. bayani</i>	■																											42	
<i>C. characteristicus</i>	■																											48	
<i>C. striatus</i>	■																											48	
<i>C. virgo</i>	■																											48	
<i>C. eximius</i>	■																											27	
<i>C. geographus</i>	■																											18	
<i>C. augur</i>	■																											10	
<i>C. lividus</i>	■																											22	
<i>C. madagascariensis</i>	■																											20	
<i>C. rattus</i>	■																											9	
<i>C. lentiginosus</i>	■																											16	
<i>C. terebra</i>	■																											52	
<i>C. aculeiformis</i>	■																											3	
<i>C. acutangulus</i>	■																											2	
<i>C. bengalensis</i>	■																											2	
<i>C. biliosus</i>	■																											28	
<i>C. consors</i>	■																											4	
<i>C. dictator</i>	■																											38	
<i>C. imperialis</i>	■																											2	
<i>C. marmoreus</i>	■																											2	
<i>C. milneedwardsi</i>	■																											3	
<i>C. pertusus</i>	■																											3	
<i>C. pretiosus</i>	■																											4	
<i>C. quercinus</i>	■																											4	
<i>C. vexillum</i>	■																											8	
<i>C. zeylanicus</i>	■																											120	
<i>C. achatinus</i>	■																											5	
<i>C. arenatus</i>	■																											8	
<i>C. asiaticus</i>	■																											15	
<i>C. aulicus</i>	■																											2	
<i>C. australis</i>	■																											2	
<i>C. coronatus</i>	■																											2	
<i>C. ebraeus</i>	■																											8	
<i>C. eburneus</i>	■																											2	
<i>C. eucoronatus</i>	■																											2	
<i>C. frigidus</i>	■																											14	
<i>C. gubernator</i>	■																											1	
<i>C. hyaena</i>	■																											16	
<i>C. litoglyphus</i>	■																											1	
<i>C. longurionis</i>	■																											1	
<i>C. miles</i>	■																											1	
<i>C. mitratus</i>	■																											1	
<i>C. nussatella</i>	■																											1	
<i>C. praecellens</i>	■																											1	
<i>C. striolatus</i>	■																											2	
<i>C. suratensis</i>	■																											6	
<i>C. tuticorinensis</i>	■																											1	
<i>C. vimineus</i>	■																											1	
<i>C. violaceus</i>	■																											3	
Number of species	13	12	17	12	11	13	10	10	03	04	03	01	03	03	22	17	06	13	34	19	02	24	04	01	02	01	03	Total	2266



FIGURES 2 to 61. Photographs of *Conus* spp. Shells with its distribution shown in TamilNadu map.





Remarks. In Colaba, Bombay (18° 53'N 72° 48'E), *C. achatinus* (piscivore) occurs together with *C. hyaena* (vermivore) on the upper intertidal region of the west coast, but it occurs only subtidally on the east coast.

Four types of shell colour patterns were observed among *C. achatinus* found on the west coast (Figure 62A, B, C & D) whereas only one type was observed in the east (Figure 2). The size range was similar between both coast specimens.

2. *Conus aculeiformis* Reeve, 1844 (Figure 3)

Conus aculeiformis Reeve, 1844: pl. 44, no. 240b (lectotype, BMNH 196168 (38 x 15 mm) (Walls 1979); "Cagayan, island of Mindanao, Philippines").

Conus (Asperi) delicatus Schepman, 1913: 392–393, pl. 25, fig. 3 (holotype, ZMA (18.5 x 6 mm) (Röckel *et al.* 1995); "Madura-bay").

Material examined: MBMCS 102, 3 specimens, SL 35–41 mm; SW 11–15 mm.

Description. Shell moderately small and light. Body whorl narrowly conical, elongated anteriorly, outline almost straight. Shoulder angulate with a deep exhalent notch. Spire of moderate height, sharply pointed and concave. Body whorl with widely spaced, axially striate spiral grooves separating very flat ribbons and extending from base to shoulder. Aperture long, narrow and slightly wider anteriorly, outer lip very thin and fragile, posteriorly sloping strongly below level of shoulder. Ground colour cream. Body whorl with spiral rows of brown squarish to rectangular spots on ribbons, often fused into an interrupted spiral band on each side of the centre. Aperture pale brown.

Distribution. There have been no records in the literature on the distribution of this species in India. However, specimens from Madras (at AMNH) and Tranquebar (at ZMUC) were collected by the *Galathea* expedition (Kohn 1978).

The specimens described herein were collected from Madras by trawling in 20–40 m and at Cuddalore from the trash discard (Table 6).

Remarks. The present shell collected from Cuddalore is larger (41 mm) than the maximum length (38 mm) of this species previously reported by Röckel *et al.* (1995).

3. *Conus acutangulus* Lamarck, 1810 (Figure 4)

Conus acutangulus Lamarck, 1810: 286, no. 121 (neotype, MNHN (27 x 12.5 mm) (Kohn 1981); "Mer des Grandes Indes").

Conus turriculatus Sowerby II, 1866: pl. 27 (288), figs. 643, 644 (type, BMNH (22 x 10.5 mm) (Röckel *et al.* 1995)).

Conus gemmulatus Sowerby III, 1870: 257, pl. 22, fig. 8 (Holotype, BMNH (13 x 6 mm) (Röckel *et al.* 1995); "China Seas").

Materials examined: MBMCS 103, 2 specimens, SL 32–38 mm; SW 15–17 mm.

Description. Shell medium-sized, moderately solid. Body whorl conical, sides nearly straight with broad raised ribs of fairly uniform width separated by narrow deep grooves. Ground colour white. Body whorl light brown with scattered blotches of ground colour at shoulder and centre. Shoulder carinate. Spire high, marked by distantly spaced brown spots and streaks. Aperture narrow, interior pale brown; outer lip thin and fragile.

Distribution. Melvill & Standen (1901) and Kohn (1978) reported specimens of *C. acutangulus* from Bombay and Malabar Coast. Kohn (1978) reported specimens (in ZSI) from Coromandel Coast and Vizhagapattinam on the east coast.

The specimens described herein were collected from Nagapattinam and Palayar (Table 6) by trawling in 50 m and 55 m.

Remarks. The specimen collected from Nagapattinam is larger (38 mm) than the previous size (30 mm) reported by Röckel *et al.* (1995). This species appears to be rare along the TamilNadu Coast.

4. *Conus amadis* Gmelin, 1791 (Figure 5)

Conus amadis Gmelin, 1791: 3388, no. 32 (lectotype, ZMUC (78 x 41 mm) (Kohn 1966); "Rameswaram, India").

Conus amadis Hwass in Bruguière, 1792: 689–690, no. 78 (lectotype, MHNG (85 x 46 mm) (Kohn 1968); "aux isles de Java et de Borneo").

Cucullus venustus Röding, 1798: 47, no. 599.

Conus amadis var. *aurantia* "Lamarck" Dautzenberg, 1937: 14–15 (representation of lectotype, Knorr 1772: pl. 5, fig. 3 (71 x 33 mm) (Coomans *et al.* 1981); locality unknown).

Conus amadis var. *castaneofasciata* "Sowerby" Dautzenberg, 1937: 15 (lectotype, MHNG (80 x 40.5 mm) (Coomans *et al.* 1983); locality unknown).

Conus subacutus Fenaux, 1942: 4, fig. 10 ("Madagascar").

Conus arbonatalis da Motta, 1978: 5, 7 (holotype, MHNG (64 x 30 mm) (Rockel *et al.* 1995); "off the coastal waters arching from Ranong South West Thailand toward Bangladesh in the Bay of Bengal").

Conus (Leptoconus) lozeti Richard, 1980: 91–95 (holotype, MNHN (56 x 30 mm) (Röckel *et al.* 1995); "Fort-Dauphin au sud-est de Madagascar").

Material examined: MBMCS 104, 291 specimens, SL 35–112 mm; SW 17–54 mm.

Description. Shell medium sized to large, solid. Body whorl broadly conical, glossy and thinner at aperture lip. Shoulder angulate to carinate. Spire of moderate height, sometimes shorter; apex sharply pointed, strong spiral ridge runs along spire. Body whorl with distinct to obsolete spiral grooves from base to centre or beyond, separated by ribs at base and ribbons above. Ground colour white. Body whorl with yellow to dark brown variable, irregular, zig-zag markings. Two transverse yellowish to dark brown bands interrupted by white dots or small tents either side of centre. Spire marked with yellow to dark brown spots. Aperture bluish-white, translucent and uniformly wide. End of siphon is yellow to dark brown with a black band behind anterior edge.

Distribution. Thurston (1890) first reported *C. amadis* from Rameswaram. Subsequent records are from Pamban (Thurston 1895; Satyamurti 1952), Krusadai Island ([Chennappayya] 1927, as '*C. acuminatus*'), Mandapam (Sundaram 1969), Madras (Melvill & Standen 1898; Crichton 1940, 1941; Gravely 1942; Satyamurti 1952) and PortoNovo (Kohn 1978). Kohn (1978) has reported museum specimens from Tuticorin (at BMNH) and Tranquebar (at ZMUC).

The specimens described herein were collected from all the stations selected for this study (except Rameswaram and Vellapatti) by trawling in 10–30 m (Table 6).

Remarks. *Conus amadis* was found to be a common species. The colour pattern on the body whorl varied widely within populations and among stations (Figure 62E). Shells of many specimens from the Gulf of Mannar and Southern regions were infested with sessile barnacle *Balanus amphitrite* Darwin (Figure 62F) and *Balanus variegatus* Darwin (Figure 62G). *Conus amadis* was frequently collected at Periyakuppam when fishing for seashells after monsoons.

5. *Conus araneosus* [Lightfoot], 1786 (Figure 6)

Conus araneosus [Lightfoot], 1786: 106, no. 2328 (representation of lectotype, Martini 1773: pl. 61, fig. 676 (64 x 39 mm) (Kohn 1964); "China, Coromandel").

Conus arachanoides Gmelin, 1791: 3388, no. 34 (representation of lectotype, Knorr 1772: pl. 4, fig. 4 (49 x 27 mm) (Kohn 1966); locality unknown).

Conus nicobaricus Hwass in Bruguière, 1792: 612, no. 7 (representation of lectotype, Cuvier 1798: pl. 318, fig. 9 (63 x 36 mm); "des grandes Indes").

Conus araneosus Hwass in Bruguière, 1792: 612–613, no. 8 (lectotype, MHNG (94 x 55 mm) (Kohn 1968); "isles Moluques").
Conus reticulatus Perry, 1811: pl. 24, no. 2 (representation of holotype, Perry 1811: pl. 24, no. 2 (61 x 37 mm); locality unknown).
Conus monstrosus "Chemnitz" Küster, 1838: 77, pl. 12, figs. 5, 6 (representation of holotype, Küster 1838: pl. 12, fig. 6 (50 x 32 mm); "Indischer Ozean").
Conus peplum Sowerby II, 1857: 3, no. 11 ("Red Sea").

Material examined: MBMCS 105, 122 specimens, SL 24–105 mm; SW 15–63 mm.

Description. Shell moderately large, solid to heavy with a high gloss. Body whorl conical. Shoulder broad, faintly canaliculated, angulate, weakly to strongly tuberculate. Outline straight to slightly convex. Spire of low to moderate height; outline straight. Spiral whorls strongly tuberculate. Body whorl with weak spiral ribs above base. Aperture moderately wide; outer lip thick, sharp, straight.

Ground colour white, entire shell tinged with violet. Body whorl with fine network of dark brown reddish brown lines outlining small white tents, with two dark brown or black spiral bands on each side of the centre. Spire low. Aperture white to pale violet, interior deep yellow.

Distribution. *Conus araneosus* was reported from the Coromandel Coast ([Lightfoot] 1786). Mawe (1823) recorded it from Tranquebar (as '*C. arachanoideus*'). Subsequent records were made from Pamban (Satyamurti 1952; Sundaram 1969), Pamban, Mandapam and Vedhalai (Natarajan 1957) and Mandapam and Tuticorin (Kohn 1978). Museum specimens (in ANSP) from Hare Island were reported by Kohn (1978).

The specimens described herein were collected from Gulf of Mannar (Table 6) by trawling in 10–30 m and diving in 5–10 m on limestone and sandy substrates.

Remarks. In this survey, we have not observed any specimens of *C. araneosus* from the Northern and Palk Bay regions. Thus, the northward extension of this species from Gulf of Mannar remains to be verified. The high abundance of this species compared to other gastropods at Oolakuda, Rameswaram, has earned a name 'Oolakuda vallapoo' (also see Vallapoo in Introduction) by the local fishermen. Three albino specimens were collected from Tuticorin and their characteristic radular teeth confirmed identification. This species is usually heavily infested with the sessile barnacle *Balanus amaryllis* Darwin (Figure 62H). One malformed specimen was collected from Vellapatti (Figure 62I) with elevated stepped spire, running one-fourth of the total shell length (102 mm).

6. *Conus arenatus* Hwass in Bruguière, 1792 (Figure 7)

Conus arenatus Hwass in Bruguière, 1792: 621–622, no. 16 (lectotype, MHNG (35.5 x 19.5 mm) (Kohn 1968); "des Isles Philippines").
Cucullus arenosus Röding, 1798: 40, no. 494 (representation of lectotype, Martini 1773: pl. 63, fig. 696 (Kohn 1975); locality unknown).
Cucullus stercusmuscarum Röding, 1798: 40, no. 495 (representation of lectotype, Martini 1773: pl. 63, fig. 697 (25 x 13 mm) (Kohn 1975); locality unknown).
Conus arenatus var. *punctisminutissimus* Lamarck, 1822: 452, no. 18b.
Conus arenatus var. *granulosa* Lamarck, 1822: 452, no. 18c.
Conus arenatus var. *mesokatharos* Tryon, 1883: 18, pl. 27, fig. 2 (holotype, NMWC (28 x 15 mm) (Röckel *et al.* 1995); locality unknown).
Conus aequipunctata Dautzenberg, 1937: 31, pl. 1, fig. 2 (holotype, IRSN (55 x 32 mm) (Röckel *et al.* 1995); "the Red Sea coast at Jiddah (Saudi Arabia)").
Conus arenatus var. *undata* Dautzenberg, 1937: 31, pl. 1, fig. 3 ("Amboine").
Conus arenatus var. *granulosa* Dautzenberg, 1937: 32, pl. 1, fig. 4 ("Amboine").
Conus arenatus bizona Coomans, 1981: 16–18, figs. 98, 131 (holotype, ZMA (35 x 20 mm) (Röckel *et al.* 1995); "Malindi, Kenya").

Material examined: MBMCS 106, 8 specimens, SL 25–42 mm; SW 12–18 mm.

Description. Shell medium sized to large, moderately solid to moderately heavy. Body whorl ventricosely conical, outline convex. Siphonal fasciole distinct, occasionally separated from basal zone by an incision. Shoulder rounded, indistinctly tuberculate. Spire low, outline moderately convex. Body whorl with weak spiral ribs at base, ribs granulose and extend to shoulder in small shells. Aperture narrow posteriorly, wide anteriorly; outer lip thick, convex.

Ground colour white. Body whorl with spiral rows of widely spaced brown dots, clustered in two interrupted spiral bands, and one above centre and the other near the base; dotted areas often with underlying grey shadows, most conspicuous within spiral bands. White dashes often irregularly alternating with brown dots. Early spire whorls white. Spire with radial clusters of brown dots. Aperture white.

Distribution. Kohn (1978) reported two museum specimens of *C. arenatus*, one from Tuticorin (at BMNH) and another labeled "Bombay" (at NMW).

The specimens described herein were collected from Pamban (Table 6) by trawling in 10–40 m.

Remarks. The last whorl has widely spaced dark brown dots, as opposed to narrowly spaced dots reported by Kohn (1978).

7. *Conus asiaticus* da Motta, 1985 (Figure 8)

Conus asiaticus da Motta, 1985a: 25 (holotype, MHNG (41.5 x 19 mm) (Röckel *et al.* 1995); "off Tai-chung, Straight of Taiwan, East China Sea").

Conus lovellreevei, Massilia, 1993: 3–6, pl. 1, figs. 4, 5 (holotype, BMNH (42.5 x 19.5 mm) (Röckel *et al.* 1995); "off Madras, South East India").

Material examined: MBMCS 107, 12 specimens, SL 35–50 mm; SW 16–22 mm.

Description. Shell medium sized, moderately solid. Body whorl conical; outline convex adapically; left side slightly concave near base. Shoulder angulate, weakly granulose. Spire of moderate height, outline concave. Body whorl with strong, with prominent widely spaced spiral ribs and ribbons, strongly granulose.

Ground colour white. Body whorl overlaid with yellowish brown irregular axial streaks and blotches arranged in two spiral bands. Early postnuclear sutural ramps white to pale brownish. Aperture white. Periostracum brown, thin and translucent.

Distribution. Massilia (1993) reported a specimen of *C. asiaticus* (as '*C. lovellreevei*') from Madras.

The specimens described herein were collected from Vembar (Table 6) by trawling in 5–15 m, mainly on the sandy bottoms.

Remarks. Some specimens of *C. asiaticus* appear similar to *C. inscriptus*. However, *C. asiaticus* can be distinguished from the latter by the irregular yellowish brown axial streaks and blotches on its body whorl, while *C. inscriptus* has regular spirals of both brown dots and dashes or sometimes either dots or blotches.

Massilia (1993) has reported a specimen of *C. lovellreevei* from the southeast coast of India. There have been no records in the literature on the distribution of *C. asiaticus* from India. The geographical range of *C. asiaticus* is given as "Japan to Philippines and Vietnam; Queensland" and for *C. lovellreevei*: "off Madras, India" (Röckel *et al.* 1995). The specimen described above collected from Vembar has the characteristic features of *C. asiaticus* thus disproves the statement of Röckel *et al.* (1995) that 'because of their disjunct geographical ranges, the slight differences in shell morphology between *C. asiaticus* and *C. lovellreevei* justify separation'. The specimen presently collected extends the distribution of *C. asiaticus* to southeast India.

8. *Conus augur* [Lightfoot], 1786 (Figure 9)

Conus augur [Lightfoot], 1786: 44, no. 1046 (representation of lectotype, Knorr 1772: pl.13, fig. 6 (51 x 27 mm) (Kohn

1964); "Ceylon").

Conus punctatus Gmelin, 1791: 3389, no. 40.

Conus augur Hwass in Bruguière, 1792: 685–686, no. 74 ("Isle de Ceylan").

Cucullus magus Röding, 1798: 49, no. 624 (representation of lectotype, Martini 1773: pl. 58, fig. 641 (41 x 22 mm) (Kohn 1975); locality unknown).

Cucullus pulverulentus Röding, 1798: 44, no. 556 (same as lectotype of *C. magus* (Kohn 1975); locality unknown).

Material examined: MBMCS 108, 6 specimens, SL 36–50 mm; SW 16–24 mm.

Description. Shell medium sized to large, solid to heavy. Body whorl broadly conical; the sides nearly straight. Shoulder sub-angulate; weakly tuberculate. Spire of moderate height; outline moderately convex. Body whorl with weak spiral ribs at base, ribs granulose in large specimens.

Ground colour white to pale yellow. Body whorl with numerous spiral rows of fine reddish brown dots from base to shoulder, with two interrupted reddish brown transverse bands on either side of the centre. The posterior band extends irregularly towards the shoulder. Aperture white, outer lip thick.

Distribution. Kohn (2001) reported *C. augur* without giving precise locality data.

The specimens reported herein were collected from Yerwadi, Keelakarai and Vembar (Table 6) by trawling in 8–15 m.

Remarks. *Conus augur* is presumed to inhabit sand substrates. It appears to be rare on the TamilNadu Coast.

9. *Conus aulicus* Linnaeus, 1758 (Figure 10)

Conus aulicus Linnaeus, 1758: 717, no. 279 (lectotype, MSNP (91 x 36 mm) (Kohn 1963); "Asia" corrected to Moluccas, "Indonesia").

Conus auratus Hwass in Bruguière, 1792: 740–741, no. 134 (lectotype, MHNG (106 x 49 mm) (Kohn 1968); "Océan Indien").

Cucullus aurifer Röding, 1798: 49, no. 634 (representation of lectotype, Knorr 1768: pl. 19, fig. 1 (84 x 33 mm) (Kohn 1975); locality unknown).

Conus particolor Perry, 1810: pl. 39 (representation of holotype, Perry 1810: pl. 39 (119 x 49 mm) (Rockel *et al.* 1995); locality unknown).

Conus gracianus da Motta & Blocher, 1982: 16–17, figs. 15a, b (holotype, MHNG (44 x 15 mm) (Röckel *et al.* 1995); "at the fringes of the Grand Recif towards the open sea of Tulear, South West Madagascar").

Conus aulicus var. *aurantia* "Lamarck" Dautzenberg, 1937: 36 (representation of lectotype, n Knorr 1764: pl. 1, fig. 1 (64 x 27 mm) (Coomans *et al.* 1981); locality unknown).

Conus aulicus propenudus Melvill, 1900: 310 (holotype, NMWC (88 x 40 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS 109, 2 specimens, SL 110–148 mm; SW 52–74 mm.

Description. Shell moderately solid to heavy. Body whorl broadly fusiform, outline straight. Shoulder rounded. Spire of moderate height; outline straight. Body whorl with fine, closely spaced spiral ribs on basal fourth to third. Aperture wider at base; outer lip thick.

Ground colour white. Body whorl with irregular reddish brown and tan blotches separated by large white tents that tend to form three spiral bands, one below the shoulder, one at centre and one above the base. Aperture yellowish pink; outer lip creamy yellow.

Distribution. Röckel *et al.* (1995) reported *C. aulicus* from Rameswaram.

The specimens reported herein were collected from Keelakarai (Table 6) by trawling in 20–50 m and diving in 12 m on coral rubble substratum.

Remarks. The occurrence of living specimens at shallow depths agrees with Kohn's (2001) observation. Of the two specimens collected, one was larger (148 mm) than previous reported specimen (99 mm) from Rameswaram (Röckel *et al.* 1995).

10. *Conus australis* Holten, 1802 (Figure 11)

Conus australis Holten, 1802: 39, no. 87 (representation of lectotype, Chemnitz 1795: pl. 183, figs. 1774, 1775 (60 x 24 mm) (Kohn 1981); "Taiwan").

Conus australis Lamarck, 1810: 439, no. 179 (representation of lectotype, Chemnitz 1795: pl. 183, figs. 1774, 1775 (60 x 24 mm) (Kohn 1981); "Botany Bay, Australie").

Conus gracilis Sowerby I, 1823: pl. 267, fig. 4 (representation of holotype, Sowerby I 1823: pl. 267, fig. 4 (72 x 25 mm) (Röckel *et al.* 1995); locality unknown).

Conus duplicatus Sowerby I, 1823: pl. 267, fig. 5 (representation of holotype, Sowerby I 1823: pl. 267, fig. 5 (68 x 30 mm) (Röckel *et al.* 1995); "Solomon Is").

Asprella alabasteroides Shikama, 1963: 65, pl. 1, figs. 9a, b ("Tatsugahama. Wakayama Pref").

Conus cebuganus da Motta & Martin, 1982: 1, 3, fig. 1 (holotype, MHNG (36 x 14.5 mm) (Röckel *et al.* 1995); "Visayan Sea, between Malapascua Is. and Bantayan Is. and northward").

Conus gabryae Röckel & Korn, 1992: 13–16, pl. 2, figs. 11–20 (holotype, SMNS (62.5 x 26 mm) (Röckel *et al.* 1995); "Russell Is., Solomon Archipelago").

Material examined: MBMCS 110, 1 specimen, SL 40 mm; SW 15 mm.

Description. Shell moderately large to large, moderately solid-to-solid, with low gloss. Body whorl narrowly conoid-cylindrical, outline convex adapically straight below. Shoulder subangulate. Spire of moderate height; sharply pointed, outline slightly concave. Body whorl encircled with variably spaced granulate ribs, posteriorly obsolete. Aperture moderately wide, outer lip straight, thin, sloping below level of shoulder.

Ground colour white, suffused with pale brown. Body whorl with brown blotches, tending to form 3 interrupted spiral bands, below the shoulder and above and below centre, the former weakest. Most have many rows of widely spaced squarish brown dots on the spiral ribs. Aperture pale violet.

Distribution. Smith (1894) reported three specimens from the west coast off Calicut. Specimens from Tranquebar dredged by the *Galathea* Expedition are in ZMUC (Kohn 1978).

The specimens described herein were collected from Palayar (Table 6) by trawling in 60 m, mainly of muddy bottom.

Remarks. *Conus australis* appears to be a rare species along TamilNadu Coast. The specimen presently collected is the second record from India.

11. *Conus bayani* Jousseaume, 1872 (Figure 12)

Conus bayani Jousseaume, 1872: 200–202, pl. 18, fig. 1 (holotype, BMNH (51 x 24 mm) (Röckel *et al.* 1995); "Bourbon").

Material examined: MBMCS 111, 42 specimens, SL 43–72 mm; SW 20–36 mm.

Description. Shell medium sized to moderately large, moderately solid. Body whorl conical; outline straight to slightly sigmoid. Shoulder broad and carinate. Body whorl with distinct or weak spiral ribs and ribbons at base separated by fine grooves. Spire of moderate height, extremely concave and sharply pointed. Aperture generally narrow; outer lip straight, sharp, thin and fragile.

Ground colour white to pinkish or cream. Body whorl variously covered with deep yellowish-brown blotches and streaks; these tend to form two broad broken spiral bands above and below centre. Some specimens have traces of an additional interrupted spiral band below the shoulder. Spire whorls with scattered blotches of brown. Aperture white, with violet tone. Periostracum brown, thin and translucent.

Distribution. Melvill & Standen (1901) reported several dead specimens off Bombay (west coast). Along the east coast, Kohn (1978) reported *C. bayani* specimens obtained from fishing-boats off Madras and specimens deposited in AMNH. Röckel *et al.* (1995) reported this species from Madras and Cuddalore.

We collected specimens from northern region (Table 6) by trawling in 5–50 m.

Remarks. *Conus bayani* is comparatively abundant at Periyakuppam and occurs frequently with *C. amadis*, *C. monile* and *C. betulinus*. The limited distribution of *C. bayani* to the Northern region could be due to its preference for sand bottoms. Kohn (2001) considered *C. bayani* as a deep-water species. However, at Periyakuppam, this species was found at depths <15 m. Specimens collected at Periyakuppam are larger (72 mm) in shell length than those reported (65 mm) by Röckel *et al.* (1995).

12. *Conus bengalensis* (Okutani, 1968) (Figure 13)

Darioconus bengalensis Okutani, 1968: 66–69, pl. 7, fig. 2 (holotype, NSMT (97 x 31 mm) (Röckel *et al.* 1995); "The Bay of Bengal").

Material examined: MBMCS 112, 2 specimens, SL 92–112 mm; SW 46–56 mm.

Description. Shell large, solid, tall with high gloss. Body whorl narrowly conical, outline straight. Shoulder narrow, straight angled, slightly concave above and merging into spire. Spire of moderate height, stepped; outline almost straight and sharply pointed. Aperture narrow, parallel, slightly wider posteriorly, anal notch very deep, outer lip sharp, straight; slightly curved anteriorly.

Ground colour white, heavily covered with dense network of small and medium reddish-brown tents; two rows of dark reddish brown blotches, one above the centre and the other below; blotches are oval and do not tend to form complete spiral bands; blotches contain weakly defined reticulated lines and traces of fine spiral dashes. Spire with similar reddish-dark brown blotches. Spire tip pale pinkish. Aperture white.

Distribution. Okutani (1968) first reported *C. bengalensis* (Glory of Bengal) from the Bay of Bengal (as '*Darioconus bengalensis*'). Kohn (2001) stated that *C. bengalensis* was restricted to the Indian Ocean.

The specimens reported herein were collected from Mandapam and Keelakarai (Table 6) by trawling in 50–60 m and 25–30 m.

Remarks. Röckel *et al.* (1995) observed that the shells of *C. bengalensis* from southeast India differed from typical *C. bengalensis* in having a broader body whorl. However, the specimens from Gulf of Mannar had comparatively narrowly conical body whorl. *Conus bengalensis* is rare along the TamilNadu Coast.

13. *Conus betulinus* Linnaeus, 1758 (Figure 14)

Conus betulinus Linnaeus, 1758: 715, no. 266 (lectotype, LSL (101 x 67 mm) (Kohn 1963); "island of Java, Indonesia").

Cucullus medusae Röding, 1798: 43, no. 546 (representation of lectotype, Chemnitz 1788: pl. 142, fig. 1321 (73 x 43 mm); locality unknown).

Conus betulinus var. *immaculate* Dautzenberg, 1906: 54, no. 27 ("Ambodifoutra (Côte est de sainte Marie de Madagascar)").

Conus betulinus var. *alternans* Dautzenberg, 1937: 48 (representation of lectotype, Cuvier 1798: pl. 334, fig. 8 (Coomans *et al.* 1980); locality unknown).

Conus betulinus var. *tabulata* Dautzenberg, 1937: 48–49.

Conus betulinus var. *plurizonata* Dautzenberg, 1937: 49.

Conus betulinus var. *scripta* Dautzenberg, 1937: 49.

Conus betulinus var. *paucimaculata* Dautzenberg, 1937: 50 (representation of lectotype, Martini 1773: pl. 61, fig. 673); locality unknown).

Conus zulu Petuch, 1979: 19–20, figs. 28–31 (holotype, DMNH (62 x 35 mm) (Röckel *et al.* 1995); "off the mouth of the Umfolozi River, Zululand Coast, Natal, South Africa").

Material examined: MBMCS 113, 228 specimens, SL 15–148 mm; SW 09–110 mm.

Description. Solid to heavy shell, body whorl broadly pyriform, outline convex. Body whorl with about a dozen rounded and closely spaced basal spiral ridges, remainder of the whorl smooth except for fine spiral and

axial scratches and occasional random spiral ridges; often with heavy axial growth marks. Shoulder very broad, rounded, not distinct from spire; spire very low, nearly flat except for the first few whorls, forming a small projecting pointed cone. Aperture wide, nearly uniform; outer lip thick, sharp and straight. Small specimens are relatively narrower than adults and the basal ridges extend up to centre.

Body whorl uniformly creamy white, yellowish to deep orange, more strongly tinged at shoulder and base; covered with few to many spiral rows of small to large blackish spots, usually regularly spaced; spots may be large squares or rounded dots, sometimes with secondary rows of finer brown dots between. The spiral rows are often closely spaced anteriorly and more widely spaced posteriorly; spire and shoulder about same colour as body whorl; early spire whorls often spotted, later spire whorls with blotches. Aperture white; margins pale orange. Juveniles are commonly whitish instead of orange or yellow. Periostracum thick and yellowish brown. Foot and proboscis are dark brown to black.

Distribution. This species has been reported from Madras southward to Tuticorin (Melvill & Standen 1898; Crichton 1941; Gravely 1942). Specimens collected from Gopalpur and Tuticorin are in the BMNH and from Tranquebar in the ZMUC (Kohn 1978).

Conus betulinus is widely distributed from shallow inshore water to sand and sandy mud bottoms at depths of 50 m, and also in the coral reefs of the Gulf of Mannar Islands. The specimens reported herein were collected from almost all stations of the Northern and Gulf of Mannar regions (Table 6). *Conus betulinus* is landed abundantly in Mandapam compared to other stations and is always found together with *C. amadis*, *C. figulinus*, *C. suratensis* and *C. lorisii*.

Remarks. We note that *C. betulinus* is absent from Palk Bay although it occurs both north and south of there. An unidentified species of sea anemone is invariably found attached to the shells in Palayar. A specimen presently collected at Palayar (148 mm) is larger than any earlier reported from India (90 mm) (Röckel *et al.* 1995).

14. *Conus biliosus* [Röding, 1798] (Figure 15)

Cucullus biliosus Röding, 1798: 39, no. 489 (representation of lectotype, Chemnitz 1788: pl. 139, fig. 1294 (42 x 25 mm); "Gulf of Mannar, between India and Ceylon").

Conus punctatus Hwass in Bruguière, 1792: 628, no. 23 (lectotype, MHNG (54 x 33 mm) (Walls 1979); "Océan Africain").

Conus parvulus Link, 1807: 106 (representation of lectotype, Martini 1773: pl. 63, fig. 707 (20 x 12 mm); locality unknown).

Conus roseus Lamarck, 1810: 37, no. 32 (lectotype, same as that of *C. biliosus*; "Antilles").

Conus piperatus Dillwyn, 1817: 401, no. 86.

Conus concinnus Sowerby II, 1866: 329, no. 438, pl. 28, fig. 646.

Conus sapphirostoma Weinkauff, 1874: 268.

Virroconus imperator Woolacott, 1956: 72, fig. 3 (holotype, AMS (42 x 23.5 mm) (Röckel *et al.* 1995); "Trinity Bay, Queensland, Australia").

Conus biliosus meyeri Walls, 1979: 3 (holotype, DMNH (44 x 24.5 mm) (Walls 1979); "South Africa, Natal, Genezano".

Conus neoroseus da Motta, 1992: 29–30 ("Tabayas Bay, Luzon, Philippines").

Material examined: MBMCS 114, 28 specimens, SL 36–52 mm; SW 15–24 mm.

Description. Shell moderately small to large, solid, with a low gloss or dull finish; outline conical, sides straight or inflated posteriorly. Body whorl usually elongate, covered with numerous low and undulating spiral ridges from base to shoulder, ridges weaker near mid-body, below shoulder and heaviest near base; numerous axial and spiral growth threads, lines, and flaws often present, sometimes smooth. Shoulder wide, roundly angled, weakly coronated or undulate, usually slightly concave above. Spire low, bluntly pointed, sides straight to slightly concave, spire whorls distinctly coronate. Aperture moderately wide, uniform; outer lip

nearly straight, moderately thick and sharp.

Distribution. *Conus biliosus* was reported to occur from Bombay (Subrahmanyam *et al.* 1952) to Okha in Gujarat (as '*C. punctatus* Chemnitz') on the west coast (Menon *et al.* 1961). In the east coast, it has been found as far north as Vizhagapattinam (Mitchell 1867) to Madras (Melvill & Standen 1898; Röckel *et al.* 1995), Rameswaram (as '*C. piperatus* Dillwyn') and Gulf of Mannar in the South (Thurston 1890, 1895; Satyamurti 1952; Röckel *et al.* 1995).

The specimens described herein were collected from Keelakarai by diving in 15–20 m mainly on sand bottom and at Yerwadi by trawling in 10–35 m (Table 6).

Remarks. The restricted distribution of *C. biliosus* only to two stations (S-18 & S-19) is yet to be studied.

15. *Conus characteristicus* Fischer Von Waldheim, 1807 (Figure 16)

Conus characteristicus Fischer Von Waldheim, 1807: 139, no. 113–116 (representation of lectotype, Chemnitz 1795: pl. 182, fig. 1761 (40 x 27 mm) (Kohn 1981); "Java Sea").

Conus muscosus Lamarck, 1810: 281, no. 105 (holotype, MNHN (44 x 27 mm) (Röckel *et al.* 1995); locality unknown).

Conus characteristicus Dillwyn, 1817: 367, no. 26 (holotype, same as lectotype of *C. characteristicus* Fischer Von Waldheim (Röckel *et al.* 1995); the coast of the Island of St. Bartholomew").

Conus masoni Nevill & Nevill, 1874: 22, pl. 1 (holotype, BMNH (25 x 14.5 mm) (Röckel *et al.* 1995); "Andaman Islands").

Conus brevis E. A. Smith, 1877: 222–223 (Holotype, BMNH (18.5 x 11 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS 115, 48 specimens, SL 36–68 mm; SW 16–36 mm.

Description. Shell heavy, glossy, sides straight. Body whorl conical to broadly conical, outline convex below shoulder, straight towards base. Shoulder angulate to rounded. Spire nearly flat; seldom slightly elevated, early whorls form a small bluntly pointed cone. Body whorl with strong spiral ridges anteriorly, separated by wide grooves. Aperture moderately wide, uniform in width, slightly flaring anteriorly; outer lip fairly thin.

Ground colour glossy white or cream with three irregular spiral bands of broad, reddish brown blotches widely inter-spaced below shoulder and on both sides of centre. Shoulder with alternating reddish-brown and white blotches, the same pattern continued on to spire, tip of spire white. Aperture deep yellow. Periostracum yellowish brown, thin, translucent. Siphon with black band on white or pale brown ground colour.

Distribution. This species has been reported off the Andaman Islands as well as off the coast of Madras (Röckel *et al.* 1995).

The specimens described herein were collected from Pondicherry to Nagapattinam (Table 6) by trawling in 10–15 m.

Remarks. Röckel *et al.* (1995) stated that *C. characteristicus* inhabits sub-tidal to 30 m depths. Subsequently, Kohn (2001) reported this species inhabiting intertidal and shallow sub-tidal regions. We observed this species on sandy bottoms at depths of 10–15 m. One specimen collected off Periyakuppam is the largest (66 mm) in shell length recorded from the Indian coast.

16. *Conus consors* Sowerby I, 1833 (Figure 17)

Conus consors Sowerby I, 1833: pt. 36, fig. 42 (representation of lectotype, Sowerby I 1833: pt. 36, fig. 42 (62 x 34 mm) (Kohn 1992); "Singapore").

Conus anceps A. Adams, 1854: 118 (lectotype, BMNH (78 x 36 mm) (Coomans *et al.* 1980); "Moluccas").

Conus innexus A. Adams, 1854: 119 (syntype, BMNH (48 x 22 mm) (Röckel *et al.* 1995); "Natal").

Conus daullei Crosse, 1858: 119–120, pl. 2, figs. 2, 2a ("insulam Mayotte").

Conus poehlianus Sowerby III, 1887: 257, no. 474, pl. 31, figs. 682, 683 (holotype, BMNH (48 x 22 mm) (Röckel *et al.*

1995); "New Ireland".

Conus turschi da Motta, 1985b: 1–7, pl. 1, figs. 1, 2; pl. 2, fig. 4 (holotype, MHNG (82.5 x 35 mm) (Röckel *et al.* 1995); "Andaman Sea off Kantang, South West Thailand").

Material examined: MBMCS 116, 4 specimens, SL 42–66 mm; SW 25–48 mm.

Description. Shell medium sized, moderately solid to heavy. Body whorl narrowly conical; outline convex apically; with high gloss; about 10 to 12 low, rounded spiral ridges above the base separated by shallow, weakly punctuate grooves; rest of the body whorl with numerous spiral and axial threads and growth lines. Shoulder broad, rounded and narrower than body whorl immediately anterior to it. Spire moderately low, sharply pointed, sides straight. Aperture fairly wide, outer lip slightly concave in the middle.

Body whorl pale yellow with two spiral bands above and below the centre; spiral band above the centre is broader. Colour of bands ranges from yellowish brown to dark brown. Usually indistinct dark brownish axial streaks on the spiral band, spire yellowish to tan, almost with a few pale brown spots and streaks near sutures, the pattern indistinct. Aperture bluish white. Periostracum thin, transparent and brown.

Distribution. Röckel *et al.* (1995) and Kohn (2001) reported *C. consors* from India without precise locality data.

The specimens reported herein were collected from Pamban and Keelakarai (Table 6) by trawling in 20–30 m and 30–50 m.

Remarks. *Conus consors* appears to be a rare species along the TamilNadu Coast.

17. *Conus coronatus* Gmelin, 1791 (Figure 18)

Conus coronatus Gmelin, 1791: 3389, no. 39 (neotype, BMNH (27.5 x 16.5 mm) (Kohn 1966); "Australia").

Cucullus coronalis Röding, 1798: 38, nos. 478, 479 (refers to the original figure of *C. coronatus* Gmelin (Röckel *et al.* 1995); locality unknown).

Conus parvus Gebauer, 1802: 7, no. 55 (representation of lectotype, Martini 1773: pl. 63, fig. 704 (30 x 18 mm) (Kohn 1981); locality unknown).

Conus aristophanes "Duclos" Sowerby II, 1857: 9, pl. 4, figs. 81, 82 (lectotype, BMNH (35.5 x 23 mm) (Coomans *et al.* 1981); "Philippine and Sandwich Islands").

Conus minimus Linnaeus var. *condoriana* Crosse & Fisher, 1864: 334 (holotype (21 x 12 mm) acc. Crosse & Fisher (Röckel *et al.* 1995); "Poulo-Condor, in the South China Sea, off Saigon").

Material examined: MBMCS 117, 2 specimens, SL 37 mm; SW 26 mm.

Description. Shell medium sized, moderately solid. Body whorl ventricosely conical, outline slightly convex, wider near the base. Shoulder sub-angulate, weakly tuberculate. Spire of low to moderate height. Aperture wide, outer lip convex.

Ground colour pinkish to violet, with pale bluish spiral bands below shoulder and centre. Spiral bands of variously sized brown and black markings on either side of sub-central band, overlaying the two solid colour bands. Spire similar to body colour. Aperture pale grey, edges tinged dark violet.

Distribution. The occurrence of this species in the east coast was restricted to the islands of the Gulf of Mannar *viz.* Krusadai Island ([Chennappayya] 1927), Shingle Island (Satyamurti 1952), Krusadai Island and Mandapam Camp (Kohn 1978). In the west coast, Kohn (1978) collected specimens from Okha, Gujarat. He also reported museum specimens collected from Tuticorin (at BMNH) and Purnagath, Ratnagiri (at AMNH).

The specimens reported herein were collected from Keelakarai (Table 6) by diving in 12 m on sand and coral rubble and from the seaweed washed ashore.

Remarks. In concurrence with previous records, the two specimens collected in this study were found off Keelakarai, approximately 50 km west of Krusadai Island and Mandapam Camp, where the species was previously reported. *Conus coronatus* is a rare species along the TamilNadu Coast. The present and previous reports suggest the distribution of this species is restricted to the Gulf of Mannar.

18. *Conus dictator* Melvill, 1898 (Figure 19)

Conus (Leptoconus) dictator Melvill, 1898: 9–10, pl. 1, fig. 10 (holotype, BMNH (46 x 19 mm) (Röckel *et al.* 1995); "Sheikh Shuaib Island, Persian Gulf").

Material examined: MBMCS 118, 38 specimens, SL 22–46 mm; SW 08–28 mm.

Description. Shell small to medium sized, moderately light. Body whorl narrowly to broadly conical. Shoulder angulate. Spire of moderate height, outline concave. Body whorl with spiral grooves separated by ribbons on basal third to two thirds, sometimes to shoulder.

Ground colour cream. Body whorl with orange to brown axial streaks or flammules, generally fusing in three spiral bands, within the basal third, near centre and below the shoulder. Aperture white marginally, violet within; basal portion often orange.

Distribution. Röckel *et al.* (1995) reported *C. dictator* from Rameswaram, south India.

The specimens described herein were collected from Keelakarai by trawling in 10–50 m and very few from Vembar by diving in 3–8 m (Table 6). This species was found to occur along with *C. inscriptus* on sand substrates.

Remarks. *Conus dictator* may be mistaken for *C. lentiginosus*; the latter species is more convex and has a broader body whorl, with weak tuberculation on the spire whorls. Previous records revealed that *C. dictator* occurs in 15–100 m. We collected specimens within depths of 3–8 m. A specimen collected from Keelakarai of 46 mm shell length is the largest reported from Indian waters.

19. *Conus ebraeus* Linnaeus, 1758 (Figure 20)

Conus ebraeus Linnaeus, 1758: 715, no. 268 (lectotype, LSL (28 x 19 mm) (Kohn 1963); "India").

Conus quadratus Perry, 1811: pl. 24, fig. 5 (representation of holotype, Perry 1811: pl. 24, fig. 5 (40 x 25 mm) (Röckel *et al.* 1995); "Coast of Africa").

Conus judaeus Bergh, 1895: 161–163, pl. 4, fig. 91; pl. 6, figs. 128–131 (holotype, ZMUC (32 x 21 mm) (Röckel *et al.* 1995); "M. philippinense").

Material examined: MBMCS 119, 8 specimens, SL 25–32 mm; SW 13–15 mm.

Description. Shell moderately small and heavy, broadly conical, sides convex. Body whorl with low spiral ridges, basally these often extend to centre. Shoulder roundly angled, coronated, coronations weak. Spire low, convex and bluntly pointed; spire whorls weakly coronated and with 4–5 heavy spiral ridges on top. Aperture narrower posteriorly; outer lip thick, sharp and convex.

Ground colour white. Body whorl with 3–4 spiral rows of black blotches between base and sub-shoulder; blotches squarish to more or less axially elongate. Shoulder with large squarish black spots, alternating with light background; spire with irregular black blotches. Aperture bluish. Periostracum thin, smooth, translucent and yellowish to olive.

Distribution. The first report of *C. ebraeus* was by Linnaeus (1758) from India. Subsequent distributional records were from in and around Krusadai Islands of the Gulf of Mannar (Thurston 1890; [Chennappayya] 1927; Satyamurti 1952).

The specimens described herein were collected from Keelakarai (Table 6) by diving in 10–15 m on sand and coral rubble substrate and few washed ashore.

Remarks. *Conus ebraeus* appears to be a very rare species along the TamilNadu Coast, with the distribution restricted to the Gulf of Mannar.

20. *Conus eburneus* Hwass in Bruguière, 1792 (Figure 21)

Conus eburneus Hwass in Bruguière, 1792: 640–641, no. 89 (representation of lectotype, Cuvier 1798: pl. 324, fig. 1 (46 x 30 mm) (Kohn 1968); "aux mers des Indes orientales").

Cucullus quadratulus Röding, 1798: 41, no. 512 (representation of lectotype, Martini 1773: pl. 61, fig. 670 (45 x 24 mm) (Kohn 1975); locality unknown).

Conus alternatus Link, 1807: 101–102 (lectotype same as of *C. quadratulus* Röding (Kohn 1981); locality unknown).

Conus crassus Sowerby II, 1858: 25, no. 203, pl. 12, figs. 254, 255 (lectotype, BMNH (44 x 29 mm) (Walls 1979); "Feejee Islands").

Conus eburneus var. *polyglotta* Weinkauff, 1874: 244 ("Pelew Ins., Gesellsch.-Ins. ").

Material examined: MBMCS 120, 2 specimens, SL 40 mm; SW 25 mm.

Description. Shell medium sized, moderately solid with high gloss. Body whorl conical, outline convex at sub-shoulder and straight below. Base truncate. Shoulder rounded. Spire low, pointed and sides straight; spire whorls flat. Body whorl with numerous weak spiral ribs and ribbons on basal fourth to half. Aperture narrow, slightly wider at base, outer lip thin and sharp.

Ground colour white, body whorl with spiral rows of large, variably spaced reddish-brown squarish spots and rectangular bars of various sizes; four light-yellow bands underlie spiral rows of spots below the shoulder, on both sides of centre and on the base. Shoulder with regular oblique brown spots, extending on to last spire whorl; other spire whorls with regular reddish-brown spots; tip of spire white. Aperture white.

Distribution. Kohn (1978) reported museum specimens of *C. eburneus* collected from Tuticorin (at BMNH) and Tranquebar (at ZMUC) by Winckworth.

The specimens described herein were collected from Tuticorin (Table 6) from the trash discarded at the fishing harbour. The depth and substratum informations are thus not known.

Remarks. After Winckworth's collection, this is the second report of *C. eburneus* from India.

21. *Conus eucoronatus* Sowerby III, 1903 (Figure 22)

Conus eucoronatus Sowerby III, 1903: 217, pl. 3, fig. 9 (lectotype, SAMC (45 x 25 mm) (Coomans *et al.* 1986); "Cape St. Blaize bearing N. 850 W.; distant 4 ½ miles").

Material examined: MBMCS 121, 2 specimens, SL 32–35 mm; SW 18–20 mm.

Description. Shell moderately heavy, biconic. Shoulder broad and angulate with many small tubercles. Spire moderately high, sharply pointed, sides straight. Body whorl with 15 broad, flat spiral ribbons from base to shoulder, axially striate. Aperture wide and uniform in width, outer lip thin and sharp.

Ground colour white, body whorl with spirally arranged dark or light brown blotches. Aperture white. Periostracum pale yellow and thin.

Distribution. Röckel *et al.* (1995) reported the occurrence of *C. eucoronatus* in south India. Kohn (2001) reported a specimen trawled at 400 m off Kanyakumari.

The specimens described herein were collected from Tuticorin (Table 6) from the discards of the fishing-boats trawled at 50–200 m.

Remarks. *Conus eucoronatus* is a rare deep water species of *Conus* known for its unique shape, sculpture and pattern (Röckel *et al.* 1995). The specimen presently collected is the largest (35 mm), compared to the previous recorded (28 mm) by Röckel *et al.* (1995) from India.

22. *Conus eximius* Reeve, 1849 (Figure 23)

Conus eximius Reeve, 1849: pl. 6, no. 256 (type, BMNH (27.5 x 15 mm) (Röckel *et al.* 1995); "Bay of Bengal to Papua New Guinea, Philippines and Taiwan").

Material examined: MBMCS 122, 27specimens, SL 35–55 mm; SW 20–36 mm.

Description. Shell medium sized, light to solid. Body whorl conical, outline slightly convex near shoulder, straight below. Shoulder angulate; spire low to high, outline concave to deeply concave; basal half of body whorl with variably spaced spiral grooves separating ribs anteriorly and a few ribbons posteriorly. Outer lip of aperture thick and nearly straight.

Ground colour white. Body whorl with broad, mostly interrupted brown spiral bands on either side of the centre; often brown axial flames extend from the posterior brown band to shoulder, sometimes additional irregularly spaced band below shoulder. Aperture white.

Distribution. Kohn (1978) first reported the occurrence of *C. eximius* in India by noting museum specimens in the AMNH and USNM, collected from Madras.

We collected specimens from Madras to Periyakuppam (Table 6) by trawling in 5 to 15 m mainly on sand bottom.

Remarks. No previous record of this species was available from the TamilNadu Coast, except that based on specimens deposited at AMNH and USNM. The specimen collected from Periyakuppam is the largest (55 mm) recorded so far in India. *Conus eximius* is generally reported as a deep-water species (Walls 1979; Röckel *et al.* 1995; Kohn 2001), but the present survey collected this species in shallow depths. This species is usually landed with *C. amadis*, *C. malacanus*, *C. bayani*, *C. monile* and other gastropods like *Xancus pyrum* Linnaeus and *Rapana bulbosa* Solander.

The specimens of *C. eximius* are morphologically similar to *C. malacanus*. However, the latter has two uninterrupted yellowish to orange bands on either side of the centre of the last whorl. Spire height and colour pattern of last whorl of *C. eximius* varied considerably.

23. *Conus figulinus* Linnaeus, 1758 (Figure 24)

Conus figulinus Linnaeus, 1758: 715, no. 267 (lectotype, LSL (65 x 42 mm) (Kohn 1963); locality unknown).

Cucullus buxeus Röding, 1798: 42, no. 530 (representation of lectotype, Martini 1773: pl. 59, fig. 656 (57 x 37 mm) (Kohn 1975); "Amboine").

Conus figulinus violascens Barros e Cunha, 1933: 37–38 (two syntypes, MZUC (SL 48 and 42 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS 123, 142 specimens, SL 22–84 mm; SW 14–46 mm.

Description. Shell medium sized to large, solid to heavy with high gloss. Body whorl ventricosely conical, posteriorly very convex with a narrow base, anterior third to quarter of body whorl with variable spiral ridges, these sometimes heavy or weak; rest of body whorl smooth, except for numerous axial threads and growth marks; shoulder rounded, flat or slightly convex above; spire very low or flat, early whorls form a small sharply pointed cone in the middle. Aperture wide, slightly flaring anteriorly; outer lip thick.

Body whorl grey to dark tan, usually densely covered with narrow uninterrupted dark brown spiral lines; top of shoulder and spire usually dark brown, contrasting with body whorl colouration. Interior of aperture bluish white to pale bluish. Siphon and foot black.

Distribution. Mitchell (1867) and Frauenfeld (1869) first reported *C. figulinus* from Madras. Subsequent records along the east coast are from Tuticorin (Thurston 1895), Pamban (Sundaram 1969) and Rameswaram (Röckel *et al.* 1995). Along the west coast, Subrahmanyam *et al.* (1952) recorded specimens from Bombay. Museum specimens were reported by Kohn (1978) from Bombay (at ANSP), Travancore (at ZMS) and Malabar (at NMW).

The specimens described herein were collected by trawling in 5–50 m. This species was widely distributed in almost all stations of the northern region and found abundant in the Gulf of Mannar (Table 6).

Remarks. *Conus figulinus* is often mistaken for *C. leroisii* because of its similar shape, especially if the periostracum is intact. However, the absence of distinct brown spiral lines on the last whorl of *C. leroisii* dis-

tinguishes it from *C. figulinus*. In addition, *C. lorioisii* and *C. lorioisii* f. *insignis* do have similar shape and differ only in the colour pattern. The body whorl of *C. lorioisii* f. *insignis* has more closely spaced blackish brown spiral lines from base to shoulder than *C. figulinus*. There are several views in assigning *C. lorioisii*, *C. figulinus* and form *insignis* to a valid species / subspecies level (Walls 1979; Coomans *et al.* 1979b; Tucker 1984; Richard 1990; Röckel *et al.* 1995). Richard (1990) assigned form *insignis* to *C. lorioisii* and declared *C. lorioisii* as a valid species. Recently, Röckel *et al.* (1995) have clearly analysed earlier literatures as well the morphological characters and defined that *C. figulinus* and *C. lorioisii* as distinct species. Also they have assigned form *insignis* to *C. lorioisii*. We agree and have followed Röckel *et al.* (1995).

Conus figulinus is often landed with *C. betulinus*, *C. lorioisii* and other gastropods such as turrids, *Xancus pyrum* Linnaeus, *Hemifusus pugilinus* Born, and *Babylonia spirata* Linnaeus.

Previous records suggested *C. figulinus* is a shallow water species, but we observed this species to occur in both deep and shallow fine sand and algal bottoms. A large population of this species was observed around the sea grass bottoms of Oodai (Mandapam) indicating a specific preference.

Living *C. figulinus*, *C. monile* and *C. lorioisii* are found with sea anemones on their shell surface (Figure 62J, K & L).

24. *Conus frigidus* Reeve, 1848 (Figure 25)

Conus frigidus Reeve, 1848: pl. 3, no. 284 (type, BMNH (26 x 15 mm) (Röckel *et al.* 1995); locality unknown).

Conus maltzanianus Weinkauff, 1873: 204–205, pl. 32, figs. 3–6 (two syntypes, LMD (51 x 29; 41.5 x 23 mm) (Röckel *et al.* 1995); "Tahiti und andere Südsee-Inseln").

Material examined: MBMCS 124, 14 specimens, SL 38–42 mm; SW 15–20 mm.

Description. Shell small to medium sized, solid. Body whorl conical; outline almost straight. Shoulders sub-angulate; spire of moderate height, outline straight. Body whorl usually with variably spaced generally granulate spiral ribs from base to centre or shoulder, surface seldom smooth.

Shell tan, with paler transverse bands at shoulder and centre, base violet. Aperture purple. Exterior colour band visible as a band along interior border of lip. Periostracum yellowish brown, thick, opaque with numerous axial ridges.

Distribution. Kohn (1978) first reported *C. frigidus* from India with precise locality data. He has also reported museum specimens collected from Dwarka, Gujarat (at ZSI) and Tuticorin (at BMNH).

The specimens reported herein were collected from Keelakarai (Table 6) by diving in 3–8 m on sand bottom around rock boulders and within rock crevices and by trawling in 10–30 m.

Remarks. The previous record by Kohn (1978) and the present observations of this species at Keelakarai suggests that its distribution is limited to the Gulf of Mannar. This is the second record of *C. frigidus* from the east coast and the largest (38 mm).

25. *Conus geographus* Linnaeus, 1758 (Figure 26)

Conus geographus Linnaeus, 1758: 718 (lectotype, LSL (98 x 48 mm) (Röckel *et al.* 1995); "Indiis").

Material examined: MBMCS 125, 18 specimens, SL 60–120 mm; SW 28–48 mm.

Description. Shell thin, large and light in weight, but solid. Body whorl narrowly cylindrical; outline nearly straight or slightly convex above and nearly parallel centrally, slightly concave to convex (right side) or concave (left side) below. Body whorl with a few, very low and indistinct oblique ridges on the base, numerous axial threads over body whorl. Shoulder angulate with low, rounded coronations. Spire low, sides con-

cave, the whorls stepped and with raised margins. Aperture wider at base than near shoulder, outer lip thin, sharp and convex.

Body whorl creamy white, pinkish or bluish white, heavily covered with a reticulated network of fine brownish lines from base to shoulder; reticulations may be distinct or broken appearing mottled; usually two to three broad spiral bands within basal third, above centre and often below shoulder (invariably few specimens showed slight variation in the intensity of the colour pattern of the body whorl). Spire colour like body whorl with large brownish blotches at the margins of the coronations; early whorls pink. Interior of aperture bluish white to pale pinkish, exterior pattern showing through. Periostracum thin, smooth translucent, yellowish-orange.

Distribution. The first report of *C. geographus* was from Tuticorin (Thurston 1895). Subsequent records are from Krusadai Island (Satyamurti 1952) and Rameswaram (Sundaram 1969). Kohn (1978) reported a museum specimen collected from Tuticorin (at MGM). He also stated that the distribution of this species in India is probably restricted to the Gulf of Mannar and Palk Bay.

The specimens from described herein were collected from Gulf of Mannar (Table 6) by trawling in 15–30 m.

Remarks. One of the specimens of *C. geographus* collected from Pamban resembles *C. fragilissimus*, comparatively thinner and with sharp outer lip compared to other specimens (Figure 62M). The restricted distribution of this species to the Gulf of Mannar could be due to its preference for corals and sand bottoms with appropriate prey organisms.

26. *Conus gubernator* Hwass in Bruguière, 1792 (Figure 27)

Conus gubernator Hwass in Bruguière, 1792: 727–728, no. 121 (lectotype, MHNG (76 x 34 mm) (Kohn 1968); "Ocean asiatique").

Conus terminus Lamarck, 1810: 426, no. 141 (representation of holotype, Kiener 1845: pl. 48, fig. 1d (83 x 32 mm) (Röckel *et al.* 1995); "Ocean asiatique").

Conus leehmani Röckel & da Motta, 1979: 17–18 (holotype, MHNG (65.5 x 34 mm) (Röckel *et al.* 1995); "Maldives Is., Indian Ocean").

Conus veillardii da Motta, 1990: 44–46 (holotype, MHNG (52.5 x 25.5 mm) (Röckel *et al.* 1995); "Glorieuses Islands, 11.30 S 47.20 E, western Indian Ocean").

Material examined: MBMCS 126, 1 specimen, SL 43 mm; SW 18 mm.

Description. Shell moderately large, solid to moderately heavy, glossy. Body whorl ventricosely conical; outline slightly convex adapically, straight below. Shoulder angulate. Spire of moderate height, bluntly pointed; outline slightly convex. Body whorl with several shallow spiral grooves on basal fourth to third, rest of the whorl smooth. Aperture uniformly wide, outer lip thin, sharp, straight.

Ground colour white suffused with light brown. Body whorl with separated blackish-brown axial markings; variable in shape and size, ranging from irregular flecks to large, zig-zag flames. Early spire whorls pinkish. Aperture white.

Distribution. Melvill & Standen (1898) first reported *C. gubernator* from the Indian Coast. Satyamurti (1952) reported it from Pamban. Kohn (1978) reported specimens of *C. gubernator* deposited in BMNH and NMW.

The specimen described herein was collected from the Pamban shore (Table 6). The exact depth is not known.

Remarks. *Conus gubernator* appears to be a rare species along the TamilNadu Coast.

27. *Conus hyaena* Hwass in Bruguière, 1792 (Figure 28)

Conus hyaena Hwass in Bruguière, 1792: 656–657, no. 55 (lectotype, MHNG (61 x 33.5 mm) (Kohn 1968); "la côte ouest de l' Arique").

Conus unicolor Sowerby I, 1834: pl. 54, fig. 59 (lectotype, BMNH (46 x 23.5 mm) (Kohn 1992); locality unknown).

Conus concolor Sowerby II, 1841: pls. 177–184 ("Solomon Islands").

Conus mutabilis Reeve, 1844: pl. 45, nos. 249 (syntype, BMNH (29 x 16.5 mm) (Röckel *et al.* 1995); locality unknown).

Conus tribunus Crosse, 1865: 312–313, pl. 10, fig. 2 ("California").

Conus kobelti Löbbecke, 1882: 189–190, pl. 10, figs. 4, 5 (holotype, LMD (42 x 23 mm) (Röckel *et al.* 1995); locality unknown).

Conus halli da Motta, 1983: 3, figs. 2, 6 (holotype, MHNG (53 x 28 mm) (Röckel *et al.* 1995); "Pasir Putih, about 180 kilometers east of Surabaya, Java, Indonesia").

Material examined: MBMCS 127, 16 specimens, SL 36–68 mm; SW 17–32 mm.

Description. Shell medium to moderately large, moderately solid-to-solid. Body whorl conical, upper sides convex near shoulder, less so or conical below, left side concave near base; shoulder angulate to rounded. Spire of low to moderate height, outline straight to slightly convex. Aperture uniformly wide; outer lip sharp evenly convex.

Body whorl dull white to yellow, heavily covered with broad reddish brown to dark brown streaks, usually a paler mid-body area visible through streaks; spire and shoulder dirty white to brown, heavily covered with curved light brown lines and blotches, about the same colour as the body whorl. Aperture bluish white. Periostracum thick, brown to dark brown in colour.

Distribution. Abercrombie (1893) and Melvill & Abercrombie (1893) first reported *C. hyaena* (as '*C. mutabilis* Reeve') from Bombay along the west coast. Subsequent records are from Madras (Melvill & Standen 1898) on the east coast and from Goa and Panjim on the west coast (Melvill & Standen 1901). Röckel *et al.* (1995) reported specimens from the east (Madras & Keelakarai) and west coasts (Bombay).

The specimens reported herein were collected from Keelakarai (Table 6) by trawling in 20–50 m. We have also collected 42 specimens from Colaba, Bombay, in sandy intertidal regions and buried in sand around rock boulders and in rock crevices. Kohn (1978) has also made similar observations of this species from Bombay.

Remarks. The specimens classified as *C. mutabilis* Reeve (Kohn 1978) is now considered a junior synonym of *C. hyaena* Hwass (Kohn 2001). A large population of this species was found in Bombay. A detailed study of the population attributes of *C. hyaena* would be of interest given that the habitats of these two populations are different and also for their discontinuous distribution between the west and east coasts of India.

28. *Conus imperialis* Linnaeus, 1758 (Figure 29)

Conus imperialis Linnaeus, 1758: 712, no. 251 (lectotype, LSL (65 x 37 mm) (Walls 1979); locality unknown).

Conus fuscatus Born, 1778: 126–127, no. 1780 (lectotype, NMW (53 x 31 mm) (Kohn 1964; Walls 1979); "Mauritius").

Cucullus coronaducalis Röding, 1798: 38, no. 464 (representation of lectotype, Martini 1773: pl. 62, fig. 693 (41 x 26 mm); locality unknown).

Cucullus regius Röding, 1798: 38, no. 465 (representation of lectotype, Chemnitz 1788: pl. 139, fig. 1289 (44 x 25 mm) (Kohn 1975); locality unknown).

Conus viridulus Lamarck, 1810: 31, no. 9 (representation of type, Kiener 1845: pl. 7, fig. 1 (65 x 36 mm) (Röckel *et al.* 1995); "Océan austral").

Conus queketti E.A.Smith, 1906: 22, pl. 7, fig. 1 (holotype, BMNH (27 x 14 mm) (Röckel *et al.* 1995); "Isezela, Natal").

Conus dautzenbergi Fenaux, 1942: 2, fig. 2 ("Madagascar").

Conus douvillei Fenaux, 1942: 2–3, fig. 5 ("Madagascar").

Conus imperialis compactus Wils, 1970: 8, 12, pl. 2, fig. 7 (lectotype, ZMA (71 x 43 mm) (Coomans *et al.* 1985a); "Nosy Bé, Madagascar").

Conus imperialis nigrescens Barros e Cunha, 1933: 17, no. 9 (holotype, MZUC (66 x 39 mm) (Röckel *et al.* 1995); locality unknown).

Conus imperialis flavescens Barros e Cunha, 1933: 18, no. 10 (two syntypes, MZUC (42 x 25; 39 x 20.5 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS 128, 1 specimen, SL 48 mm; SW 24 mm.

Description. Shell moderately large, solid and glossy. Body whorl conical; outline nearly straight and tapering to a narrow base. Body whorl with several low, widely spaced spiral ridges near basal third. Shoulder wide, angulate and strongly tuberculate. Spire very low; irregularly stepped, tip rounded, blunt; outline slightly concave. Post nuclear spire whorls distinctly tuberculate. Aperture narrow slightly wider anteriorly; outer lip sharp, thick.

Ground colour white. Body whorl encircled with two brown bands variable in width, split into axial streaks and blotches. Spiral rows of alternating blackish-brown and white dashes extending from base to shoulder, rows closer near anterior. Base, siphonal fasciole and basal part of columella bluish grey suffused with brown. Spire dull white with small brownish blotches and streaks. Aperture white.

Distribution. *Conus imperialis* has not been previously reported from India.

The specimen described herein was collected from Tuticorin and Keelakarai (Table 6) by trawling in 40–80 m and 20–50 m.

29. *Conus inscriptus* Reeve, 1843 (Figure 30)

Conus inscriptus Reeve, 1843: pl. 29, no. 164 (three syntypes, BMNH (34.5 x 18; 32.5 x 17; 29 x 14.5 mm); locality unknown).

Conus kaetii Sowerby II, 1858: 34, no. 298, pl. 20, fig. 479 (two syntypes, BMNH (48.5 x 22 mm; 46 x 22 mm); "Seychelles").

Conus planiliratus Sowerby III, 1870: 255, pl. 22, fig. 1 (type, BMNH (41 x 20 mm) (Röckel *et al.* 1995); locality unknown).

Conus tegulatus Sowerby III, 1870: 256, pl. 22, fig. 12 (holotype, BMNH (19 x 9 mm); "China Seas").

Conus cuneiformis E.A. Smith, 1877: 202–204 (lectotype, BMNH (25 x 14 mm) (Coomans *et al.* 1985a); locality unknown).

Conus adenensis E. A. Smith, 1892: 401–402, pl. 33, fig. 1 (lectotype, BMNH (48 x 21.5 mm) (Coomans *et al.* 1979a); "Aden").

Conus maculospira Pilsbry, 1921: 329–330.

Conus cavailloni Fenaux, 1942: 4, fig. 12 ("Bermudes").

Conus keatiformis Shikama, 1977: 19–20, pl. 4, figs. 1a, b, pl. 5, fig. 7 (holotype, KPM (46 x 24 mm) (Röckel *et al.* 1995); "East China Sea").

Conus maculospira bangladeshianus da Motta, 1985c: 6–7, pl. 1, figs. 5a, b, 6a, b (holotype, MHNG (43 x 23 mm) (Röckel *et al.* 1995); "off the coast of Bangladesh in the Bay of Bengal, Indian Ocean").

Material examined: MBMCS 129, 315 specimens, SL 23–68 mm; SW 11–33 mm.

Description. Shell medium to moderately large, light in weight with a low gloss or dull surface. Body whorl ventricosely conical to conical, outline convex posteriorly, usually straight below tapering to a very narrow and long base. Shoulder angulate to sub-angulate. Spire of low to moderate height; outline concave to straight, most frequently straight and sometimes with stepped whorls in smaller specimens. Body whorl with widely spaced, weak to pronounced spiral grooves separated by ribbons on basal third to two thirds; anteriorly, grooves are wide, often containing spiral threads or fine ribs.

Ground colour pale brown to dark brown, sometime rusty brown. Body whorl with spiral rows of orange to dark brown dots, spots, bars or axial streaks fusing into axial flames and blotches and forming interrupted spiral bands below shoulder and within adapical and abapical thirds. Sub-shoulder band usually less prominent than anterior bands. Aperture white. Periostracum brown, thin, translucent and smooth; sometimes thicker and coarse. Almost completely white shells of *C. inscriptus* from India were described as *C. i. cuneiformis* (Röckel *et al.* 1995).

Distribution. The earliest report of *C. inscriptus* (as '*C. planiliratus* Sowerby') was by Smith (1894) off Calicut. Melvill & Standen (1901) reported this species (also as '*C. planiliratus*') from Bombay. Kohn (1978) reported museum specimens collected from Gujarat (at MCZ). Along the east coast, specimens are reported from Ratnagiri (at MCZ), Tranquebar (at ZMUC) and off Cape Comorin (at AMNH). Specimens were also obtained off Madras [as communicated by F. B. Steiner to Kohn (1978)]. Kohn (1978) obtained *C. inscriptus* specimens trawled off PortoNovo. All specimens in the above reports were collected at depths of 40–100 m.

The specimens described herein were collected by trawling in 15–80 m at major fish landing centers of the TamilNadu Coast (Table 6). Particularly at Palayar and Cuddalore, enormous quantities (approximately more than half a tonne per week) of *C. inscriptus* were landed as by-catch from the fishing-boats that trawl for shrimp (*Penaeus monodon* Fabricius).

Remarks. We obtained albino specimens of *C. i. cuneiformis* from Vembar (Figure 62N). The large quantity of *C. inscriptus* around Palayar and Cuddalore suggest that this species prefers sandy-mud and muddy substrates. *Conus lorisii* and turrid species are always found associated with *C. inscriptus*.

30. *Conus lentiginosus* Reeve, 1844 (Figure 31)

Conus lentiginosus Reeve, 1843: pl. 44, no. 245 (syntype, BMNH (29 x 16 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS 130, 16 specimens, SL 32–36 mm; SW 16–18 mm.

Description. Shell moderately small to medium-sized, light to solid, glossy. Body whorl conical; outline convex at adapical two-thirds to three-fourths, straight or concave below; left side consistently sigmoid, right side almost straight. Shoulder angulate. Spire of moderate height, outline concave or sigmoid. Body whorl with axially striate spiral grooves on basal third, separated by ribs anteriorly and by ribbons posteriorly.

Ground colour white, variably tinged with violet. Body whorl with confluent brown axial flames, generally arranged in three spiral bands, below shoulder, near centre and within basal third. Spiral rows of brown dots and dashes extend from base to shoulder, varying in number and arrangement. Aperture white, tinged with violet deep within. Periostracum thin, brown, smooth and translucent.

Distribution. The first record of this species from India was by Reeve (1843). Subsequent records (Abercrombie 1893; Melvill & Abercrombie 1893; Melvill & Standen 1901; Hornell & Tomlin 1951; Subrahmanyam *et al.* 1952) reported this species off Bombay (west coast). Along the east coast, Kohn (1978) referred to specimens in the AMNH and BMNH from the Gulf of Mannar and also reported one specimen of *C. lentiginosus* deposited in the ZSI as dredged off Vizhagapattinam.

The specimens described herein were collected from Keelakarai (Table 6) by trawling in 10–20 m and diving in 8–10 m and from Vembar (Table 6) by trawling in 10–30 m.

Remarks. The restricted distribution of this species in the Gulf of Mannar and the particular abundance at Keelakarai (S-19) indicate that they probably prefer sandy bottoms and rock crevices similar to previous records from Vizhagapattinam. Kohn (1978) observed that specimens from east and west coasts are essentially similar except for the pinkish tan base found in the Gulf of Mannar. Such an exception was not observed in this study.

31. *Conus leopardus* Röding, 1798 (Figure 32)

Conus leopardus Röding, 1798: 41, no. 520 (representation of lectotype, Martini 1773: pl. 60, fig. 666 (78 x 43 mm) (Kohn 1975); locality unknown).

Conus millepunctatus Lamarck, 1822: 461–462, no. 45 (representation of lectotype, Cuvier 1798: pl. 323, fig. 5 (137 x 75 mm) (Walls 1979); "Océan asiatique").

Conus millepunctatus var. *aldrovandi* Dautzenberg, 1937: 171–172 representation of lectotype, Cuvier 1798: pl. 324, fig. 4 (119 x 66 mm) (Coomans *et al.* 1980); locality unknown).

Material examined: MBMCS 131, 48 specimens, SL 60–147 mm; SW 32–90 mm.

Description. Shell large and heavy. Body whorl usually conical, outline almost straight. Shoulder broad, angulate, and occasionally sub-angulate. Spire very low or flat, sometimes moderate height, outline slightly concave to slightly convex. Body whorl with weak spiral ribs above base, obsolete in larger specimens.

Ground colour white to cream, body whorl with spiral rows of rounded or squarish, reddish brown spots or sometimes short axial streaks from base to shoulder, these sometimes in alternating large and small series; shoulder and spire with many narrow revolving dark brown broader lines on white. Aperture relatively narrow, slightly wider anteriorly. Periostracum greenish-brown, smooth and very thick. Siphon ends with a black band on a white background.

Distribution. The only report of *C. leopardus* from India is that of Röckel *et al.* (1995). The specimens from Gulf of Mannar (Table 6) were collected by trawling in 9 to 40 m and from lobster cages laid at depths of 3 to 5 m.

Remarks. The restricted distribution of *C. leopardus* to the Gulf of Mannar agrees with earlier reports of its preference for vast subtidal stretches of sand and reef flats (Cernohorsky, 1964; Kohn & Nybakken 1975). We collected a large number of specimens from lobster cages at Vedhalai and Keelakarai. Fishermen engaged in diving and lobster fishing reported the occurrence of *C. leopardus* within the rocky crevices.

32. *Conus litoglyphus* Hwass in Bruguière, 1792 (Figure 33)

Conus litoglyphus Hwass in Bruguière, 1792: 692–693, no. 81 (lectotype, MHNG (52 x 29 mm) (Walls 1979); "les mers des grandes Indes").

Cucullus cinamomeus Röding, 1798: 43, no. 534 (representation of lectotype, Martini 1773: pl. 57, fig. 631 (50 x 23 mm) (Kohn 1975); locality unknown).

Cucullus orleanus Röding, 1798: 44, no. 558 (representation of lectotype, Chemnitz 1788: pl. 140, fig. 1298 (37 x 20 mm) (Kohn 1975); locality unknown).

Conus bicolor Sowerby II, 1833: pt. 24, fig. 2 (representation of lectotype, Sowerby I 1833: pl. 24, fig. 2 (18 x 10 mm) (Röckel *et al.* 1995); locality unknown).

Conus albomaculatus Sowerby II, 1841: pls. 177–184 (representation of lectotype, Sowerby II, 1833: pl. 24, fig. 2 (17.5 x 9.5 mm); "Moluccas, Indonesia").

Conus lacinulatus Kiener, 1845: pl. 108, fig. 2.

Conus carpenteri Crosse, 1865: 302–303, pl. 9, fig. 1 (holotype, BMNH (46.5 x 25 mm); "Nova Guinea, Oceaniae").

Conus (Rhizoconus) seychellensis Nevill & Nevill, 1874: 22 (holotype, ZSI (SL 38.5 mm); "Seychelle Islands").

Conus inermis Tinker, 1952: pl. 178.

Material examined: MBMCS 132, 1 specimen, SL 46 mm; SW 24 mm.

Description. Shell medium sized, solid, glossy. Body whorl conical, outline straight. Body whorl with widely spaced, partially granulose, spiral ribs basally. Shoulder broad, sub-angulate. Spire low, sides straight, whorls flat; early whorl eroded. Aperture uniformly narrow; outer lip thin, straight.

Ground colour white. Body whorl overlaid with brownish, leaving spiral white bands at shoulder and below centre. White bands solid, irregularly interrupted by axial colour markings. Base dark brown. Spire mostly brown covered with triangular white spots, early whorls whitish. Aperture white, dark brown at base.

Distribution. Except for the report of Röckel *et al.* (1995) from the Gulf of Mannar, no previous report is available on *C. litoglyphus* from India.

The specimen described herein was collected from Mandapam (Table 6) by trawling in 10–30 m.

Remarks. This is the second record from India after the report by Röckel *et al.* (1995). Kohn (1978) considered this species as unconfirmed from India, as it was reported only once. The occurrence of this species was verified by Röckel *et al.* (1995) and added in the list of conidae of India by Kohn (2001).

33. *Conus lividus* Hwass in Bruguière, 1792 (Figure 34)

Conus lividus Hwass in Bruguière, 1792: 630–632, no. 28 (lectotype, MHNG (43 x 26 mm) (Kohn 1968); "isles Antilles").

Cucullus monachos Röding, 1792: 39, no. 490 (representation of lectotype, Martini 1773: pl. 63, fig. 694 (47 x 28 mm) (Kohn 1975); locality unknown).

Conus plebejus Link, 1807: 106 (lectotype, same as for *C. monachos* Röding).

Conus primula Reeve, 1849: pl. 6, no. 259 (type, BMNH (31 x 18 mm); locality unknown).

Material examined: MBMCS 133, 22 specimens, SL 24–48 mm; SW 12–29 mm.

Description. Shell small to moderately large, solid to heavy. Body whorl broadly conical; outline almost straight. Shoulder angulate, strongly to weakly tuberculate. Spire of low to moderate height, outline straight to slightly concave. Body whorl with variably granulose spiral ribs above base, sometimes to centre.

Body whorl olive to brownish yellow, with pale or white transverse bands at centre and below shoulder. Base dark violet-brown. Apex usually pink. Late spire whorls and shoulder white, sometimes with paler ground colour of body whorl between tubercles. Aperture deep purple-violet, behind narrow orange-brown margin, with pale band at centre and shoulder. Periostracum yellowish-brown, opaque and smooth with fine axial ridges.

Distribution. Satyamurti (1952) reported this species from Shingle Island of Gulf of Mannar. Kohn (1978) has referred to a specimen deposited in ZMUC as being obtained off Tranquebar. Röckel *et al.* (1995) reported a specimen from south India.

The specimens reported herein were collected from Gulf of Mannar (Table 6) by trawling in 10–30 m. Specimens were found to be comparatively abundant at Keelakarai.

Remarks. The distribution of *C. lividus* is restricted to the Gulf of Mannar. The occurrence of a larger number of specimens from Keelakarai may be associated with the fact that they generally inhabit the edges of the fringing reefs of the nearby coral islands.

34. *Conus longurionis* Kiener, 1845 (Figure 35)

Conus longurionis Kiener, 1845: pl. 92, fig. 6 (type, Coll. Prevost (33 x 10 mm) (Röckel *et al.* 1995); locality unknown).

Conus kantanganus da Motta, 1982: 11–12, figs. 10a, b (holotype, MHNG (33 x 10 mm) (Röckel *et al.* 1995); "off the coast of Kantang, South West Thailand in the Andaman Sea").

Material examined: MBMCS 134, 1 specimen, SL 37 mm; SW 12 mm.

Description. Shell moderately small to medium sized, light. Body whorl usually narrowly conical, outline nearly straight. Shoulder sub-angulate, exhalant notch deep. Spire high, outline almost straight. First 3–10 post nuclear whorls tuberculate and distinct, sutures deep and wide. Body whorl with regularly spaced, axial striate spiral grooves and ribbons. Aperture long, narrow and slightly wide anteriorly.

Ground colour light brown. Body whorl with spiral rows of regular large brown dots on ribbons, partly fusing into irregularly sized axial flecks that cluster into spiral bands above and below centre. A weaker spiral band around shoulder. Aperture pale lavender.

Distribution. The earliest published record of *C. longurionis* from India was from Gulf of Mannar (Thurston 1985). Subsequent records are from Madras (at AMNH) and Tranquebar (at ZMUC) (Kohn 1978).

The specimen reported herein was collected from the trash dumped on the fish-landing centre off Madras (Table 6).

Remarks. Specimens from India and West Thailand were described as *C. kantanganus* (Röckel *et al.* 1995). *C. kantanganus* and the similar shells from Thailand and Philippines cannot be separated from *C. longurionis* at the species level and are considered geographical forms (Röckel *et al.* 1995). Since the shell characters of the specimens from Madras agree well with *C. kantanganus*, it is treated as *C. longurionis*.

35. *Conus loroisii* Kiener, 1845 (Figure 36)

Conus loroisii Kiener, 1845: pl. 65, fig. 1 (types, Coll. Lorois and Coll. Boivin; "la mer de l'Inde").

Conus (*Dentroconus*) *agrestis* Morch, 1850: 16, 31, no. 405 (paratype, ZMUC (76 x 49.5 mm) (Coomans *et al.* 1979b); "Insulas Nicobaricus").

Conus huberorum da Motta, 1989: 9–11, no. 2 (holotype, MHNG (48 x 24.5 mm) (Röckel *et al.* 1995); "off the Coromandel Coast, Bay of Bengal, northward from Madras, India").

Conus figulinus var. *insignis* Dautzenberg, 1937: pl. 1, fig. 6 (type, IRSN (75 x 48 mm) (Röckel *et al.* 1995); "Amboine").

Material examined: MBMCS 135, 142 specimens, SL 30–92 mm; SW 16–56 mm.

Description. Shell medium sized to large, solid to heavy. Body whorl usually ventricosely conical; outline convex adapically, straight toward base. Shoulder subangulate to rounded. Spire low to moderate height; outline variably concave. Basal third of last whorl with variably spaced spiral grooves separating ribs and ribbons.

Ground colour grey mixed with pale blue, brown and violet in some. Colours arranged in blending spiral and axial zones. Body whorl with contrasting light narrow spiral bands at shoulder and below centre; shoulder band always present but often very narrow and inconspicuous. Solid or interrupted reddish to blackish brown lines occur infrequently on body whorl. Aperture usually white to bluish-white, sometimes reddish-brown. Periostracum brown, fairly thick, opaque with raised spiral ridges corresponding in position to the larger dark transverse lines on the shell.

Distribution. India is the type locality of *C. loroisii* (Kiener 1847). Kohn (1978) observed its occurrence from Madras to PortoNovo on the east coast. Röckel *et al.* (1995) reported its distribution from the north and south of Madras to Vizhagapattinam and Cuddalore, suggesting its occurrence only on the east coast of India. However, Kohn (1978) reported specimens of *C. loroisii* in the BMNH labeled with Bombay, west coast of India.

The specimens reported herein were collected from various stations (Table 6) of the TamilNadu Coast by trawling in 5–50 m.

Remarks. *Conus loroisii* and *C. figulinus* appear similar, and both the species are sympatric in the northern Indian Ocean and Philippines and their specific characters either coincide or overlap as described previously. The absence of further records of *C. loroisii* from India was probably due to consideration of *C. figulinus* as conspecific (Kohn 1978). Röckel *et al.* (1995) considered *C. loroisii* a distinct species.

The present study extended the distribution of this species from Vizhagapattinam down south to Tuticorin.

Several species of sea anemones are often found attached to the shells of *C. loroisii* (see Figure 62K). Kohn (1978) reported that the association of sea anemones with living *C. loroisii* was hitherto unknown. *Conus loroisii* is usually found along with *C. betulinus*, *C. figulinus* and *C. amadis* and also with other gastropods such as turrids, *Hemifusus pugilinus* Born and *Babylonia spirata* Linnaeus.

36. *Conus madagascariensis* Sowerby II, 1858 (Figure 37)

Conus madagascariensis Sowerby II, 1858: 43, sp. 371, pl. 24, fig. 582 (three syntypes, BMNH (44 x 22; 42 x 23.5; 38.5 x 20.5 mm); "Madagascar").

Material examined: MBMCS 136, 6 specimens, SL 42–68 mm; SW 18–29 mm.

Description. Shell medium sized to moderately large, moderately solid. Body whorl ventricosely conical to conoid-cylindrical; outline moderately convex at adapical third, straight below; left side often slightly concave near base. Aperture somewhat wider at base than near shoulder. Shoulder angulate. Spire low, outline slightly concave to slightly sigmoid, with a straight sided apex. Body whorl with weak spiral ridges on basal third.

Ground colour white, often variably tinged with violet, sometimes more prominently so at base. Body whorl with rather fine and regular network of dark brown lines edging numerous tiny to medium sized white tents. Overlying light brown to reddish brown spiral streaks, spots, flecks or blotches generally arranged in interrupted spiral bands on each side of centre and interspersed with spiral lines of alternating darker brown and white markings. Aperture white. Periostracum yellow, thin, translucent and smooth.

Distribution. Kohn (1978) first reported *C. madagascariensis* (as '*C. pennaceus* Born') from India, citing Hare Island, Tuticorin. He has also referred to a museum specimen (in BMNH) collected from there. *C. madagascariensis* is restricted to south India (Röckel *et al.* 1995).

The specimens reported herein were collected from Gulf of Mannar by trawling in 9–30 m around the fringe coral reef islands and a large number of specimens from Kanyakumari by trawling in 20–50 m (Table 6).

Remarks. Specimens of *C. madagascariensis* are often difficult to distinguish from *C. pennaceus*. However, the consistently straight-sided apex and rather uniformly reticulate pattern on the body whorl of *C. madagascariensis* distinguishes the latter. Although previously reported only from Tuticorin, during the three years of this survey not even a single specimen was encountered at Tuticorin.

37. *Conus malacanus* Hwass in Bruguière, 1792 (Figure 38)

Conus malacanus Hwass in Bruguière, 1792: 645, no. 43 (representation of holotype, Cuvier 1798: pl. 325, fig. 9 (53 x 31 mm) (Röckel *et al.* 1995); "Pres du détroit de Malacca").

Conus canaliculatus Dillwyn, 1817: pl. 325, fig. 9 (lectotype same as holotype of *C. malacanus* (Walls 1979); "the coasts of Ceylon, and the Nicobar Islands. Chemnitz. Straits of Malacca. Bruguière").

Conus subcarinatus Sowerby II, 1865: 518, pl. 32, figs. 12, 13 (two syntypes, BMNH (45 x 25; 40 x 23 mm); locality unknown).

Conus cuneatus Sowerby III, 1873: 146, pl. 15, fig. 5 (holotype, ZMA (33 x 20 mm) (Röckel *et al.* 1995); "Nicobar Islands").

Material examined: MBMCS 137, 81 specimens, SL 42–68 mm; SW 22–36 mm.

Description. Shell medium sized to moderately large, solid to heavy. Body whorl conical to broadly conical; outline variably convex at adapical third, straight below. Shoulder broad and carinate. Spire of low to moderate height; outline concave to straight; early whorls forming a small projecting cone. Body whorl smooth except for a few weak spiral ridges above base.

Ground colour white, body whorl usually with two variably broad continuous or interrupted brown spiral bands, leaving white zones below shoulder at centre and at base. Several widely spaced narrow axial stripes may be continuous from shoulder to base, or interrupted at mid-body. Spire and shoulder whitish, sparsely or heavily marked with brownish blotches and curved streaks, early whorls pale brown. Aperture moderately wide, uniform in width; outer lip thin, straight. Aperture white or sometimes cream. Periostracum yellow, thin, smooth and translucent.

Distribution. Gravely (1942) reported *C. malacanus* (as '*C. voluminalis* Hinds') from Madras. Kohn (1978) collected a live specimen from PortoNovo. He also reported museum specimens collected off Ennore (at Madras), Karaikal (at IRSN) and Tranquebar (at ZMUC).

The specimens described herein were collected from the Northern and Palk Bay regions (Table 6) by trawling in 8–50 m, mainly on sand and sandy-mud bottoms.

Remarks. Kohn (1978) stated that the distribution of *C. malacanus* is restricted to the east coast. In this survey we observed this species is limited to the Northern and Palk Bay regions. Its absence in the Gulf of Mannar and further south probably suggests that it is not a coral-associated species. It often occurs in the same habitat as like *C. monile*, *C. bayani*, *C. amadis* and *C. betulinus*.

38. *Conus marmoreus* Linnaeus, 1758 (Figure 39)

Conus marmoreus Linnaeus, 1758: 712, no. 250 (lectotype, LSL (51 x 28 mm) (Walls 1979); "Asia").

Cucullus proarchithalassus Röding, 1798: 38, no. 470 (representation of lectotype, Martini 1773: pl. 62, fig. 686 (56 x 33 mm) (Kohn 1975); locality unknown).

Conus maculatus Perry, 1811: pl. 24, fig. 24 (representation of holotype, Perry 1811: pl. 24, fig. 4 (76 x 45 mm) (Kohn 1986); locality unknown).

Conus marmoreus var. *granulatus* Sowerby I, 1839: pt. 155/156, fig. 120 (representation of lectotype, Sowerby I 1839: pt. 155/156, fig. 120 (30 x 17 mm) (Kohn 1992); locality unknown).

Conus crosseanus Bernardi, 1861: 168–169, pl. 6, figs. 3, 4 (lectotype, BMNH (69 x 39.5 mm) (Coomans *et al.* 1985a); "Nova Caledonia").

Conus suffusus Sowerby III, 1870: 255–256, pl. 22, fig. 9 (holotype, BMNH (55 x 33 mm); "New Caledonia").

Conus suffusus var. *noumeensis* Crosse, 1872: 155–156, pl. 16, fig. 2 (type, Coll. Marie?; "Noumea, Novae Caledoniae").

Conus pseudomarmoreus Crosse, 1875: 223–225, pl. 9, fig. 4 (holotype, MNHN (50.5 x 30 mm) (Röckel *et al.* 1995); locality unknown).

Conus crosseanus var. *lineata* Crosse, 1878: 168, pl. 3, figs. 3, 3a (type, BMNH 65 x 37 mm (Röckel *et al.* 1995); "Nova Caledonia").

Material examined: MBMCS138, 2 specimens, SL 62–85 mm; SW 30–42 mm.

Description. Shell medium sized, moderately solid to heavy. Body whorl conical, sides straight. About ten to twelve weak and closely spaced spiral ridges above the base. Body whorl with weak regularly spaced spiral ribs on basal fourth to half. Shoulder angulate, strongly tuberculate; spire low, outline straight.

Ground colour white. Body whorl with a regular network of black lines and triangular to rhomboid areas, outlining white tents that are quite uniform in shape and arrangement and usually separate from each other. In live specimen apex is purplish red. Aperture white.

Distribution. Frauenfeld (1869) first reported this species from Madras. Subsequently, Thurston (1890, 1895) and Satyamurti (1952) reported it from Pamban. Along the west coast, it was recorded from the Malabar Coast (Weinkauff, 1875).

The specimens reported herein were collected from Keelakarai and Tuticorin (Table 6) by trawling in 10–20 m, close to the fringing coral islands of the Gulf of Mannar.

Remarks. Appears to be a rare species along the Indian Coast.

39. *Conus miles* Linnaeus, 1758 (Figure 40)

Conus miles Linnaeus, 1758: 713, no. 255 (lectotype, LSL (53 x 31 mm) (Kohn 1963); "India").

Material examined: MBMCS 139, 1 specimen, SL 45 mm; SW 24 mm.

Description. Shell moderately large, solid, glossy; outline broadly conical. Shoulder angulate, broad, weakly undulate. Spire of moderate height, bluntly pointed; outline straight. Body whorl smooth except widely spaced spiral ribs on basal third and few spiral threads in between. Aperture moderately wide, uniform in width; outer lip thin and sharp.

Ground colour dull white. Body whorl with a narrower light-brown spiral band above centre, also wider deep solid brown band on basal fourth to third, remaining areas clouded with lighter brown crossed by well separated fine orange axial lines that extend to shoulder ramp. Spire white, covered with fine orange brown axial lines, early whorls badly eroded, white. Aperture translucent.

Distribution. We obtained a specimen from Pamban (Table 6) by trawling in 10–20 m.

Remarks. Linnaeus gave the type locality of this species as 'India' (Röckel *et al.* 1995) without precise locality data. This record appears to be first to give the exact locality of *C. miles* in India. This species is extremely rare along the TamilNadu Coast.

40. *Conus milneedwardsi* Jousseaume, 1894 (Figure 41)

Conus milneedwardsi Jousseaume, 1894: 99 (holotype, MNHN (46 x 14 mm) (Röckel *et al.* 1995); "Aden").

Conus (Cylinder) *clytospira* Melvill & Standen, 1899b: 461–463 (lectotype, BMNH (107 x 32 mm) (Coomans *et al.* 1985a); "Arabian Sea, about 125 miles WSW of Bombay, long. 71° 30' to 71° 45'E, lat. 18° 43'N").

Leptoconus kawamurai Habe, 1962: 117, pl. 37, fig. 15 (holotype, NSMT (80.5 x 33.5 mm) (Röckel *et al.* 1995); "Amami and Ryukyu Islands").

Conus lemuriensis Wils & Delsaerd, 1989: 105–110, figs. 1–3, 7, 12 (holotype, KBIN (110.5 x 35.5 mm) (Röckel *et al.* 1995); "Réunion Islands, La Souris Chaude").

Material examined: MBMCS140, 3 specimens, SL 85–120 mm; SW24–35 mm.

Description. Shell moderately large, thin, heavy, glossy; body whorl narrowly conical with elevated spire, about one-third of total length; bluntly pointed, with somewhat concave sides. Spire whorls strongly stepped. Depth of exhalent notch in the largest shell is about 2/5th of maximum diameter of the last whorl. Shoulder narrow, angulate; outline generally straight. Aperture narrow; slightly wider basally, upper edge of the outer lip strongly sloping below shoulder; outer lip rather thin, concave at centre.

Ground colour white. Body whorl generally with reddish brown reticulated lines forming small to large triangles and with similarly coloured triangular spots to variably shaped blotches concentrated in two spiral bands, within basal third, and just above centre. Spire whorls with large reddish brown regular blotches. Aperture white.

Distribution. Two specimens of *C. milneedwardsi* (as '*C. clytospira*') were reported from Bombay by Melvill & Standen (1899b, 1901). Kohn (1978) remarked that this species occurs around the margin of the Arabian Sea in the western Indian Ocean.

The specimens described herein were collected from Pamban and Keelakarai (Table 6) by trawling in 30–80 m. This appears to extend the distribution from the west to east coast of India.

Remarks. The shell of this species is reported to be moderately solid to solid (Walls 1979 & Röckel *et al.* 1995). All the three specimens collected in this study had relatively thin shells. Depth of exhalent notch is about 1/4 of the diameter of the last whorl. In contrast, the earlier records state that the depth ranges from 1/3 to 2/5 of the diameter.

Compared to the earlier record from Madras, east coast (102 mm) (Röckel *et al.* 1995), the present specimen collected from Keelakarai is larger (120 mm). Like *C. bengalensis* this species is also in high demand by collectors due to its rarity.

41. *Conus mitratus* Hwass in Bruguière, 1792 (Figure 42)

Conus mitratus Hwass in Bruguière, 1792: 738, no. 132 (lectotype, MHNG (43 x 15 mm) (Walls 1979); "Ocean indien").

Conus mitratus var. *pupaeformis* Sowerby III, 1870: 256, pl. 22, fig. 2 ("Mauritius").

Material examined: MBMCS 141, 1 specimen, SL 41 mm; SW 13 mm.

Description. Shell medium sized, thick, moderately light, glossy. Body whorl elongate and cylindrical. Shoulder indistinct. Spire high; outline convex, sharply pointed; earliest two to three whorls with fine nodules, later whorls with indistinct spiral ridges often bearing small granules. Body whorl with granulose spiral ribs from base to anterior half of the body whorl. Aperture narrow, slightly widened anteriorly; outer lip thick slightly convex.

Ground colour yellowish. Body whorl with dark brown, blurred axial streaks and blotches. Pattern elements fusing into a spiral band at centre and similar but narrower band above base. Apex white. Shoulder edges of early post nuclear whorls including tubercles with brown band. Aperture white, external visible through at margin.

Distribution. *Conus mitratus* has not been reported previously from India.

The specimen reported herein was collected from Tuticorin (Table 6) by trawling in 10–30 m, associated with coarse sand.

Remarks. This is an extremely rare species in India.

42. *Conus monile* Hwass in Bruguière, 1792 (Figure 43)

Conus monile Hwass in Bruguière, 1792: 646–647, no. 45 (lectotype, MHNG (70 x 36 mm) (Kohn 1968); "Ocean Asia-tique").

Cucullus cereolus Röding, 1798: 44, no. 557/67 (representation of lectotype, Chemnitz 1788: pl. 140, fig. 1301 (52 x 25 mm) (Kohn 1975); locality unknown).

Material examined: MBMCS142, 157 specimens, SL 66–120 mm; SW 35–42 mm.

Description. Shell medium to large, moderately heavy, and conical with high gloss; sides nearly straight. Body whorl conical, outline variably convex over adapical fourth to third and straight below. Body whorl with a few weak spiral ridges above the base and sometimes conspicuous axial threads. Shoulder broad, carinate to angulate, concave above. Spire of low to moderate height.

Ground colour white or cream. Body whorl suffused or spirally banded with pale orange or pink. Spiral rows of brown dots, dashes and variously shaped spots extend from base to shoulder but vary in number and arrangement, often concentrated at both sides of the centre. Sometimes dark markings fuse into axial flames or blotches. Base pale orange or brown. Aperture white. Periostracum yellowish brown, thin, translucent to opaque, smooth or with fine axial ridges.

Distribution. Gravely (1942) first reported this species from Madras. Subsequently, Hornell (1949) recorded it from India without giving precise locality data. Kohn (1978) collected two specimens trawled off PortoNovo. He also reported museum specimens dredged off Madras (at MGM) and Tuticorin (at BMNH). *Conus monile* has also been recorded from Bombay along the west coast (Subrahmanyam *et al.* 1952).

The specimens reported herein were collected from various stations (Table 6) of the TamilNadu Coast by trawling in 9–40 m, mainly on sand and sandy-mud bottoms. However, at Periyakuppam it was collected in 5–15 m.

Remarks. Although the shell shape is generally uniform, few specimens showed markedly elevated spire, and there is considerable variation in the colour pattern of the body whorl (Figure 62O). The occurrence of this species around the northern region suggests its preference for shallow sand and sandy-mud bottoms.

43. *Conus nussatella* Linnaeus, 1758 (Figure 44)

Conus nussatella Linnaeus, 1758: 716, no. 273 (lectotype, LSL (49 x 18 mm) (Kohn 1963); "Nussatello Insulam, Asiae").

Conus nussatella var. *tenuis* Sowerby I, 1834: pt. 54, fig. 62 (representation of lectotype, Sowerby I 1834: pt. 54, fig. 62 (35 x 12 mm) (Kohn 1992); "ad Insulam Annaa").

Hermes kawanishii Shikama, 1970: 26–27, pl. 1, fig. 28 (holotype, GIYU (36.5 x 13.5 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS 143, 1 specimen, SL 54 mm; SW 20 mm.

Description. Shell medium-sized, moderately solid. Body whorl narrowly cylindrical; outline straight, parallel-sided at upper two thirds. Shoulder indistinct. Spire of moderate height, outline convex. Body whorl with fine, weakly granulose spiral ribs from base to shoulder; intervening grooves spirally striate. Aperture wide at base than near shoulder; outer lip straight, sharp and thick.

Ground colour light cream with spiral rows of small dark brown spots and variably sized orange brown axial blotches coalescing axially as well as spirally, especially concentrating above and below the centre. Aperture white.

Distribution. *Conus nussatella* has been recorded from Madras (Melvill & Standen, 1898) and Shingle Island (Satyamurti 1952). Kohn (1978) collected an empty shell from Ohka and also reported one specimen in ANSP trawled off south India by fishermen.

A specimen reported herein from Tuticorin (Table 6) was collected from the trash discard. The depth and nature of substratum was not known.

Remarks. Although known to be present on both east and west coasts, this species appears to be very rare along the TamilNadu Coast.

44. *Conus pertusus* Hwass in Bruguière, 1792 (Figure 45)

Conus pertusus Hwass in Bruguière, 1792: 686–687, no. 75 (lectotype, MHNG (50.5 x 24.5 mm) (Walls 1979); "les mers des grandes Indes").

Conus amabilis Lamarck, 1810: 425, no. 137 (lectotype, MHNG (29 x 16 mm) (Kohn 1981); "Mers des grandes Indes").

Conus festivus Dillwyn, 1817: 413, no. 116 (lectotype, ZMUC (23x13 mm) (Kohn 1986); "Molucca Islands").

Material examined: MBMCS144, 3 specimens, SL 40–45 mm; SW 25–28 mm.

Description. Shell moderately small and moderately heavy with high gloss. Body whorl conical, outline convex just below shoulder, straight below. Shoulder angulate. Spire of moderate height, outline convex, apex sharp. Aperture narrow, slightly wider anteriorly; outer lip thin, sharp, and straight. Body whorl smooth except for a few weak spiral ribs at base.

Ground colour white, body whorl with orange red blotches fusing into two variably broad spiral bands on each side of the centre. Adapical and central white bands crossed by axial blotches. Aperture pale pink.

Distribution. Kohn (2001) first reported this species from India without giving precise locality data.

The specimens described herein were collected from Mandapam and Keelakarai (Table 6) by trawling in 8–20 m, around coral islands of Gulf of Mannar.

Remarks. Except Kohn (2001), no previous record of *C. pertusus* is known from India. This species is probably restricted to the Gulf of Mannar and appears to be a rare species along the TamilNadu Coast.

45. *Conus praezellens* A. Adams, 1854 (Figure 46)

Conus praezellens A. Adams, 1854: 119 (type, BMNH (35 x 15 mm); "China Seas").

Conus bicolor Sowerby I, 1833: pt. 24, fig. 2 (representation of lectotype, Sowerby I 1833: pt. 37, fig. 56 (36 x 18 mm) (Kohn 1992); "China").

Conus sinensis Sowerby II, 1841: 174–188.

Conus sowerbii Reeve, 1849: 2 (type, BMNH (36 x 15 mm); locality unknown).

Conus sowerbyi Sowerby II, 1857: 12 ("Feejee Islands").

Conus sowerbyi var. *subaequalis* Sowerby III, 1870: 257, pl. 22, fig. 5 ("China Seas").

Materials examined: MBMCS145, 1 specimen, SL 38 mm; SW 16 mm.

Description. Shell moderately small, solid and bi-conic. Body whorl conical, outline convex adapically, slightly concave below. Shoulder carinate, with a moderately deep exhalent notch. Spire high, over 1/3 of the entire length, sharply pointed, stepped, outline slightly concave. Body whorl with punctuates or axially striate, spiral grooves of variable width separated by strong ribbons. Aperture narrow, uniformly wide; outer lip thin and straight.

Ground colour dull white. Body whorl with spiral rows of dark brown dots and bars on ribbons and fusing into two to three spiral bands, below shoulder and on both sides of the centre. Aperture white.

Distribution. Röckel *et al.* (1995) reported a specimen from Madras.

We collected a specimen from Cuddalore (Table 6) by trawling in 20–40 m mainly on sandy-mud bottom.

Remarks. This is the second record from India; *C. praecellens* appears to be an extremely rare species along the TamilNadu Coast.

46. *Conus pretiosus* Nevill and Nevill, 1874 (Figure 47)

Conus pretiosus Nevill & Nevill, 1874: 22 (holotype, ZSI (59.5 x 24 mm); "Andamans").

Conus phuketensis da Motta, 1978: 4, fig. 2, pl. 67 (holotype, MHNG (81 x 33 mm) (Röckel *et al.* 1995); "off the coastal waters from Phuket Islands South West Thailand westward toward the Andaman Islands in the Andaman Sea").

Material examined: MBMCS146, 4 specimens, SL 48–80 mm; SW 21–33 mm.

Description. Shell moderately large to large, moderately solid. Body whorl ventricosely conical, outline convex adapically and straight below. Shoulder angulate. Spire of moderate height, stepped, outline straight, apex pointed and sharp. Body whorl smooth. Outer lip thin and sharp. Periostracum thin and translucent.

Ground colour white to cream. Body whorl with narrow brown (cream to yellowish brown) spiral bands from base to shoulder. Overlying spiral rows of variously sized and shaped brown to dark brown markings fuse into variably prominent interrupted spiral bands, below shoulder and above centre. Spire whorls white to brown, early whorls white to pale brown. Post nuclear sutural ramps white or cream with brown radial streaks and blotches. Aperture pale pinkish; exterior pattern visible on the outer lip margin. Periostracum brown and translucent.

Distribution. Nevill & Nevill (1874) reported this species for the first time from the Andaman Islands. Röckel *et al.* (1995) recorded one specimen from Tuticorin and another from Bay of Bengal; the exact locality of the latter was not given.

The specimens described herein were collected from Keelakarai and Pamban (Table 6) by trawling in 40–60 m.

Remarks. *Conus pretiosus* is extremely rare and probably restricted to Gulf of Mannar. Fishermen of Pamban consider it a rare species and differentiate it from other cones by naming it as 'Pamban vallapoo'.

47. *Conus quercinus* [Lightfoot], 1786 (Figure 48)

Conus quercinus [Lightfoot], 1786: pl. 67, no. 1501 (representation of lectotype, Martini 1773: pl. 59, fig. 657 (54 x 38 mm) (Kohn 1964); locality unknown).

Conus cingulum Gmelin, 1791: 3378, no. 72 ("Insulas amicas").

Conus quercinus Hwass in Bruguière, 1792: 681–682, no. 71 (lectotype, MHNG (82.5 x 55 mm) (Kohn 1968); "des Indes orientales").

Conus buxeus Link, 1817: 99 (representation of holotype, Martini 1773: pl. 59, fig. 657 (72 x 50 mm) (Röckel *et al.* 1995); locality unknown).

Conus akabensis Sowerby III, 1887: 273, sp. 528, pl. 36, figs. 752, 753 (holotype, BMNH (44 x 23 mm) (Röckel *et al.* 1995); "Akaba (Red Sea)").

Conus egregious Sowerby III, 1914: 475–476, pl. 19, fig. 9 (holotype in BMNH (3.5 x 2 mm); "New Caledonia").

Conus quercinus var. *albus* Shaw, 1915: 210 (holotype, BMNH (58 x 34 mm); "Aden").

Conus fulvostriatus Fenaux, 1942: 2, fig. 4 ("Bourbon").

Conus albonerosa Garrard, 1966: 11–12, pl. 1, fig. 1 (holotype, AMS (110 x 62 mm) (Röckel *et al.* 1995); "off Wide Bay, southern Queensland").

Material examined: MBMCS 147, 4 specimens, SL 48–53 mm; SW 32–34 mm.

Description. Shell moderately large, heavy, low gloss. Body whorl broadly conical; outline slightly convex adapically, straight below. Body whorl with few low spiral ridges above base, continuing as spiral threads above centre. Shoulder broad, sub-angulate. Spire of moderate height; outline slightly concave. Aperture wide, slightly flaring at base; outer lip straight and thick.

Ground colour pale yellow; a paler mid-body band visible. Spire uniformly yellowish white, early whorls dark brown. Aperture white.

Distribution. Melvill & Standen (1898) reported this species from the east coast of India (as '*C. ponderosus* Beck') without providing precise locality data. Kohn (1978) reported a museum specimen (in BMNH) collected by Winckworth from Tuticorin.

The specimens reported herein were collected from Vembar (Table 6) by trawling in 20–30 m, mainly on the sandy bottom. Few specimens were also collected from the trash discards at Tuticorin fishing harbour (Table 6).

Remarks. The earlier and present records suggest that *C. quercinus* is restricted to the east coast of India and appears to be rare along the TamilNadu Coast.

48. *Conus rattus* Hwass in Bruguière, 1792 (Figure 49)

Conus rattus Hwass in Bruguière, 1792: 700, no. 89 (representation of lectotype, Cuvier 1798: pl. 338, fig. 7 (45 x 29 mm) (Kohn 1968); "les mers d'Amérique").

Conus taitensis Hwass in Bruguière, 1792: 713, no. 108 (representation of lectotype, Cuvier 1798: pl. 336, fig. 9 (36 x 23 mm) (Röckel *et al.* 1995); "Isle d' Otaïti, dans l' Océan pacifique").

Conus chemnitzii Dillwyn, 1817: 363, no. 108 (representation of holotype, Chemnitz 1795: pl. 182, figs. 1764, 1765) (37 x 23 mm) (Röckel *et al.* 1995); "Ceylon").

Conus taheitensis Reeve, 1843: pl. 15, sp. 78.

Conus viridis Sowerby II, 1857: 20, pl. 5, fig. 102 (representation of lectotype, Sowerby II 1857: pl. 5, fig. 102 (22 x 12.5 mm) (Röckel *et al.* 1995); "Hurghada, Egypte, Rode Zee").

Conus semivelatus Sowerby III, 1882: 118, pl. 5, fig. 3 (holotype, NMWC (18 x 11.5 mm) (Röckel *et al.* 1995); "Red Sea").

Conus tahitiensis Dautzenberg, 1933: 89 ("Islands of Taheita, Annaa").

Material examined: MBMCS148, 9 specimens, SL 28–56 mm; SW 13–25 mm.

Description. Shell small to moderately large, solid, glossy. Body whorl conical to broadly conical; outline variably convex at adapical third to three fourth, left side concave below. Shoulder angulate. Spire of low to moderate height, outline slightly convex. Body whorl with variably prominent fine spiral ribs at base, becoming obsolete adapically. Aperture narrow, outer lip thin.

Ground colour bluish-white. Body whorl overlaid with various shades of brown leaving a broad interrupted spiral ground-colour band below shoulder and another obsolete to broad band at centre. Solid dark brown spiral lines may extend from base to just below the shoulder; on some portions of the body whorl, brown spiral lines articulate with white dots to produce a speckled appearance. Base violet. Aperture violet. Periostracum yellowish brown, slightly opaque and transversely finely ridged.

Distribution. In India, the first record of *C. rattus* was based on a live specimen collected by Winckworth at Krusadai Island (Kohn 1978).

The specimens described herein were collected from Keelakarai (Table 6) by trawling in 10–40 m and diving in 5–8 m, in and around the sub-tidal coral reef flats and from Pamban by trawling in 10–40 m (Table 6).

Remarks. This is the second record from India. Live specimens obtained by diving near subtidal coral reefs suggest its preference for this habitat. The distribution of *C. rattus* is probably limited to the Gulf of Mannar.

49. *Conus striatus* Linnaeus, 1758 (Figure 50)

Conus striatus Linnaeus, 1758: 716, no. 277 (lectotype, LSL (62 x 31 mm) (Kohn 1963); "Hitoe").

Conus leoninus [Lightfoot], 1786: 72, no. 1620 (representation of lectotype, Knorr 1768: pl. 12, fig. 5 (62 x 31.5 mm) (Kohn 1964); locality unknown).

Conus floridus Sowerby II, 1858: 47, fig. 558 (two syntypes, BMNH (77 x 44; 69 x 32 mm); locality unknown).

Conus chusaki da Motta, 1978: figs. 6, 8 (holotype, MHNG (65 x 30 mm) (Röckel *et al.* 1995); "shorelines of Raya Island, Phuket").

Conus subfloridus da Motta, 1985c: 27–28, figs. 4a, d (holotype, MNHG (76 x 35.5 mm) (Röckel *et al.* 1995); "Gulf of Mannar between India and Srilanka").

Material examined: MBMCS149, 60 specimens, SL 52–110 mm; SW 28–56 mm.

Description. Shell medium sized to large, solid to heavy. Body whorl narrowly conoid-cylindrical. Outline convex to straight, straight below shoulder. Aperture wider at base than shoulder. Shoulder sharply angulate to carinate. Spire of low to moderate height, outline concave to slightly convex, stepped. Body whorl with closely spaced, generally fine spiral ribs on basal third, obsolete above, occasionally persisting to shoulder.

Ground colour white, with shades of pink or grey. Sometimes white, variably suffused with pale blue to purplish white. Body whorl with brown to black flecks, blotches, flames and axial streaks, usually concentrated in two interrupted to solid spiral bands, above and below centre. The bands contain solid, dashed or dotted darker spiral lines. Shells vary from almost completely white to heavily patterned.

Distribution: Thurston (1890, 1895) first reported *C. striatus* from Tuticorin. Subsequent records are from Rameswaram (Sundaram 1969) and Shingle Island (Kohn 1978). Specimens collected from Hare Island and Krusadai Island are in MGM and ANSP respectively (Kohn 1978). Röckel *et al.* (1995) reported *C. striatus* from Rameswaram.

We collected specimens of *C. striatus* in the vicinity of the coral islands (Table 6) by trawling in 6–50 m, on sand and coral rubble bottom. Diving in 5 m off Keelakarai yielded a few specimens. Specimens from Yerwadi and Keelakarai (Table 6) were collected from the lobster cages laid overnight at 5 m, in sandy and rocky bottoms.

Remarks. Richard (1990) treated both *C. s. f. subfloridus* and *f. floridus* as conspecific with each other, but separate from *C. striatus*, while other authors consider *C. floridus* to represent only a slight variant of *C. striatus* (Smith 1894). In form *floridus* siphonal fasciole white to cream, with variably spaced very fine brown axial lines; form *subfloridus* without these lines. Aperture white to bluish in form *subfloridus*; in form *floridus*, orange deep within. Röckel *et al.* (1995) provisionally considered both to be ecological variants of *C. striatus* from deeper subtidal habitats.

We found *C. striatus* and *C. s. f. subfloridus* sympatrically at Keelakarai and they are very similar in shell shape and sculpture (Figure 62P). The specimens collected in this study are also considered conspecific with *C. striatus* following Röckel *et al.* (1995) and Kohn (2001).

50. *Conus striolatus* Kiener, 1845 (Figure 51)

Conus striolatus Kiener, 1845: pl. 105, fig. 1 (type, Coll. Bernardi; locality unknown);

Conus magus var. *decurtata* Dautzenberg, 1910: 26 (lectotype, IRSN (28.5 x 16.5 mm) Coomans *et al.* 1985b); "L alle de Rua-Sura (Archipel Salomon)".

Material examined: MBMCS150, 2 specimens, SL 22–24 mm; SW 13–14 mm.

Description. Shell small, solid. Body whorl ventricosely conical. Shoulder rounded. Spire of moderate height, outline straight. Body whorl with spiral ribs at base. Basal spiral ribs on both sides finely granulated, conspicuously prominent on the ventral side.

Ground colour pale grey. Body whorl with brown axial blotches, fusing into interrupted spiral bands on each side of centre. Spiral rows of alternating brown to black and white dots and dashes extend from base to shoulder. Aperture white.

Distribution. *Conus striolatus* has not been previously reported from India.

The specimens described herein were collected from Cuddalore (Table 6) by trawling in 10–40 m.

Remarks. The present report is the first record in India and this species is found to be a rare species along the TamilNadu Coast.

51. *Conus suratensis* Hwass in Bruguière, 1792 (Figure 52)

Conus suratensis Hwass in Bruguière, 1792: 669–670, no. 63 (lectotype, MHNG (51.5 x 31.5 mm) (Röckel *et al.* 1995); "mers des grandes Indes").

Material examined: MBMCS151, 6 specimens, SL 75–92 mm; SW 38–43 mm.

Description. Shell large, heavy and glossy. Body whorl usually ventricosely conical, outline convex over the adapical third, straight below. Shoulder subangulate to rounded. Spire low or flat, early whorl forming a small cone at the middle. Body whorl with about a dozen fairly weak spiral ridges above base, rest of whorl smooth except for fine spiral and axial threads and scratches. Aperture moderately wide, with uniform width, outer lip thick, sharp and straight.

Ground colour white to cream. Base pale orange, base and shoulder stained bright orange and yellow in some. Spiral rows of small dark brown dashes over most of the whorl, also aligned into axial bands; little fusion occurs between dashes axially. Spire white with orange tones. Aperture pale brown in colour.

Distribution. Röckel *et al.* (1995) reported this species off Cuddalore.

The specimens reported herein were collected from Mandapam (Table 6) by trawling in 10–15 m, mainly on the sandy bottom.

Remarks. *Conus suratensis* is rare and probably restricted to the Gulf of Mannar. The present record of live specimens other than a single shell (70 mm) reported from Cuddalore (Röckel *et al.* 1995) is the first report from Gulf of Mannar and the largest (92 mm) recorded.

52. *Conus terebra* Born, 1778 (Figure 53)

Conus terebra Born, 1778: 145 (lectotype, NMW (55.5 x 25 mm) (Kohn 1964); "Fiji Islands").

Conus terebellum Gmelin, 1791: 3390, no. 44 (representation of lectotype, Martini 1773: pl. 52, fig. 577 (48 x 22 mm) (Kohn 1976); "Indian Ocean").

Conus fusus Gmelin, 1791: 3390, no. 45 (representation of lectotype, Martini 1773: pl. 52, fig. 576 (19 x 10 mm); locality unknown).

Cucullus albeolus Röding, 1798: 47, no. 594/91 (lectotype same as of *C. terebellum* Gmelin (Kohn 1975); locality unknown).

Conus coelebs Hinds, 1843: 256 (holotype, Coll. Belcher; "Ambow, Feejee Islands").

Conus thomasi Sowerby III, 1881: 625–636, pl. 56, fig. 4 (Holotype, BMNH (72.5 x 36 mm); "Red Sea").

Material examined: MBMCS152, 52 specimens, SL 58–92 mm; SW 24–40 mm.

Description. Shell moderately small to large with low gloss. Body whorl conical to narrowly conical; outline convex at shoulder, straight below, sometimes concave centrally. Shoulder rounded to roundly angled, not distinct from spire. Spire of moderate height, outline convex. Body whorl with variably spaced and variably fine spiral ribs from base to shoulder. The spiral ribs are generally closer near shoulder. Aperture narrow, slightly wider anteriorly; outer lip straight.

Ground colour white to pale cream. Body whorl with a broad spiral band on each side of the centre varying from light grey to light brown. Base tinged with violet in adult specimens. Aperture white, in adult pale or dull violet. Periostracum is persistent; dark brown, thick, opaque and axially ridged; darker and rough in large specimen.

Distribution. Kohn (1978) reported *C. terebra* off Krusadai Island. He also mentioned specimens collected from Tuticorin and Madras by Winckworth and Steiner respectively. Röckel *et al.* (1995) reported a single specimen from Pamban.

The specimens described herein were collected from Keelakarai (Table 6) by diving in 5–10 m around coral reefs. In Vembar and Tuticorin (Table 6), specimens were collected by trawling in 20–50 m.

Remarks. The present and previous records of this species are all from Gulf of Mannar. Thirty-two specimens were collected at shallow depths of sand bottoms at Keelakarai and Vembar. However, at Tuticorin they were collected at a maximum depth of 50 m. This species was often collected together with *C. leopardus*, *C. virgo* and *C. araneosus*.

53. *Conus tessulatus* Born, 1778 (Figure 54)

Conus tessulatus Born, 1778: 1780 (representation of lectotype, Martini 1773: pl. 59, fig. 653 (Kohn 1964); "Africa").
Cucullus pavementum Röding, 1798: 41, no. 509/33 (lectotype same as that of *C. tessulatus* Born (Kohn 1975); locality unknown).
Conus edaphus Dall, 1910: 223–224 (holotype, USNM (24.5 x 14 mm) (Röckel *et al.* 1995); "off Clarion Island").

Material examined: MBMCS153, 34 specimens, SL 32–70 mm; SW 26–45 mm.

Description. Shell medium sized to moderately large, solid to moderately heavy. Body whorl conical to broadly conical, outline convex near shoulder, straight below. Shoulder broad, subangulate to angulate. Spire low to moderate height, sharply pointed, outline slightly concave. Aperture moderately narrow and with almost uniform width, outer lip sharp and straight. Body whorl with variously spaced, weak or incised or often punctuate spiral grooves on apical third.

Ground colour white. Body whorl with spiral rows of mostly bright orange rectangular spots or bars, often alternating with white markings. These colour markings usually fuse into spiral bands in each side of the centre. Shoulder and spire with radial markings matching bars on last whorl in size and colour. Base bluish-white. Aperture white, usually with pink tones. Periostracum orange, thin and smooth.

Distribution. Bruguière (1792) first reported *C. tessulatus* from the Malabar coast. Dautzenberg (1937) noted a specimen from Madras (at IRSN). Röckel *et al.* (1995) reported a specimen from Madras and another from India without locality data. Kohn (1978) reported museum deposited specimens collected from Tuticorin (at BMNH) and Tranquebar (at ZMUC).

The specimens described herein were collected by trawling in 5–20 m from stations 4, 5 and 19 and at depths beyond 50 m from other stations (Table 6). In Keelakarai, specimens were collected by diving in 5–8 m on sand and coral rubble bottom.

Remarks. *Conus tessulatus* occurs generally at stations with the large fishing harbours. No depth data from Indian waters was available from the previous reports. However, in this study, *C. tessulatus* was mostly obtained at depths of 5–50 m.

54. *Conus textile* Linnaeus, 1758 (Figure 55)

Conus textile Linnaeus, 1758: 717, no. 278 (lectotype, LSL (67 x 33 mm) (Kohn 1963); "Banda").
Conus archiepiscopus Hwass in Bruguière, 1792: 747–748, no. 141 (lectotype, MHNG (68 x 36 mm) (Kohn 1968); "aux mers des grandes Indes").

- Cucullus auriger* Röding, 1798: 49, no. 632/119 (representation of lectotype, Martini 1773: pl. 54, fig. 599 (Kohn 1975); locality unknown).
- Cucullus gloriamaris* Röding, 1798: 49, no. 633/120 (representation of lectotype, Martini 1773: pl. 54, fig. 598 (Kohn 1975); locality unknown).
- Cucullus auratus* Röding, 1798: 5, no. 635/122 (representation of lectotype, Knorr 1764: pl. 8, fig. 3 (Kohn 1975); locality unknown).
- Conus panniculus* Lamarck, 1810: 435, no. 170 (type, MHNG (63 x 31 mm) (Röckel *et al.* 1995); "Mers des grandes Indes").
- Conus pyramidalis* Lamarck, 1810: 438, no. 170 (representation of lectotype, Cuvier 1798: pl. 347, fig. 5 (56 x 19 mm) (Walls 1979); "Indes Orientales").
- Conus gloriamaris* Perry, 1810: pl. 16 (representation of holotype, Perry, 1810: pl. 16 (104 x 49 mm) (Röckel *et al.* 1995); "South Seas").
- Conus reteaureum* Perry, 1811: pl. 25, fig. 5 (representation of holotype, Perry 1811: pl. 25, fig. 5 (96 x 50 mm) (Röckel *et al.* 1995); "African Seas").
- Conus (Textilia) communis* Swainson, 1840: 312 (lectotype same as that of *C. archiepiscopus* Hwass (Coomans *et al.* 1985a)).
- Conus verriculum* Reeve, 1843: pl. 38, sp. 208a, b (type, Mus. Stainforth; "Ceylon").
- Conus textilinus* Kiener, 1845: pl. 103, fig. 5 (holotype, NMWC (38.5 x 21.5 mm) (Röckel *et al.* 1995); locality unknown).
- Conus concatenatus* Kiener, 1845: pl. 103, fig. 5.
- Conus dilectus* Gould, 1850: 172 (holotype, USNM (13 x 6 mm) (Röckel *et al.* 1995); "Feejee Islands").
- Conus scriptus* Sowerby II, 1858: 41, no. 357, pl. 23, fig. 569 (three syntypes, BMNH (59 x 27; 54 x 22; 50 x 22 mm); locality unknown).
- Conus tigrinus* Sowerby II, 1858: 41, no. 355, pl. 23, fig. 569 (type, BMNH (43 x 19 mm); "Madagascar").
- Conus corbula* Sowerby II, 1858: 41, no. 365, pl. 23, fig. 573 (type, BMNH (69.5 x 34.5 mm); locality unknown).
- Conus textile* var. *euetrios* Sowerby III, 1882: 12, fig. 13c (holotype, NMWC (49 x 24 mm) (Röckel *et al.* 1995); locality unknown).
- Conus cholmondeleyi* Melvill, 1900: 308 (holotype, MM (43 x 18 mm); locality unknown).
- Conus eumitus* Tomlin, 1926: 288–289, pl. 16, fig. 3 (lectotype, BMNH (53 x 28 mm); "Scottburgh").
- Dariconus textiles osullivani* Iredale, 1931: 224, pl. 25, fig. 13 (holotype, AMS (42.5 x 20 mm) (Röckel *et al.* 1995); "Black Rock, Richmond River, New South Wales").
- Conus textile* var. *ponderosa* Dautzenberg, 1932: 16 (type, IRSN (57 x 33.5 mm) (Röckel *et al.* 1995); "Ste Marie").
- Conus textile* var. *loman* Dautzenberg, 1937: 257 (type, IRSN; "de l' île Maurice et de l' île Cargados").
- Conus sirventi* Fenaux, 1943: 4, fig. 10 ("Madagascar").
- Conus textile dahlakensis* da Motta, 1982: 5–6, pl figs. 5a, b (holotype, MHNG (87 x 40 mm) (Röckel *et al.* 1995); "in the area of Dahlak Archipelago, off Massawa in the Red Sea").
- Conus textile neovicarius* da Motta, 1982: 4–5, pl figs. 4a, b (holotype, MHNG (76 x 45 mm) (Röckel *et al.* 1995); "in Sharem-el-Shech, Gulf of Aqueba").
- Conus suzannae* van Rossum, 1990: 29–31 (holotype, van Rossum coll. (39 x 17.5 mm) (Röckel *et al.* 1995); "Malindi coasts of Kenya, Indian Ocean").

Material examined: MBMCS154, 26 specimens, SL 35–104 mm; SW 11–42 mm.

Description. Shell medium sized to large, moderately light to moderately heavy, with high gloss. Body whorl ventricosely conical to ovate, outline strongly convex to nearly straight; left side straight to strongly concave near base. Shoulder usually rounded, but sometimes sharply angulate. Spire generally of moderate height, sides nearly straight to convex, sharply pointed. Aperture variably wider at base than near shoulder; outer lip sharp, slightly convex to nearly straight. Body whorl with variably weak spiral ribs near base.

Ground colour white, sometimes suffused with blue, violet, orange or pink. Body whorl generally with a network of light to dark brown lines edging tiny to moderately large tents, sometimes also small quadrangular to round markings. Yellowish-brown flecks and blotches arranged in two to three interrupted to solid spiral bands on both sides of the centre and often below shoulder; bands interspersed with broad, dark brown, straight to wavy axial lines. Occasionally one to two additional but similar but narrower spiral bands at base. Spire and shoulder whitish with many axial brown lines continued from body whorl. Aperture usually white to bluish white. Periostracum grey to yellow, thin, smooth and translucent.

Distribution. *Conus textile* has been reported from Madras (Frauenfeld 1869; Gravely 1942) to Tuticorin (Thurston 1890, 1895) on the east coast and from Ohka (Kohn 1978) to Bombay (Melvill & Abercrombie 1893; Hornell & Tomlin 1951; Subrahmanyam *et al.* 1952) on the west coast.

We collected specimens from several stations (Table 6) by trawling in 10–80 m. In contrast, at stations 4, 5, 6 and 7, specimens were collected only at shallow depths of 10–20 m (Table 6).

Remarks. *Conus textile* shows wide variations in shape and colour patterns between and within stations along the TamilNadu Coast (Figure 62Q). Dead shells were rarely found in the trawl collection during this survey.

55. *Conus tuticorinensis* Röckel & Korn, 1990 (Figure 56)

Conus tuticorinensis Röckel & Korn, 1990: 277–291, pl. 2, fig. 2, pl. 2, fig. 1 (holotype, SMF (26 x 16.5 mm) (Röckel *et al.* 1995); "Tuticorin, South East Indien").

Material examined. MBMCS155, 1 specimen, SL 24 mm; SW 14 mm.

Description. Shell small, moderately solid. Body whorl broadly conical, outline convex adapically. Shoulder angulate. Spire low, outline straight. Body whorl with flat spiral ribbons from base to shoulder.

Ground colour white, suffused with pale violet on last whorl. Body whorl with orange-brown "brick wall pattern" of about twelve spiral lines and irregular axial lines; similarly coloured irregular flecks spirally aligned below shoulder and each side of centre. Apex white. Aperture reddish white.

Distribution. Kohn (1978) first reported this species from India with reference to museum specimens collected by Winckworth from Tuticorin (at BMNH) and by Sukherwala from Tuticorin and Rameswaram (at AMNH). Röckel & Korn (1990) reported on three specimens from Tuticorin.

The specimen described herein was collected from the dumped by-catch at Tuticorin fishing harbour (Table 6). The exact depth of occurrence and nature of bottom is not known.

Remarks. This species is extremely rare in the TamilNadu Coast. Röckel & Korn (1990) described *C. tuticorinensis* as *C. boschi* (Clover 1972). The shell shape of *C. boschi* and intergrading colour pattern of the holotype specimen of *C. melvilli* Sowerby III are similar, thus, *C. boschi* and *C. melvilli* were considered as conspecific. Röckel *et al.* (1995) considered *C. boschi* as invalid species and placed it with *C. melvilli*. *C. tuticorinensis* is similar to *C. melvilli*. The latter species differs in its wider sutures and absence of spiral grooves from its sutural ramps. Also, *C. melvilli* has a dark violet aperture, less angulate shoulder and narrow last whorl.

56. *Conus vexillum* Gmelin, 1791 (Figure 57)

Conus vexillum Gmelin, 1791: 3397, no. 68 (representation of lectotype, Rumphius 1705. pl. 31, fig. 5 (68 x 39 mm) (Kohn 1966); locality unknown).

Conus sumatrensis Hwass in Bruguière, 1792: 655–656, no. 54 (representation of lectotype, n Chemnitz 1788: pl. 144a, figs. a, b (71 x 45 mm) (Walls 1979); "Isle de Sumatra").

Cucullus canonicus Röding, 1798: 43, no. 535/54 (representation of lectotype, Martini 1773: pl. 57, fig. 629 (63 x 35 mm); locality unknown).

Conus princeps Holten, 1802: 34, no. 440 (lectotype same as that of *C. sumatrensis* Hwass (Kohn 1981); locality unknown).

Conus leopardus Dillwyn, 1817: 364, no. 20 (lectotype same as that of *C. sumatrensis* Hwass (Walls 1979); "East Indian Seas, Sumatra").

Conus sulphuratus Kiener, 1845: pl. 66, fig. 3, pl. 78, fig. 4.

Conus robillardi Bernardi, 1858: 182–183, pl. 7, figs. 2, 3 (holotype, MNHN (27 x 14 mm) (Röckel *et al.* 1995); locality unknown).

Material examined: MBMCS156, 8 specimens, SL 40–108 mm; SW 22–52 mm.

Description. Shell medium sized to large, solid to heavy. Body whorl conical to broadly conical, outline convex adapically, straight below. Shoulder angulate to rounded. Spire of low to moderate height, outline straight to slightly convex, weak spiral ribs on base. Aperture uniformly wide, interior white, outer lip thin sharp and straight.

Ground colour white. Body whorl brown except for variably broad white spiral bands at centre and shoulder, often interrupted and sometimes absent. Overlying, dense wavy dark-brown streaks, and closely spaced coarse to fine lines extend from base to shoulder. Spire white, flecked with brown. Base dark-brown. Periostracum olive-brown, thick and ridged.

Distribution. *Conus vexillum* has been reported from the Malabar coast (Bruguère 1792; Mawe 1823; Melvill & Standen 1898), west coast of India. Kohn (1978) referred to museum specimens collected at Tuticorin (at ZSI and MGM) and an unlabelled specimen in the Krusadai Island Museum.

The specimens reported herein were collected from Keelakarai and Tuticorin (Table 6) by trawling in 10–40 m, mainly on sand bottoms.

Remarks. An uncommon species probably restricted to Gulf of Mannar.

57. *Conus vimineus* Reeve, 1849 (Figure 58)

Conus vimineus Reeve, 1849: pl. 7, sp. 269 (type, BMNH (29 x 10.5 mm); "Cagayan, Island of Mindanao, Philippines").

Material examined: MBMCS 157, 1 specimen, SL 36 mm; SW 12 mm.

Description. Shell moderately small, light and fragile, elongate. Body whorl narrowly conical, outline convex adapically, straight below. Entire body whorl with deep, axially striate spiral grooves separating regularly spaced ribs near base and variably arranged ribs and narrow ribbons above; elevations of ribs smooth. Shoulder broadly rounded, not distinct from spire. Spire moderately high, sharply pointed, sides straight. Aperture uniformly narrow, outer lip very thin, strongly sloping below level of shoulder; straight.

Ground colour pale brown. Body whorl with spiral rows of rectangular light brown spots on ribs, fusing into axial streaks that cluster in three indistinct spiral bands below shoulder, above centre and near base. Spire pale brown. Aperture white.

Distribution. Röckel *et al.* (1995) reported one specimen from Madras.

The specimen reported herein was collected from the trash discard of a fishing-boat at Cuddalore fishing harbour (Table 6). Depth of occurrence and nature of bottom is not known. We presume that *C. vimineus* most probably inhabits the sandy bottom of Cuddalore.

Remarks. Appears to be a rare species along the TamilNadu Coast.

58. *Conus violaceus* Gmelin, 1791 (Figure 59)

Conus violaceus Gmelin, 1791: 3391, no. 51 (representation of holotype, Martini 1777: pl. 2, figs. 18, 19 (50 x 17 mm) (Röckel *et al.* 1995); locality unknown).

Conus tendineus Hwass in Bruguère, 1792: 733–734, no. 127 (lectotype, MHNG (76 x 27 mm) (Walls 1979); "les mers d' Afrique").

Material examined: MBMCS 158, 1 specimen, SL 55 mm; SW 20 mm.

Description. Shell medium sized, moderately solid, glossy. Body whorl narrowly cylindrical; outline convex over adapical third and straight below to almost uniformly straight and parallel-sided. Shoulder indistinct from spire. Spire of moderate height; outline convex, sutures narrowly channeled. Spire tip rounded and

sharp. Body whorl with widely separated narrow spiral ribs from base to shoulder; weaker at shoulder. Aperture narrow, wider anteriorly; outer lip thick, straight, sloping below shoulder.

Ground colour white. Body whorl with light brown axial streaks and with three dark-brown spiral bands above centre, within basal third and at shoulder. Spire light-brown with early whorls white. Base violet. Aperture white; outer colour visible along the inner lip margin.

Distribution. This species has not been previously reported from India.

The specimen described herein was collected from Pamban (Table 6) by trawling in 10–20 m, mainly on intertidal sandy-mud.

Remarks. This study reports the occurrence of *C. violaceus* for the first time from India. It is a very rare species along the TamilNadu Coast.

59. *Conus virgo* Linnaeus, 1758 (Figure 60)

Conus virgo Linnaeus, 1758: 713, no. 253 (representation of lectotype, Rumphius 1705: pl. 31, fig. E (63 x 30 mm) (Kohn 1963); locality unknown).

Material examined: MBMCS 159, 48 specimens, SL 50–110 mm; SW 28–52 mm.

Description. Shell moderately large, heavy with a low gloss. Body whorl conical, outline slightly convex over the adapical quarter, straight below. Shoulder broad, angulate. Spire low to flat, outline slightly concave to slightly convex. Aperture moderately narrow, posteriorly slightly wider anteriorly, outer lip sharp, straight or nearly so. Body whorl with weak or obsolete spiral ribs near base. Widely spaced fine ribs and wrinkled threads between extend to centre or beyond.

Ground colour white to yellow, with occasionally darker orange collabral lines marking growth cessations. Base broadly stained deep purple, visible both dorsally and ventrally. Spire same colour as body whorl, usually paler. Aperture glossy white, with a large, dark purple blotch at base. Periostracum thick, dark brown and opaque.

Distribution. Early reports of *C. virgo* are by Melvill & Standen (1898) and by Sundaram (1969) from Mandapam along the east coast. Based on specimens deposited in museums, Kohn (1978) reported that this species is known to occur from Pondicherry (at MNHN) to Tuticorin (at ZSI, MGM) on the east coast and also from Bombay (at ZMUC) on the west coast.

The specimens reported herein were collected from various stations (Table 6) by trawling in 5–20 m around the coral reef islands of the Gulf of Mannar. However, at Vedhalai the specimens were collected by diving in 5 m, on the sand and coral rubble.

Remarks. This species is confined to the Gulf of Mannar. Their prevalence at shallow depths around the coral islands indicates their preference for such habitat. They often occur with *C. araneosus*, *C. leopardus* and *C. terebra*.

60. *Conus zeylanicus* Gmelin, 1791 (Figure 61)

Conus zeylanicus Gmelin, 1791: 3389, no. 41 (representation of lectotype, Martini 1777: pl. 2, fig. 20 (44 x 23 mm) (Kohn 1966); locality unknown).

Conus obesus Hwass in Bruguière, 1792: 623–624, no. 19 (lectotype, MHNG (65 x 45.5 mm) (Kohn 1968); "les mers des Indes orientales").

Cucullus meningeus Röding, 1798: 39, no. 491/17 (representation of lectotype, Chemnitz 1788: pl. 142, fig. 1318 (42 x 23 mm) (Kohn 1975); locality unknown).

Cucullus theobroma Röding, 1798: 43, no. 549/60 (representation of lectotype, Chemnitz 1788: pl. 142, fig. 1318 (42 x 23 mm) (Kohn 1975); locality unknown).

Material examined: MBMCS 160, 120 specimens, SL 42–56 mm; SW 25–38 mm.

Description. Shell medium sized to moderately large, solid to moderately heavy. Body whorl conical or ventricosely conical, outline slightly convex above base and below shoulder and more straight in between. Body whorl with variably broad spiral ribs at base, smoother posteriorly with many low spiral and axial threads and growth marks. Shoulder wide, rounded, margins irregularly undulate. Spire of low to moderate height, sharply pointed, sides slightly convex. Aperture narrow posteriorly, much wider below; outer lip thick, straight or nearly so.

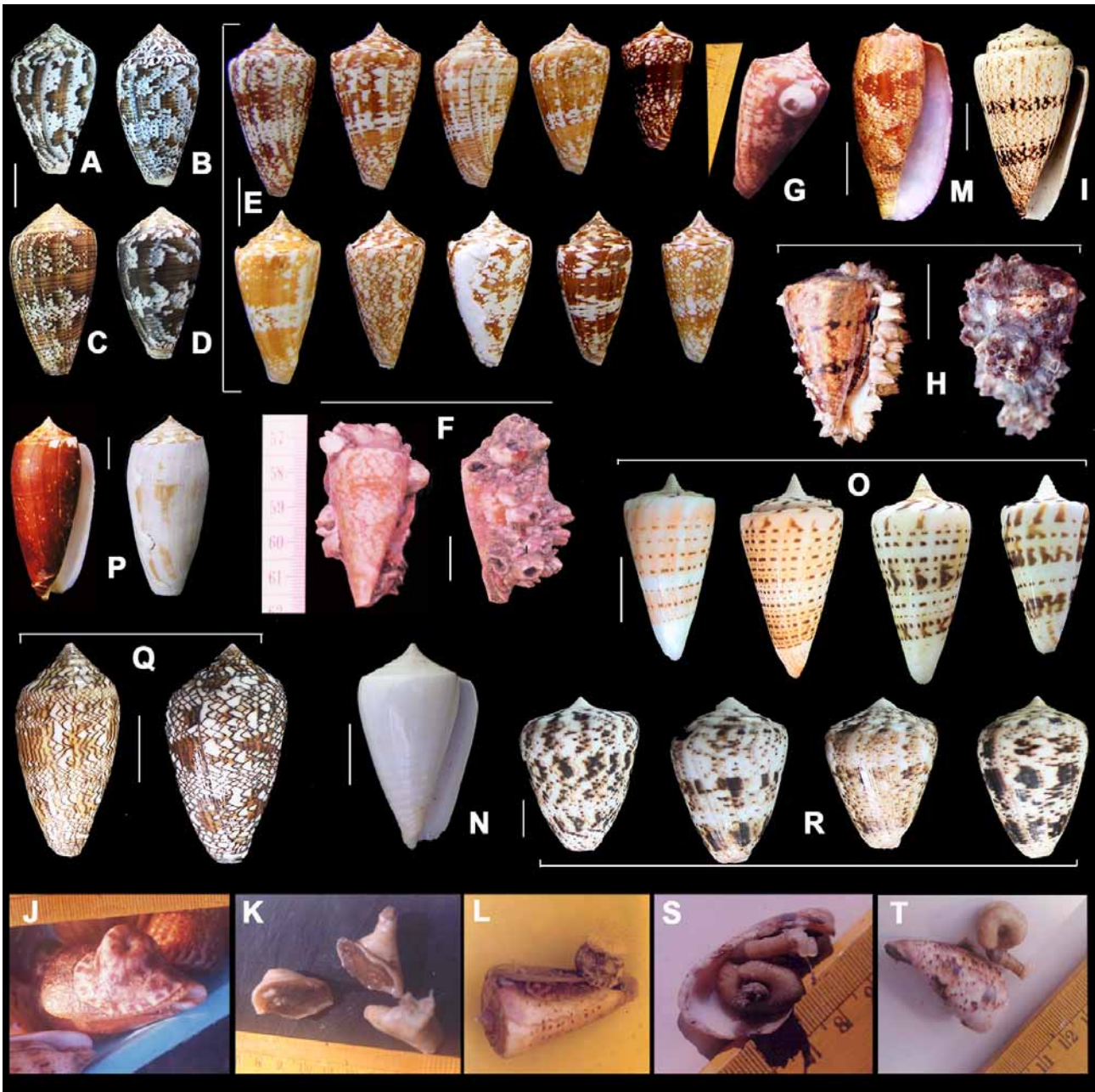
Ground colour white with strong pinkish tones, covered with a variable pattern of small brown dashes and spots, opaque white blotches, larger black triangles; combinations of these features result in patterns usually comprising two broad and indistinct spiral bands of dark brownish triangles and blotches; the bands usually above and below centre, sometimes a weak additional band below shoulder; the whole pattern is very inconsistent. Shoulder whitish with large dark-brown blotches. Spire whorls whitish with smaller brown blotches. Aperture white.

Distribution. Kohn (1978) first reported *C. zeylanicus* from Tuticorin and he also referred to unpublished records of two specimens trawled near Madras.

The specimens described herein were collected by trawling in sandy bottoms at 8–10 m at Periyakuppam and in 10–50 m at Cuddalore, mainly on sand and sandy-mud bottoms.

Remarks. *Conus zeylanicus*, though abundant, was found only at Cuddalore and Periyakuppam. Specimens of *C. zeylanicus* varied in the colour pattern of the body whorl (Figure 62R). The pinkish tones may be heavy or reduced. Apart from the typical two broad spiral bands of blackish triangles and blotches on the body whorl, specimens vary from inconstant spiral bands to complete absence.

Rarely, a worm, probably *Aspidosiphon muelleri* Diesing (Pers. comm. by Kohn) was found to inhabit empty shells of *C. zeylanicus*, coiled around the posterior columella (Figure 62S&T).



Figures 62. A, B, C & D. Specimens of *C. achatinus* showing variation of colour pattern, E. Specimens of *C. amadis* showing variation of colour pattern, F. *C. amadis* with a heavy infestation of *Balanus amphitrite* on the shell surface, G. The occurrence of *Balanus reticulatus* on the shell surface of *C. amadis*, H. *C. araneosus* with a heavy infestation of *Balanus amaryllis* on the shell surface, I. An odd specimen of *Conus araneosus* with a turreted or stepped spire, J. Sea anemone on *C. figulinus*, K. Sea anemones removed from the shell surface of *C. lorisii*, L. Sea anemone on *C. monile*, M. An unusual shell of *C. geographus* with very thin shell and sharp lip, N. Albino specimen of *C. inscriptus* without any banding pattern, O. Specimens of *C. monile* showing variation of the banding pattern in the last whorl, P. Dorsal and ventral view of *C. striatus* f. *subfloridus*, Q. Specimens of *C. textile* showing variation of colour pattern, R. Specimens of *C. zeylanicus* showing variation of colour pattern, S & T. A worm probably *Aspidosiphon muelleri* Diesing coiled around the anterior columella of an empty shell of *C. zeylanicus*. **Scale bars:** 62A, B, C, D & N: 1 cm; 62H, I, M, O, Q & R: 2 cm.

Geographic distribution of Conidae along the TamilNadu Coast

A total of 60 species of the genus *Conus* were recorded along the TamilNadu Coast. Regionally, the Gulf of Mannar was observed to be most diverse followed by the Northern region. The number of species was variable among the different stations (Figure 63). The highest values were registered in the Gulf of Mannar; most significantly in station 19 (34 spp.) followed by stations 22 and 15 (Figure 64; Table 6). Geographically, *C. amadis* was the most widespread species, present at almost all stations, followed by *C. betulinus*, *C. figulinus* and *C. monile*. In the Palk Bay region, *C. amadis* was the most common species followed by *C. monile* and *C. malacanus*. *Conus araneosus* was present at all the Gulf of Mannar stations. Other widespread species in this region were *C. leopardus*, *C. betulinus*, *C. amadis*, *C. striatus* and *C. virgo*. In the Southern region *C. amadis* was common. Across the study area, 11 species occurred at 10 or more stations, six species in 6 to 9 stations and the remaining 43 species occurred at only one or two stations. *Conus amadis*, *C. inscriptus*, *C. betulinus*, *C. monile*, *C. lorisii*, and *C. figulinus* occurred frequently as well as abundantly. Thirty-eight species occurred only in the Gulf of Mannar at depths <50m. In the Northern region, 22 species were recorded, of which 12 were limited to that region. The Palk Bay and Southern regions were species poor with only five and six species respectively.

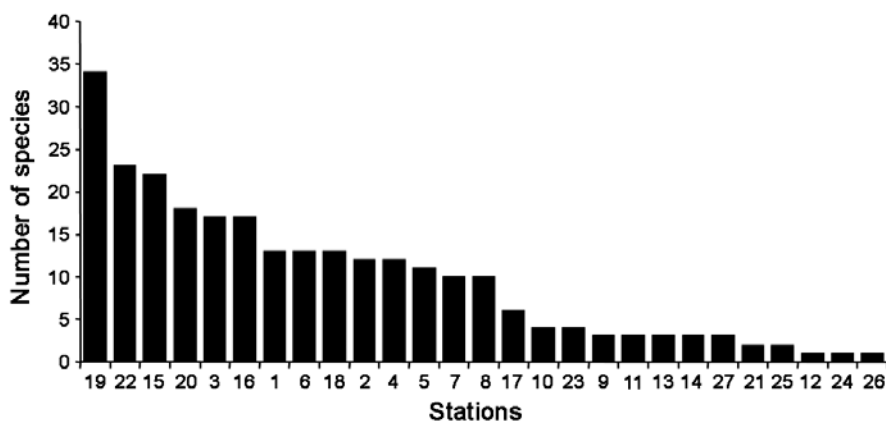


FIGURE 63. Variation of *Conus* species richness across the stations. The values of species richness are also shown in Table 6.

Based on the similarity of the species composition between stations, the Jaccards index of similarity for all the 27 stations generated a phenogram that reflected the species similarity between stations. Five groups (40% as baseline) obtained from the phenogram (Figure 65) indicated the variation in species composition. The highest similarity was between stations 9 and 11 and species composition is identical. On the other hand, stations 12, 24 and 26 also showed high similarity, all having only one species (*C. amadis*). The first group contains 6 of the 27 stations, primarily located at the Palk Bay and the Southern region (Table 1). Stations 9, 10 and 11, all located in the northern part of the Palk Bay form the second group. The third one is formed by stations 14, 23, 21 and 17, all from Gulf of Mannar except station 23, from northern extremity of the Southern region. The stations that formed the fourth group (stations 1, 2, 3, 4, 5, 6, 7 and 8) are all from the Northern region and contain a number of frequent *Conus* species (see Table 6). Stations 15, 16, 18, 20, 22 and 19 forms the fifth group, in which all the stations are located in the Gulf of Mannar. The groups also reflect the species assemblage of *Conus* between the different regions. The species assemblage between the stations of Northern region is more similar and formed a distinct group. Similarly, most stations of Palk Bay, Gulf of Mannar and Southern region formed definite groups. However, few stations of Gulf of Mannar showed overlap, grouping with stations in Palk Bay to the North and the Southern region to the South. The species turnover across the four regions was very high and this largely represents the different habitats of the southeast coast. The five

groups broadly correspond to four predominant substrate types of the TamilNadu coast. Since the predominant substrates of Northern, Palk Bay, Gulf of Mannar and Southern region are sandy, muddy, coral and rocky respectively; the difference in species composition could be due to difference in habitat preference.

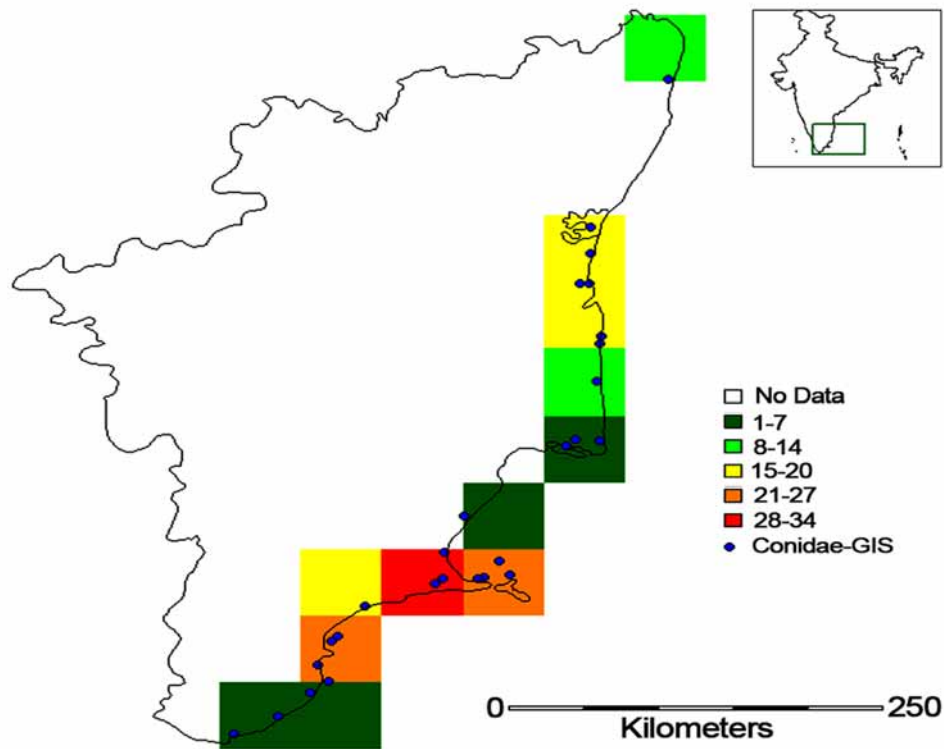


FIGURE 64. Species diversity of cone snails (*Conus* sp.) along the TamilNadu coast.

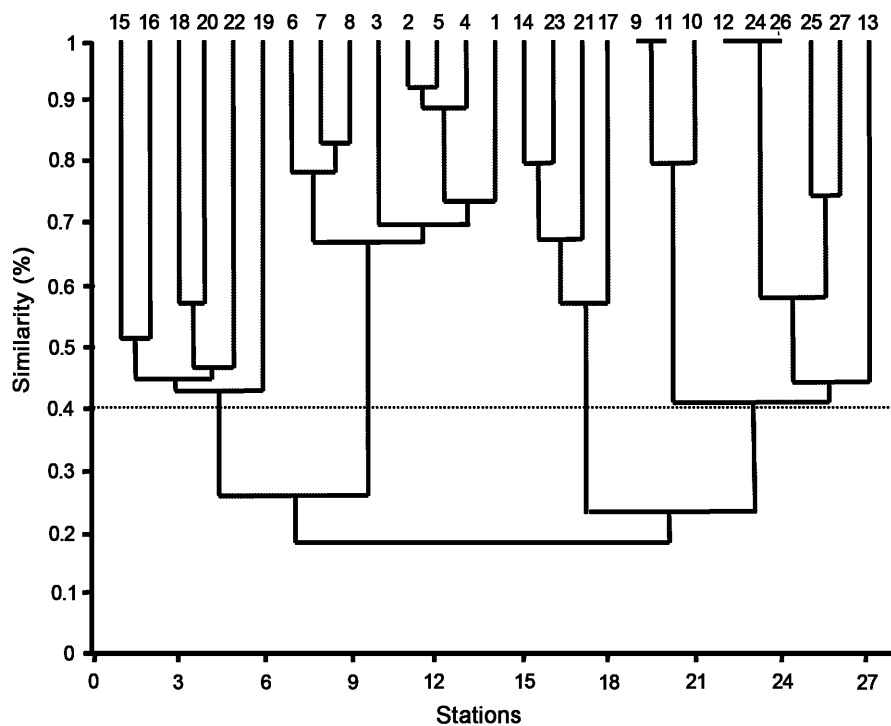


FIGURE 65. Phenogram derived from the Jaccard's similarity values among the stations.

Discussion

The wide distributions of species such as *C. amadis*, *C. betulinus*, *C. monile*, *C. figulinus*, *C. tessulatus*, *C. inscriptus*, *C. textile*, *C. figulinus* and *C. lorioisii* can probably be attributed to the widespread occurrence of their preferred habitats (Röckel *et al.* 1995). However, regional difference in abundance of different species could be attributed to specific required habitat in that region. The abundance of cone snails reported from the Northern region could be attributed to dedicated fishing activity for gastropods during certain parts of the year, especially after monsoons.

Distribution across stations indicates that very few species are widely distributed (Table 6). Stations whose habitats involved coral reefs accounted for nearly 43 species. In general, species diversity was high in the stations of Gulf of Mannar. This high diversity of cone snails in coral reef habitats and low diversity in muddy and rocky habitats is expected. Similar results were also reported from other studies (Kohn 1967). The Gulf of Mannar has the most extensive coral reef habitats in India, consisting of a discontinuous chain of about 21 coral islands and sheltered by the close proximity of Srilanka (Yazhini 2004). Thus, it is apparent that the physical conditions, microhabitats and the required resources such as food and shelter provided by Gulf of Mannar favour the occurrence of the large number of species of *Conus*. The restricted distribution of 12 species only to the Northern region reflects their preference for stretches of sandy bottom. High species diversity, particularly at Cuddalore, could also be due to the presence of subtidal coral reefs (Ramaiyan & Adiyapatham 1985).

Both Palk bay and southern region supported fewer than five species. These species characteristically prefer shallow shores, except for *C. textile* and *C. madagascariensis*, which are found on rocky shores as well as in depths greater than 25 m. The bottom sediments of Palk Bay consist of silt and clay, a combination of the two, and sand (Asir Ramesh *et al.* 1997). This region is more subject to terrestrial influences of freshwater and silts than other parts of the TamilNadu Coast (Kohn 1978). Silt settlement may affect *Conus* species distributions. The fewer species in Palk Bay may possibly be due to this phenomenon, and only species tolerant to this adverse effect might have successively colonized Palk Bay.

Cone snail communities are known to respond to local habitats. Habitats such as coral reefs are known to support high diversity of cone snails (Kohn 1959, 1967, 1971; Kohn & Leviten 1976; Leviten 1976, 1978; Leviten & Kohn, 1980). High abundance and diversity in certain localities are likely due to favourable food supply and habitat heterogeneity. Physical environment, stresses and partitioning of food and space resources are known to be important determinants of species diversity patterns in *Conus* (Kohn 1978). High diversity of vermivores in cone snail communities has also been reported from other studies (Kohn 1959, 1960, 1978, 1990, 2001; Leviten 1978; Duda *et al.* 2001). However, a satisfactory explanation for this pattern remains elusive.

Conclusions

The subtidal coral reefs of the Gulf of Mannar have more diverse assemblages of cone snails than the vast stretches of sand, muddy or rocky substrates of other regions. The high diversity in the Gulf of Mannar may be partly due to the remoteness of many smaller islands from human influence. These refugia of unperturbed communities form a source pool from which larvae are exported to the neighbouring areas. Moreover, the higher heterogeneity of the substratum like sand, reef, algal cover, dead coral heads, coral boulders, coral rubbles and living corals provide shelter and food for these snails.

In comparison with previous studies in India, this study reports almost 73% (56/77) of species to be restricted to the TamilNadu Coast. Moreover, this study has increased the number of *Conus* species in India from 77 to 81. Thus, a complete analysis of *Conus* fauna along the entire Indian Coast covering all ecological regions may add to the number of known species.

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References

- Abercrombie, A. (1893) The common marine shells of the Bombay shore. (Part I). *Journal of Bombay Natural History Society*, 8, 212–222.
- Adams, A. (1854) Descriptions of New Species of the Genus *Conus*, from the Collection of Hugh Cuming, Esq. *Proceedings of the Zoological Society of London*, pp. 116–119.
- Alonso, D., Khalil, Z., Satkunanathan, N. & Livett, B.G. (2003) Drugs from the Sea: Conotoxins as Drug Leads for Neuropathic Pain and Other Neurological Conditions. *Mini Reviews in Medicinal Chemistry*, 3, 785–787.
- Asir Ramesh, D., Kannupandi, T. & Kannan, L. (1997) Protecting estuaries, lagoons and mangroves: need for an integrated strategy. *Kurukshetra*, 45, 90–92.
- Barros e Cunha, J.G. de (1933) Catálogo descritivo das conchas exóticas da coleção António Augusto de Carvalho Monteiro Família Conidae. *Memórias e Estudos do Museu Zoológico da Universidade de Coimbra*, 1 (71), 1–224.
- Bergh, R. (1895) Beiträge zur Kenntnis der Coniden. *Nova Acta der Kaiserlich Leopoldinisch-Carolinische Deutschen Akademie der Naturforscher*. 65, 67–214.
- Bernardi, M. (1858) Descriptions d'espèces nouvelles. *Journal de Conchyliologie*, 7, 182–184.
- Bernardi, M. (1861) Diagnose de Deux Espèces du Genre *Cône* nouveau. *Journal de Conchyliologie*, 9, 168–171.
- Born, I. von. (1778) *Index Rerum Naturalium Musei Caesari Vindobonensis*. Pars Prima, Testacea. Officina Krausiana, Vienna. pp. 123–155.
- Bruguière, J.G. (1792) Cone. In: *Encyclopédie Méthodique. Histoire Naturelle des Vers, des mollusques*, Paris, Panckoucke, 1, 586–757.
- Cernohorsky, A.R. (1964) The Conidae of Fiji. *The Veliger*, 7, 61–94.
- Chemnitz, J.H. (1788) *Neues Systematisches Conchylien-Cabinet*, Nürnberg, G. N. Rapse, Vol. 10.
- Chemnitz, J.H. (1795) *Neues Systematisches Conchylien-Cabinet*, Nürnberg, G. N. Rapse, Vol. 11.
- Chennappayya, H. (1927) Mollusca. In: *The Littoral Fauna of Krusadai Island in the Gulf of Mannar*. *Bulletin of Madras Government Museum*, 1, 95–109.
- Clover, P.W. (1972) Description of new species of *Conus* from South East Arabia. *Venus, Kyoto*, 31, 117–118.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1979a) Alphabetical revision of the (sub) species in recent Conidae 2 *abbas* to *adansonii*. *Basteria*, 43, 9–23.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1979b) Alphabetical revision of the (sub) species in recent Conidae 2. *adansonii* to *albuquerquei*. *Basteria*, 43, 81–105.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1980) Alphabetical revision of the (sub) species in recent Conidae 3 *albus* to *antillarum*. *Basteria*, 44, 17–49.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1981) Alphabetical revision of the (sub) species in recent Conidae 4 *aphrodite* to *azona* with the description of *C. arenatus bizona*, nov. *Subsp*, *Basteria*, 45, 3–55.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1983) Alphabetical revision of the (sub) species in recent Conidae 6, *cabritti* to *cinereus*. *Basteria*, 47, 67–143.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1985a) Alphabetical revision of the (sub) species in recent Conidae 7, *cingulatus* to *cylindraceus*, including *Conus shikamai* nomen novum. *Basteria*, 48, 223–311.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1985b) Alphabetical revision of the (sub) species in recent Conidae 8, *dactylosus* to *dux*. *Basteria*, 49, 145–196.
- Coomans, H.E., Moolenbeek, R.G. & Wils, E. (1986) Alphabetical revision of the (sub) species in recent Conidae 9, *ebraeus* to *extraordinarius* with the description of *Conus elegans ramalhoi*, nov. subspecies. *Basteria*, 50, 93–150.
- Crichton, M.D. (1940) Marine shells of Madras. *Journal of Conchology*, 21, 193–212.
- Crichton, M.D. (1941) Marine shells of Madras. *Journal of Conchology*, 42, 323–341.
- Crosse, M. (1858) Observations sur la genre Cone et description de trois espèces nouvelles, avec une catalogue alphabé-

- tique des cônes actuellement connus. *Revue et magasin de zoologie pure et appliquée*. 2, 10, 113–2091.
- Crosse, J.C.H. (1865) Description de Cônes nouveaux provenant de la collection Cuming. *Journal de Conchyliologie*, 13, 299–315.
- Crosse, J.C.H. (1872) Diagnoses Molluscorum Novæ Caledonia. *Journal de Conchyliologie*, 20.
- Crosse, H. (1875) Note sur une espèce manuscrite de M. le Professeur G.P. Deshayes. *Journal de Conchyliologie*. 23, 223–225, pl. 9.
- Crosse, J.C.H. (1878) Description d'espèces nouvelles de mollusques. *Journal de Conchyliologie*, 26, 166–169.
- Crosse, J.C.H. & Fischer, P. (1864) Diagnoses Molluscorum Australiae meridionalis. *Journal de Conchyliologie*. 12, 346–350.
- Cuvier, G.L.C.F.D. (1798) *Tableau élémentaire de l'histoire des animaux*. Baudouin, Paris, 16, 710 pp.
- Dall, W.H. (1910) Summary of the Shells of the Genus *Conus* from the Pacific Coast of America in the U.S. National Museum. *Proceedings of the United States National Museum*, 38, 223.
- Dautzenberg, P. (1906) Liste de coquilles marines d'Ambodifoutra (CBte-Est de Sainte-Marie de Madagascar). *Journal de Conchyliologie*, 54, 27–29.
- Dautzenberg, P.H. (1910) Liste de Coquilles Recueillies par le R. P. Aubin dans l'Ile de Ru-Sura (Archipel Salomon) en 1909. *Journal de Conchyliologie*, 58, 24–33.
- Dautzenberg, P. (1932) Mollusques Testacés Marins de Madagascar Supplément. *Journal de Conchyliologie*, 76, 5–119.
- Dautzenberg, P. (1937) Gastropodes Marins. 3. Famille Conidae. *Mémoires du Musée royal d'histoire naturelle de Belgique*, 2 (18), 1–184.
- Dautzenberg, P. & Bouge, J.L. (1933). Les Mollusques Testacés Marins des établissements Français de L'Océanie. *Journal de Conchyliologie*, 77 (1), 41–113.
- Dillwyn, L.W. (1817) A descriptive catalogue of recent shells, arranged according to the Linnean method; with particular attention to the synonymy. *A Descriptive Catalogue of Recent Shells, Arranged According to the Linnean Method; With Particular Attention to the Synonymy*, 1, 1–580.
- Duda, T.F., Kohn, A.J. & Palumbi, S.R. (2001) Origins of diverse feeding ecologies within *Conus*, a genus of venomous marine gastropods. *Biological Journal of Linnean Society*, 73, 391–409.
- Fenaux, A. (1942) Nouvelles Espèces du Genre *Conus*. *Bulletin de l'Institut Océanographique (Monaco)*, 814, 1–4.
- Fenaux, A. (1943) Descriptions de Scalidæ nouveaux. Observations sur la classification de cette famille. Descriptions de Connidæ nouveaux. *Bulletin de l'Institut Océanographique (Monaco)*, 834, 1–4.
- Fischer, G. (1807) *Muséum-Demidoff*. Mis en Ordre Systématique et Descrit Par G. Fischer, Végétaux et Animaux. Université Impériale, Moscow, Vol. 3, p. 330.
- Franklin, J.B., Fernando, S.A., Chalke, B.S. & Krishnan, K.S. (2007) Radular morphology of cone snails (Caenogastropoda: Conidae) from India. *Molluscan Research*, 27 (3), 111–222.
- Frauenfeld, G.R. Von. (1869) Beiträge zur Fauna der Nicobaren. III. *Verhandlungen der Zoologisch-Botanischen Gesellschaft, Wien*, 19, 853–900.
- Garrard, T.A. (1966) New Species of Mollusca from Eastern Australia (Part 2) with Notes on some Known Species. *Journal of the Malacological Society of Australia*, 10, 3–12.
- Gebauer, J.J. (1802) *Systematisches Verzeichniss der Seesterne, Seeigel, Conchylien und Pflanzenthier*. Halle: Gebauer.
- Gmelin, J.F. (1791) *Systema Naturae per Regna Tria Naturae*, Leipzig, 13th ed., 1 (6).
- Gould, A.A. (1850) Descriptions with drawings of several new species of shells brought home from the United States Exploring Expedition. *Proceedings of the Boston Society of Natural History*, 3, 169–172.
- Gravely, F.H. (1942) Shells and other animals remains found on the Madras beach. II. Snails etc. (Mollusca, Gastropoda). *Bulletin of Madras Government Museum*, 5 (2), 1–110.
- Habe, T. (1962) *Coloured Illustrations of the Shells of Japan*. Hoikusha, Osaka, 182 pp.
- Hinds, R.B. (1843) Descriptions of new shells from the collection of Captain Sir Edward Belcher. *The Annals and Magazine of Natural History*, 11, 255–257.
- Holten, H.S. (1802) *Enumeratio systematica Conchyliorum beat. J.H. Chemnitzii*, 1–88.
- Hornell, J. (1949) The study of Indian molluscs. *Journal of Bombay Natural History Society*, 48, 750–774.
- Hornell, J. & Tomlin, J.R. Le. B. (1951) Checklist of marine and fluviatile Mollusca of Bombay and neighbourhood. In: Hornell, *Indian Molluscs*, Bombay Natural History Society, Bombay, pp. 83–94.
- Hylleberg, J. & Kilburn, R. (2002) Annotated inventory of molluscs from the Gulf of Mannar and Vicinity. Tropical Marine Mollusc Programme (TMMP). *Phuket Marine Biological Centre Special Publication*, 26, 19–79.
- Iredale, T. (1931) Australian Molluscan Notes No. 1. *Records of the Australian Museum*, 18 (4), 201–235.
- Jousseume, F. (1872) Description de 3 espèces nouvelles de mollusques (deux Cônes et une Marginelle), par M. le Dr. Jousseume. *Revue et Magasin Zoologie*, 2 (23), 198–203.
- Jousseume, F. (1894) Diagnose des Coquilles de Nouveaux Mollusques. *Bulletin Société Philomathique de Paris*, 8, 6, 98–105.
- Kiener, L.C. (1845–1850) *Species general et iconographie des coquilles vivantes*. Rousseau, Paris, Vol. 2, 379 pp, 111 pls.

- Kiener, L.C. (1847) *Species general et iconographie des coquilles vivantes*, 2. Rousseau, Paris.
- Knorr, G.W. (1757–1772) *Vergnügen der Augen und des Gemüths, in Vorstellung einer allgemeinen Sammlung von Schnecken und Muscheln welche im Meer gefunden werden*, Knorr (Erben), Nürnberg, Vol. 1–6.
- Kohn, A.J. (1959) The ecology of *Conus* in Hawaii. *Ecological Monographs*, 29, 47–90.
- Kohn, A.J. (1960) Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Annals and Magazine of Natural History*, 13 (2), 304.
- Kohn, A.J. (1963) Type specimens and identity of the described species of *Conus*, I. The species described by Linnaeus, 1758–1767. *Zoological Journal of the Linnean Society, London*, 44, 740–768.
- Kohn, A.J. (1964) Type specimens and identity of the described species of *Conus*, II. The species described by Solander, Chemnitz, Born and Lightfoot between 1766 and 1786. *Zoological Journal of the Linnean Society, London*, 45, 151–167.
- Kohn, A.J. (1966) Type specimens and identity of the described species of *Conus*, III. The species described by Gmelin and Blumenbach in 1791. *Zoological Journal of the Linnean Society, London*, 46, 73–102.
- Kohn, A.J. (1967) Environmental complexity and species diversity in the gastropod genus *Conus* on Indo-West pacific reef platforms. *American naturalist*, 101, 251–259.
- Kohn, A.J. (1968) Type specimens and identity of the described species of *Conus*, IV. The species described by Hwass, Bruguière and Olivi in 1792. *Zoological Journal of the Linnean Society, London*, 47, 431–503.
- Kohn, A.J. (1971) Diversity, utilization of resources, and adaptive radiation in shallow-water marine invertebrates of tropical oceanic islands. *Limnology and Oceanography*, 16 (2), 332–348.
- Kohn, A.J. (1975) Type specimens and identity of the described species of *Conus*, V. The species described by Salis Marschlins and Röding, 1793–1798. *Zoological Journal of the Linnean Society, London*, 57, 185–227.
- Kohn, A.J. (1976) Chronological analysis of the species of *Conus* described during the 18th century. *Zoological Journal of the Linnean Society, London*, 58, 39–59.
- Kohn, A.J. (1978) The Conidae (Mollusca: Gastropoda) of India. *Journal of Natural History*, 12, 295–335.
- Kohn, A.J. (1981) Type specimens and identity of the described species of *Conus*, VI. The species described 1801–1810. *Zoological Journal of the Linnean Society, London*, 71 (3), 279–341.
- Kohn, A.J. (1986) Type specimens and identity of the described species of *Conus*, VII. The species described 1801–18200. *Zoological Journal of the Linnean Society, London*, 86 (3), 1–41.
- Kohn, A.J. (1990) Tempo and mode of evolution in Conidae. *Malacologia*, 32, 55–67.
- Kohn, A.J. (1992) A chronological taxonomy of *Conus*, 1758–1840. Smithsonian Institution Press. Washington D.C, 315 pp, 26 pls.
- Kohn, A.J. (2001) The Conidae of India revisited. *Phuket Marine Biological Centre Special Publication*, 25, 357–362.
- Kohn, A.J. & Robertson, R. (1968) The Conidae of the Maldivian and Chagos archipelagos. *Journal of Marine Biological Association of India*, 8, 273–277.
- Kohn, A.J. & Nybakken, J.W. (1975). Ecology of *Conus* on eastern Indian Ocean fringing reefs, diversity of species, and resource utilization. *Marine Biology*, 29, 211–234.
- Kohn, A.J. & Leviten, P.J. (1976) Effects of habitat complexity on population density and species richness in tropical intertidal predatory gastropod assemblages. *Oecologia*, 25, 199–210.
- Küster, H.C. (1838) *Coneae, oder Conidae, I. Conus, Linne. Systematisches Conchylien-Cabinet von Martini und Chemnitz, neu herausgegeben und vervollständigt von H.C. Küster*, 2.
- Lamarck, J.B.P. (1810) *Système des Animaux sans Vertèbres, ou Tableau Général des Classes, des Ordres et des Genres de ces Animaux*. Paris, 432 pp.
- Lamarck, J.B.P. (1822) *Histoire Naturelle sur les Animaux sans Vertèbres*, Verdiere, Paris, 7, 711 pp.
- Leviten, P.J. (1976) The foraging strategy of vermivorous conid gastropods. *Ecological Monograph*, 46, 157–178.
- Leviten, P.J. (1978) Resource partitioning by predatory gastropods of the genus *Conus* on subtidal indo-pacific coral reefs: the significance of prey size. *Ecology*, 59 (3), 614–631.
- Leviten, P.J. & Kohn, A.J. (1980) Microhabitat resource use, activity patterns, and episodic catastrophe: *Conus* on tropical intertidal reef rock benches. *Ecological Monograph*, 50, 55–75.
- Lightfoot, J.B.P. (1786) *A Catalogue of the Portland Museum, lately the property of the Duchess Dowager of Portland, Deceased; which will be sold by auction, &c.* London.
- Linnaeus, C. (1758) *Systema Naturae per Regna Tria Naturae*. 10th ed., 1 Stockholm.
- Link, H.F. (1807) *Beschreibung der Naturalien-Sammlung der Universität zu Rostock, Mollusken*, 2e Abth. Rostock, 3, 106 pp.
- Link, H.F. (1817) *Beschreibung der Naturalien Sammlung der Universität zu Rostock*, Rostock, Alders Erben, Vol. 2, 99 pp.
- Löbbecke, T. (1882) Diagnosen neuer Arten. *Jahrbücher der Deutschen Malakozoologischen Gesellschaft*, 9 (1), 90–91.
- Magurran, A.E. (1988) *Ecological Diversity and its Measurement*. Princeton University Press, Princeton, New Jersey, pp. 179.

- Magurran, A.E. (2003) *Measuring biological diversity*, Blackwell Scientific, Oxford. pp. 260.
- Martini, F.H.W. (1773) *Neues Sytematisches Conchylien-Cabinet*, Nürnberg, G. N. Rapse, Vol. 2.
- Martini, F.H.W. (1777) Beschluss der Nachricht von einigen selten konchylien. *Neuste Mannigfaltigkeiten*, 1, 429–446.
- Massilia, R.G. (1993) Remarks on a confusing group in subgenus *Asprella* (Schaufuss, 1869) (Gastropoda: Prosobranchia: Conidae) and description of *Conus (Asprella) Lovellreevei* n. sp. *Gloria Maris: The periodical of the Belgian Society for Conchology*, 22 (1), 1–7.
- Mawe, J. (1823) *The Linnaean System of Conchology*. London: Longman, Hurst, Rees, Orme, and Brown. p. 207.
- Melville, J.C. (1898) Further investigations into the molluscan fauna of the fauna of the Arabian Sea, Persian Gulf and Gulf of Oman, with descriptions of forty species (Mostly dredged by F.W. Townsend). *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, 42 (4), 1–40, pl.1–2.
- Melville, J.C. (1900) A Revision of the Textile Cones, with a Description of *C. cholmondeleyi*, n. sp. *Journal of Conchology*, 9 (10), 303–311.
- Melville, J.C. (1904) *Conus coromandalicus* Smith, its probable affinities and systematic position in the family Conidae. *Proceedings of the Malacological Society of London*, 6, 170–173.
- Melville, J.C. & Abercrombie, A. (1893) The marine Molluscs of Bombay. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, 7, 17–51.
- Melville, J.C. & Standen, R. (1898) The marine Mollusca of Madras and the immediate neighbourhood. *Journal of Conchology*, 9, 30–48, 85.
- Melville, J.C. & Standen, R. (1899a) Report on the marine mollusca obtained during the first expedition of Prof. A.C. Haddon to the Torres Straits, in 1888–89. *Journal of the Linnean Society of London*, 27, 150–206.
- Melville, J.C. & Standen, R. (1899b) Description of *Conus (Cylinder) clytospira*, sp. n., from the Arabian Sea. *Annals and Magazine of Natural History*, 7, 4, 461–463.
- Melville, J.C. & Standen, R. (1901) The Mollusca of the Persian Gulf, Gulf of Oman, and Arabian Sea, as evidenced mainly through the collection of Mr. F.W. Townsend, 1893–1900: with descriptions of new species. *Proceedings of the Zoological Society of London*, 327–460.
- Menon, P.K.B., Dattagupta, A.K. & Dasgupta, D. (1961) On the marine fauna of the Gulf of Kutch, Part 2. Gastropoda. *Journal of Bombay Natural History Society*, 58, 475–494.
- Mitchell, J. (1867) *Catalogue of the Mollusca*, in the collection of the Madras Government Central Museum, Madras, pp.78.
- Mörch, O.A.L. (1850) *Catalogus conchyliorum quæ reliquit C.P. Kierulf*. Hafinae, Copenhagen, 1–34.
- Motta, A.J. da (1978) Six new Cone shells (Gastropoda: Conidae) from Thailand. *The Centre of Thai Natural Study*, 2, 1, 7, 1–8.
- Motta, A.J. da (1982) Seventeen New Cone Shell Names (Gastropoda: Conidae). *Malacologia Mostra Mondiale*, 1, 1–20.
- Motta, A.J. da & Blöcher, M. (1982) In: da Motta, A. J., Seventeen New Cone Shells Names (Gastropoda: Conidae). *Publicações Ocasioneis da Sociedade Portuguesa de Malacologia*. 1, 1–26.
- Motta, A.J. da (1983) Two new species for the genus *Conus* (Gastropoda: Conidae). *Malacologia Mostra Mondiale*, 2, 1–9.
- Motta, A.J. da (1985a) *Conus asiaticus* n. sp. *La Conchiglia: International Shell Magazine*, 17 (192–193), 25.
- Motta, A.J. da, (1985b) A discussion of a confusing group of species in the genus *Conus* (Gastropoda-Conidae), with description of a new species. *Publicações Ocasioneis da Sociedade Portuguesa de Malacologia* 5, 3–7.
- Motta, A.J. da (1985c) Five new taxa for the genus *Conus* (Gastropoda: Conidae). *Malacologia Mostra Mondiale*, 4, 1–8. p. 6, pl. 1. Figs. 5a–b, 6a–b.
- Motta, A.J. da (1989) A New *Conus* Species Found in the Bay of Bengal, Indian Ocean. *La Conchiglia: International Shell Magazine*, 21 (242–245), 9–11.
- Motta, A.J. da (1990) A New Species for the Genus *Conus* Found in Glorieuses Islands, Western Indian Ocean. *La Conchiglia. International Shell Magazine*, 22 (253–255), 44–46.
- Motta, A.J. da (1992) Replacement Name for *Conus roseus* Lamarck, 1810 non Fischer 1807. *La Conchiglia. International Shell Magazine*, 23 (265), 29–30.
- Motta, A.J. da & Martin, R. (1982) Four new *Conus* species found in waters around Cebu and one from Balut in the Sarangani group. *Carfel Philippine Shell News*, 4 (3), 1, 3, fig. 1.
- Myers, R.A., Cruz, L.J., Rivier, J.E. & Olivera, B.M. (1993) *Conus* peptides as chemical probes for receptors and ion channels. *Chemical reviews* 93, 1923–1936.
- Natarajan, A.V. (1957) Studies on the egg masses and larval development of some prosobranchs from the Gulf of Mannar and the Palk Bay. *Proceedings of the Indian Academy of Sciences*, 46 (3), 170–228.
- Nevill G. & Nevill, H. (1874) Descriptions of New Marine Mollusca from the Indian Ocean. *The Journal of the Asiatic Society of Bengal*, 43, pt. 2, no. 1.
- Okutani, T. (1968) A New Cone from the Bay of Bengal, *Darioconus bengalensis*, n. sp. *Venus*, 26 (3&4), 66–69.
- Olivera, B.M. (2006) *Conus* peptides, Biodiversity-based discovery and exogenomics, *Journal of Biological Chemistry*,

281, 31173–31177.

- Olivera, B.M. & Cruz, L.J. (2001) Conotoxins, in retrospect, *Toxicon*, 39, 7–14.
- Olivera, B.M. & Teichert R.W. (2007) Diversity of the neurotoxic *Conus* peptides: a model for concerted pharmacological discovery. *Molecular Interventions*, 7 (5), 251–60.
- Olivera, B.M., Gray, W.R., Zeikus, R., Mcintosh, J.M., Varga, J., Rivier, J., De Santos, V & Cruz, L.J. (1985) Peptide neurotoxins from fish-hunting cone snails. *Science*, 230 (4732), 1338–1343.
- Olivera, B.M., Rivier J., Scott J.K., Hillyard., D.R & Cruz L.J. (1991) Conotoxins. *Journal of Biological Chemistry*, 266, 22067–70.
- Perry, G. (1810) *Arcana, or the Museum of Natural History; containing the most recent discovered objects*. London, George Smeeton, pp. 84, pl. 251.
- Perry, G. (1811) *Conchology, or the natural history of shells: containing a new arrangement of the genera and species, illustrated by coloured engravings executed from natural specimens and including the latest discoveries*. London, Blumer & Co., pp. 1–4, pl. 61.
- Petuch, E.J. (1979) Twelve new Indo-Pacific gastropods. *Nemouria. Occasional Papers of the Delaware Museum of Natural History*, 23, 1–6.
- Pilsbry, H.A. (1921) Revision of W. M. Gabb's Tertiary Mollusca of Santo Domingo. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 73, 330.
- Ramaiyan, V. & Adiyapatham, S. (1985) Food and feeding adaptations of some coral fishes of PortoNovo (Southeast coast of India). *Proceedings of the Fifth International coral reefs congress, Tahiti*, 2, 4.
- Ray, H.C. (1949) On a collection of Mollusca from the Coromandel coast of India. *Records of the Indian Museum*, 46, 87–122.
- Reeve, L.A. (1843–1849) Monograph of the genus *Conus*. *Conchologia Iconica*, Reeve Bros., London, Vol. 1.
- Richard, G. (1980) *Conus (Leptoconus) lozeti* sp. nov. de l'Océan Indien et Liste des Types de Conidae Conservés au Muséum National d'Histoire Naturelle de Paris. *Cahiers de l'Indo-Pacifique*, 2 (1), 90–100.
- Richard, G. (1990) *Revision des Conidae du Muséum National d'Histoire Naturelle de Paris*. Ecole Pratique des Hautes Etudes, Perpignan Cedex. pp. 231.
- Röckel, D. & Motta, A.J. da (1979) New Cone from Indian Ocean. *La Conchiglia: International Shell Magazine*, 11 (122–123), 17–18.
- Röckel, D. & Korn, W. (1990) *Conus* species from the Western Indian Ocean, dredged by Soviet biologists. *Acta Conchylorum*, 2, 45–49.
- Röckel, D. & Korn, W. (1992) New Species and Subspecies of the Genus *Conus* (Mollusca: Neogastropoda) from the Indo-Pacific. *Acta Conchylorum*, 3, 13–16, pl. 2, fig. 11–20.
- Röckel, D., Korn, W. & Kohn, A.J. (1995) *Manual of the living Conidae*. Vol. 1: Indo-Pacific. Christa Hemmen Verlag, Wiesbaden, pp. 516, pl. 84.
- Röding, P.F. (1798) *Museum Boltenianum sive Catalogus cimeliorum e tribus regnis naturae quae olim collegerat Joa, Fried, Bolten, Hamburg*, 2, 1–8, 199 pp.
- Rossum, H.M. van (1990) A New Cone from the coasts of Kenya (Indian Ocean) (Gastropoda: Conidae). *La Conchiglia. International Shell Magazine*, 22 (250–252), 29–31.
- Rumphius, G.E. (1705) *D' Amboinsche Rariteitkamer*. Fr. Halma, Amsterdam.
- Satyamurti, S. (1952) The Mollusca of Krusadai Island (in the Gulf of Manaar). 1. Amphineura and Gastropoda. *Bulletin of the Madras Government Museum*, 1, 2, 6, 1–267.
- Schepman, M.M. (1913) Prosobranchia of the Siboga Expedition, Part 5. *Siboga-Expeditie*, 49, 365–452.
- Shaw, H.O.N. (1915) Descriptions of colour varieties of *Conus quercinus*, Hwass, and *Cypraea lamarckii*, Gray. *Proceedings of the Malacological Society of London*, 11, pt. 4.
- Shikama, T. (1963) On Some Noteworthy Marine Gastropoda from from Southwestern Japan. *Science Reports of the Yokohama National University* II, 10 (65), 1.
- Shikama, T. (1970) On Some Noteworthy Marine Gastropoda from Southwestern Japan (II). *Science Reports of the Yokohama National University*, 16, 19–27.
- Shikama, T. (1977) Descriptions of new and noteworthy Gastropoda from Western Pacific and Indian Oceans. *Science Reports of the Yokohama National University*, 2, 24, 9–23.
- Smith, E.A. (1877) Descriptions of new species of Conidae and Terebridae. *The Annals and Magazine of Natural History*, 4 (19), 222–231.
- Smith, E.A. (1906) On South African Marine Mollusca, with Descriptions of New Species. *Annals of the Natal Government Museum*, 1 (1), 19–71.
- Smith, E.A. (1892) On a Collection of Marine Shells from Aden, With some Remarks upon the Relationship of the Molluscan Fauna of the Red Sea. *Proceedings of the Zoological Society of London*, 390–436.
- Smith, E.A. (1894) Natural history notes from H.M. Indian Marine Survey Steamer 'Investigator', Commander C.F. Oldham, R.N. Ser. II, No. 10, Report upon some Mollusca dredged in the Bay of Bengal and the Arabian Sea. *Annals and Magazine of Natural History*, 6, 14, 157–174.

- Sowerby I, G.B. (1823) *The Genera of Recent and Fossil Shells, for the use of Students in Conchology and Geology*. London, Vol. 2, 127–262 pls.
- Sowerby I, G.B. (1833) *Conus* In: Sowerby, II, G.B. The Conchological Illustrations or coloured figures of all the hitherto unfigured recent shells. London, pp. 24–37.
- Sowerby I, G.B. (1834) Genus *Conus*. *Proceedings of the Zoological Society of London*. London, Vol. 3.
- Sowerby I, G.B. (1839) *Conus* In: Sowerby, II, G.B. The Conchological Illustrations or coloured figures of all the hitherto unfigured recent shells. London, pp. 112–137.
- Sowerby II, G.B. (1833) *The Conchological Illustrations* or coloured figures of all the hitherto unfigured recent shells. Sowerby, London, p. 24–33, figs. 1–41.
- Sowerby II, G.B. (1841) *The Conchological Illustrations* or coloured figures of all the hitherto unfigured recent shells. Sowerby, London, pls. 177–184.
- Sowerby II, G.B. (1857) Monograph of the genus *Conus* In: *Thesaurus Conchyliorum or Monographs of the Genera of Shells*, London, Vol. 3. 17, pp. 1–24, pls. 187(1)–195(9).
- Sowerby II, G.B. (1858) Monograph of the genus *Conus* In: *Thesaurus conchyliorum or monographs of genera of shells*. London, Vol. 3, 18, pp. 25–56, pls. 196(10)–210(24).
- Sowerby II, G.B. (1865) Descriptions of Two New Species of *Conus* from the Collection of II. Cuming Esq., and Two from the Collection of the Late Mr. Denison. *Proceedings of the Zoological Society of London*, pp. 518, 519, pl. 32, fig. 8–14.
- Sowerby II, G.B. (1866) Monograph of the genus *Conus* In: *Thesaurus Conchyliorum or Monographs of the Genera of Shells*, London, Vol. 3, pp. 24–25, pp. 327–331, pls. 286(25)–289(28).
- Sowerby III, G.B. (1870) Descriptions of Forty-eight new Species of Shells. *Proceedings of the Zoological Society of London*. pp. 219–259.
- Sowerby III G.B. (1873) Descriptions of five new Cones. *Proceedings of the Zoological Society of London*, 145–146.
- Sowerby III, G.B. (1881) Description of eight new species of shells. *Proceedings of the Zoological Society of London*, pp. 635–639.
- Sowerby III, G.B. (1882) Descriptions of new species of shells in the collection of Mr. J. Cosmo Melvill. *Proceedings of the Zoological Society of London*, pp. 117–121.
- Sowerby III, G.B. (1887) *Thesaurus Conchyliorum*. Supplements to the Monograph of *Conus* and *Voluta*, London, Vol. 5. pp. 249–279, pls. 29–36.
- Sowerby III, G.B. (1903) Mollusca of South Africa. *Marine Investigations of South Africa*. 2, 213–232, pl. 3,4.
- Sowerby III, G.B. (1914) Descriptions of new Mollusca from New Caledonia, Japan, Philippines, China, and West Africa. *The Annals and Magazine of Natural History*, 8, 14, 475–480.
- Stoliczka, F. (1867–1868) *Cretaceous fauna of southern India 2. The Gastropoda*. Memoirs of the Geological Society of India, Palaeontologia Indica, I–V, pp. 1–497, pls. 1–28.
- Subrahmanyam, T.V., Karandikar, K.R., & Murti, N.N. (1952) Marine gastropoda of Bombay. Part. II. *Journal of University of Bombay*, 21(3), 26–73.
- Sundaram, K.S. (1969) Catalogue of Molluscs in the reference collections of the Central Marine Fisheries Research Institute. I. Molluscs excluding cephalopods. *Bulletin of Central Marine fisheries Research Institute*, (9), 22.
- Swainson, W. (1840) *A Treatise on Malacology; or the Natural Classification of Shells and Shell-fish*, Lardner's Cabinet Cyclopaedia, London, 419 pp.
- Thurston, E. (1890) *Notes on the pearl and chank fisheries and marine fauna of the Gulf of Mannar*. Madras: Government Central Museum, 116 pp.
- Thurston, E. (1895) Littoral fauna of the Gulf of Mannar. *Bulletin of the Madras Government Museum*, 3, 102–138.
- Tinker, (1952) *Pacific Sea Shells*. A handbook of common marine mollusks of Hawaii and the south seas. Tuttle, Tokyo, 240 pp.
- Tomlin, J.R. le (1926) On South African Marine Mollusca, with Descriptions of New Species. *Annals of the Natal Government Museum*, 5 (3), 298–301.
- Tryon, G.W. Jr. (1883) Family Conidae. *Manual of conchology, structural and systematic, with illustrations of the species*, 1 (6), 3–150.
- Tucker, J.K. (1984) The species described by da Motta and co-workers. *Hawaiian Shell News*, 32 (2), 5–6.
- Walls, J.G. (1979) *Cone shells: A Synopsis of the Living Conidae*. TFH Publications, Neptune City, pp.1011.
- Weinkauff, H.C. (1873) *Die Gattung Conus*. In Küster, H.C., Martini, F.W. & Chemnitz, J.H. *Systematisches Conchylien-Cabinet von Martini und Chemnitz*. Nürnberg, Bauer & Raspe, pp. 204–221.
- Weinkauff, H.C. (1874) Catalog der bis jetzt bekannt gewordenen Arten der Gattung *Conus* L. *Jahrbücher der Deutschen Malakozoologischen Gesellschaft*, 1, 236–268, 273–305.
- Weinkauff, H.C. (1875) *Systematisches Conchylien-Cabinet von Martini und Chemnitz. Die Familie Conacea order Conidae*. Nürnberg: Bauer and Raspe, pp. 413.
- Wils, E. (1970) Family Conidae. Antwerpen, pp. 8–12, pl. 2, fig. 7.
- Wils, E. & Delsaerdt, A. (1989) *Conus lemuriensis* a New Species from Reunion. *Gloria Maris: The periodical of the*

- Belgian Society for Conchology*, 28 (6), 105–110.
- Winckworth, R. (1943) Holten's systematic list of the shells of Chemnitz. *Proceedings of the Malacological Society of London*, 25, 146–150.
- Winckworth, R. (1945) The types of the Boltenian genera. *Proceedings of the Malacological Society of London*, 25, 136–148.
- Woolacott, L. (1956) Notes on Australian Shells No. 1. *Proceedings. Royal Zoological Society of New South Wales*, 1954–55.
- Wright, A.D., Goclik, E., Konig, G.M., Kaminsky, R. & Lepadins, R. (2002) Antiplasmodial and antitrypanosomal decahydroquinoline derivatives from the tropical marine tunicate *Didemnum* sp. *Journal of medicinal chemistry*, 45, 3065–3072.
- Yazhini, H. (2004) Gulf of Mannar needs help. *Indian Ocean Turtle Newsletter*, 3, 10–11.