

## ECHINODERMS OF NIZAMPATNAM BAY, EAST COAST OF INDIA

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The present study provides information about systematics and distribution of echinoderms for the first time along the Nizampatnam Bay, east coast of India. The study carried out over two consequent Post-monsoon seasons (October-November 2006, 2007) and two Pre-monsoon seasons (March-April 2007, 2008) spanning an area of 20 GPS fixed stations (15° 30' 000"-15° 47' 500" N; 80° 17' 000"-80° 45' 000" E) along the Nizampatnam Bay, east coast of India. Altogether 18 species were identified represented by 17 genera, 13 families, 8 orders and 3 classes. During the present study, the asteroid *Astropecten velitaris* has been added to the fauna of India, the asteroids – *Luidia hardwicki*, and *Echinaster purpureus*, *Goniiodiscaster* sp., the ophiuroids – *Ophiocnemis marmorata*, and *Ophiothrix* sp. and the echinoids – *Salmaciella dussumieri*, *Salmacis virgulata* and *Clypeaster humilis* have been added as new species to Andhra Pradesh.

**Key words:** Echinoderms, Nizampatnam Bay, east coast of India

## INTRODUCTION

Echinoderms are exclusively marine organisms and are widely distributed in benthic habitats from the intertidal zone to the deep sea. Apart from the mention in the comprehensive accounts of R.I.M.S *Investigator* collections, there have been a few accounts, particularly of the echinoderms of Andhra Pradesh. Notable among these are of Ganapati and Rao (1962a, b), Radhakrishna and Ganapati (1968) and Vijayakumar *et al.* (1991). However, these are mainly directed towards ecological aspects with only cursory accounts or lists of fauna. Sastry (2007) prepared an annotated list of echinoderm species reported from the Indian coast with state-wise distribution. Based on the literature, it could be stated that there is no information on echinoderms from the Nizampatnam Bay, east coast of India. This is the first available data set on echinoderms from the Nizampatnam Bay, east coast of India. A detailed description and distribution are presented here.

## MATERIAL AND METHODS

The study was carried out over two consequent post-monsoon seasons (October-November 2006, 2007) and pre-monsoon seasons (March-April 2007, 2008) spanning an area of 20 GPS fixed stations (15° 30' 000"-15° 47' 500" N; 80° 17' 000"-80° 45' 000" E) along the Nizampatnam Bay, east coast of India (Table 1; Fig. 1). A naturalist's dredge made of a metal frame (30 cm x 45 cm), fitted with a nylon mesh (1 sq. cm) net and appropriately weighed, proved useful and worked quite satisfactorily up to 50 m while collecting benthos. Altogether, 100 dredge hauls were made. At each location, the dredge was operated for 10-15 minutes at

1.5 knots. Only live specimens were picked and the fauna narcotized and preserved in 5% formalin, later transferred to 70% alcohol and labelled for further work. Simultaneously, observations on environmental variables (sea temperature, dissolved oxygen, salinity, sediment texture-sand, silt, clay or organic matter) were made according to standard protocols (Holme and McIntyre 1984). Biological examination included taxonomic identification based on standard literature (Clark

Table 1: Station Locations

Station No.	Depth (m)	Latitude	Longitude
1	11	15°36'000" N	80°17'000" E
2	11	15°43'000" N	80°22'000" E
3	11	15°46'000" N	80°27'000" E
4	11	15°47'500" N	80°34'000" E
5	10	15°46'000" N	80°41'000" E
6	13	15°37'000" N	80°22'000" E
7	13	15°42'000" N	80°29'000" E
8	13	15°44'000" N	80°37'000" E
9	15	15°30'000" N	80°20'000" E
10	15	15°36'000" N	80°27'000" E
11	15	15°40'000" N	80°34'000" E
12	12	15°30'000" N	80°22'000" E
13	20	15°30'000" N	80°31'000" E
14	20	15°32'500" N	80°34'000" E
15	22	15°36'000" N	80°41'000" E
16	24	15°37'000" N	80°45'000" E
17	24	15°28'000" N	80°34'000" E
18	26	15°31'000" N	80°38'000" E
19	34	15°33'000" N	80°41'000" E
20	26	15°35'500" N	80°45'000" E



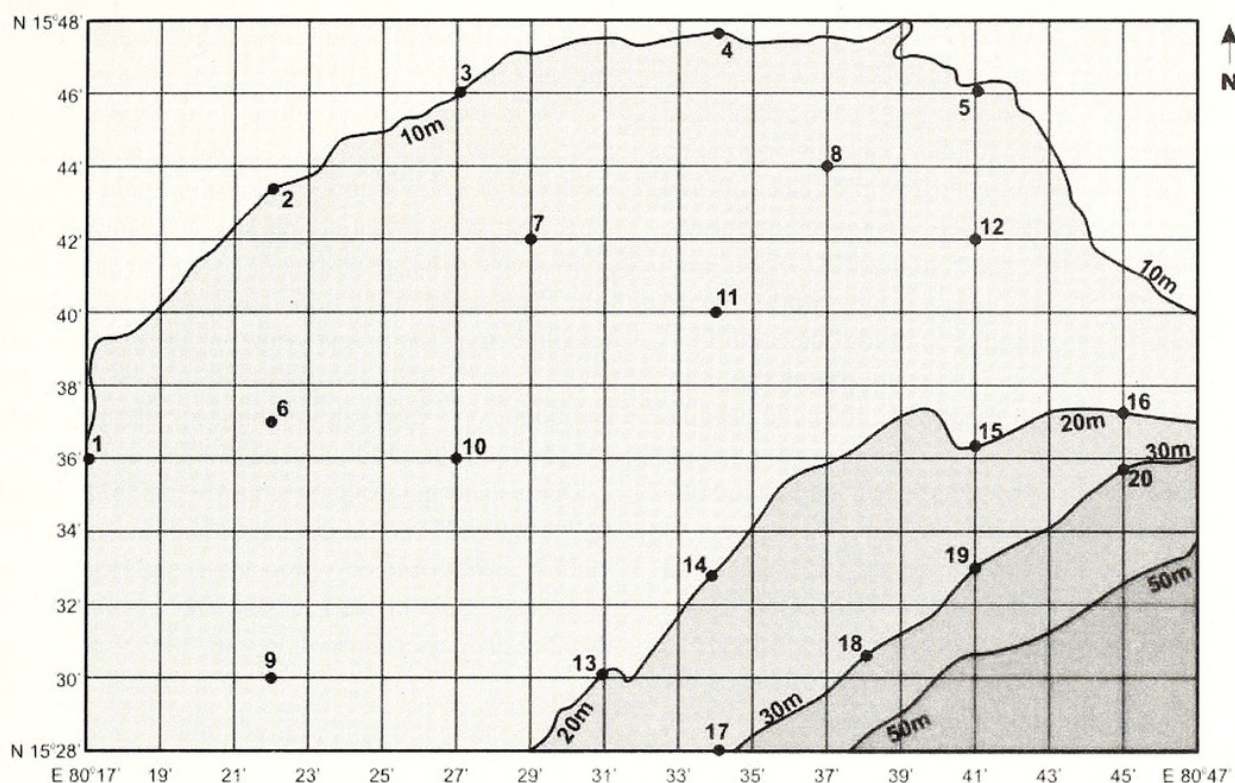


Fig. 1: Study Area

and Rowe 1971; Sastry 2007) and estimations of numerical abundance and biomass.

## RESULTS

Altogether 18 species belonging to 17 genera, 13 families, 8 orders and 3 classes have been identified and reported for the first time from the Nizampatnam Bay. Information on the environmental conditions and organic matter content is presented in Table 2.

In the Bay, the hydrographical conditions are characterised by salinity that varied between 24.8 PSU (st.6, November 07) and 36.81 PSU (st.3, March 07; st.18, March 08), the temperature ranged between 25.0 °C

(st.9, March 07) and 34.1 °C (st.13, October 06) and the dissolved oxygen in the bottom waters ranged from 1.344 ml/l (st.9, October 06) to 5.824 ml/l (st.6, November 07). Sediment organic matter ranged between 0.09% (sts.9,12, October 06) and 2.54% (st.1, March 07). Table 3 contains a classified list of the echinoderm taxa and its distribution in the Nizampatnam Bay.

### Abbreviations:

R - the major radius, from centre to arm tip; r - the minor radius, from centre to interradial edge; br - across the base of the arm; d.d - disc diameter; D - diameter; H - height

**Phylum:** Echinodermata

**Class:** Asteroidea

**Order:** Paxillosida

**Family:** Luidiidae

1. *Luidia hardwicki* (Gray, 1840)

1971. *Luidia hardwicki*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 44 (key), 30-31 (distribution).

2007. *Luidia hardwicki*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Paper No. 271*: 24.

**Material:** Andhra Pradesh: Guntur district,

**Table 2:** Environmental variables of Nizampatnam Bay

Temperature (°C)	25.0-34.1 (29.39 ± 1.51)
Salinity (PSU)	24.8-36.81 (32.25 ± 3.07)
DO (ml/l)	1.344-5.824 (3.64 ± 0.91)
Organic Matter	0.09-2.54 (1.26 ± 0.36)

Note: Values presented range, mean ± S.D.



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Table 3: Checklist and distribution of Echinoderms of Nizampatnam Bay

Species	Stations																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<b>Class Asteroidea</b>																				
<b>Order Paxillosida</b>																				
<b>Family Luidiidae</b>																				
<i>Luidia (Luidia) hardwicki</i> *	+	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	+	+	+	-
<b>Family Astropectinidae</b>																				
<i>Astropecten velitaris</i> **	+	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+	+	+	-
<b>Order Valvatida</b>																				
<b>Family Oreasteridae</b>																				
<i>Anthenea pentagonula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
<i>Goniodiscaster</i> sp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
<b>Order Spinulosida</b>																				
<b>Family Echinasteridae</b>																				
<i>Echinaster purpureus</i> *	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
<b>Class Ophiuroidea</b>																				
<b>Order Ophiurida</b>																				
<b>Family Amphipruridae</b>																				
<i>Amphioplus (Lymanella) depressus</i>	+	+	+	-	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+
<b>Family Ophiotrichidae</b>																				
<i>Ophiocnemis marmorata</i> *	+	+	+	-	+	+	+	-	+	-	+	+	+	-	-	+	+	+	+	+
<i>Ophiotrix</i> sp.*	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	+	+	-	-	-
<b>Class Echinoidea</b>																				
<b>Order Diadematoidea</b>																				
<b>Family Diademataidae</b>																				
<i>Chaetodiadema granulatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
<b>Order Temnopleuroidea</b>																				
<b>Family Temnopleuridae</b>																				
<i>Salmaciella dussumieri</i> *	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	+	+	+	-
<i>Salmacis virgulata</i> *	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	+	+	-
<i>Temnopleurus foreumaticus</i>	+	-	+	+	+	-	-	+	+	-	-	+	-	-	+	-	-	+	+	-
<b>Order Clypeasteroidea</b>																				
<b>Family Clypeasteridae</b>																				
<i>Clypeaster humilis</i> *	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
<i>Clypeaster rarispinus</i>	+	+	-	-	-	-	-	+	+	-	+	-	-	+	+	-	+	+	+	-
<b>Family Astroclypeidae</b>																				
<i>Echinodiscus auritus</i>	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	+	-	-
<b>Order Spatangoida</b>																				
<b>Family Brissidae</b>																				
<i>Brissopsis luzonica</i>	-	-	-	-	-	-	-	-	-	-	+	+	-	+	+	-	+	+	+	-
<b>Family Spatangidae</b>																				
<i>Nacospatangus (Pseudomarettia) alta</i>	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-	+	+	+	-
<b>Family Loveniidae</b>																				
<i>Lovenia elongata</i> *	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	+

+ Present; - Absent

\*\* New Report from India; \* New Reports from Andhra Pradesh



Nizampatnam Bay. During October 2006, single specimen was collected from st.9; two specimens from st.15, of which one specimen has the longest arm ( $R/r = 45/8$  mm) and the second has regenerating arms of 20-22 mm size; two specimens from st.17, larger specimen with complete arm ( $R = 75$  mm), other arms are broken; five specimens from st.18 (four specimens  $R = 11-65$  mm); five specimens from st.19 (two specimens  $R/r = 37/7$  and  $32/7$  mm). In March 2007, two specimens were collected from st.1, single specimen from st.18. In November 2007, twelve specimens were collected from st.17, two from st.18, eight from st.19.

**Remarks:** The specimens measure 12-75 mm in  $R$  and  $r$  = about 5 mm; some of the specimens have only one complete arm and the others are broken or regenerating small arms.

**Distribution:** INDIA: Maharashtra, Tamil Nadu and West Bengal. The specimens are newly recorded from Andhra Pradesh. ELSEWHERE: SE Arabia, Persian Gulf, Islands of Western Indian Ocean, Bay of Bengal, East Indies, South China Sea and North Australia.

**Family:** Astropectinidae

## 2. *Astropecten velitaris* von Martens, 1865

1865. *Astropecten velitaris*: von Marten

1971. *Astropecten velitaris*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 46 (key), 30-31 (distribution).

1989. *Astropecten velitaris*: Clark, A.M. In: Jangoux, M. & J.M. Lawrence (eds): Echinoderm Studies 3: 47

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, two specimens:  $R = 9$  and  $10$  mm (st.18); two specimens  $R = 18$  mm (st.19); one specimen (st.17), eight specimens (st.9) were collected in October 2006; single specimen (sts.1,9,18), two specimens (st.17) collected in March 2007; three specimens (st.9), single (st.13), four specimens (st.17) in November 2007, and single specimen (st.13, March 2008).

**Remarks:** The specimens measure 7-62 mm in  $R$  and  $R = 4.0-4.5$  r.

**Distribution:** The species is new to India. ELSEWHERE: Sri Lanka, East Indies, South China Sea and North Australia.

**Order:** Valvatida

**Family:** Oreasteridae

## 3. *Anthenea pentagonula* Lamarck

1816. *Anthenea pentagonula* Lamarck, J.B.P.A. de: *Hist. nat. anim. s. vert.* 2: 554.

1997. *Anthenea pentagonula*: James, D.B.: *J. mar. biol. Ass. India*, 38: 134.

2007. *Anthenea pentagonula*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Paper No. 271*: 58.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, five specimens,  $R/r = 19/8, 20/8, 25/12, 28/13, 30/13$  (st. 18, October 2006), colour after preservation, pinkish on abactinal, and some actinal plates, others colourless; one specimen  $R/r = 65/30$ , colour reddish when live, turned light brown on preservation (st.17, March 2007); one specimen,  $R/r = 13/6$ . Nine specimens (st.17) and single specimen (st.18) in November 2007, two specimens (st.18, March 2008).

**Description:** Abactinal side slightly convex, abactinal plates irregularly polygonal, closely packed, covered with uniform granulations, a single enlarged tubercle on some of the abactinal plates only in the largest specimen. Superomarginal plates large, vertically aligned but extending to abactinal side forming a side wall, covered with uniform granulation. Inferomarginal plates with a prominent flat spine on the outer lower margin. Actinal plates parallel to the adambulacrals, covered with uniform granulation and with 1-3 large bivalved pedicellariae conspicuous, particularly on the plates adjacent to the adambulacrals. Adambulacral plates with 6-8 furrow spines, 2-3 subambulacral spines and fine granulation outer to these.

**Remarks:** The smallest specimen from st.17 with poorly developed granulation only on the abactinal side, pedicellariae not yet developed, and very small subactinal spines, appeared to be a juvenile. James (1997) revised the specimens of the genus and gave full synonymy.

**Distribution:** INDIA: Gujarat, Tamil Nadu and Orissa. The species is newly recorded from Andhra Pradesh. ELSEWHERE: Bay of Bengal and South China Sea.

## 4. *Goniodiscaster* sp.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay (st.18, October 2006); one disc.

**Remarks:** Because of the availability of a single specimen, the specimen could not be identified up to species level.

**Distribution:** INDIA: Orissa (Barwa and Pundi), Gulf of Mannar, Mandapam, Tamil Nadu. *Goniodiscaster* sp. was reported for the first time from Andhra Pradesh coast. ELSEWHERE: Philippine islands, East Indies, Bay of Bengal. *Goniodiscaster* sp. was reported for the first time from Andhra Pradesh coast.

**Order:** Spinulosida

**Family:** Echinasteridae

## 5. *Echinaster purpureus* (Gray)

1971. *Echinaster purpureus*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 73 (key), 40-41 (distribution).

2007. *Echinaster purpureus*: Sastry, D.R.K.: *Rec. zool.*



*Surv. India, Occ. Papers*, No. 271: 82.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay (st.17, October 2006), one specimen, R/r = 28/6 mm, br = 6 mm, single specimen (st.18, March 2007), three specimens (st.17, November 2007).

**Remarks:** Cylindrical arms with bluntly rounded tips, space between the furrow spines and subambulacral spines, and a single madreporite characterise the specimens.

**Distribution:** INDIA: Gujarat, Tamil Nadu, Orissa and Nicobar Islands. The species is new to Andhra Pradesh. ELSEWHERE: Red Sea, East Africa, Islands of Western Indian Ocean, Mascarene Islands, Maldives and Bay of Bengal.

**Class:** Ophiuroidea

**Order:** Ophiurida

**Family:** Amphiuridae

6. *Amphioplus (Lymanella) depressus* (Ljungman, 1867)

1971. *Amphioplus (Lymanella) depressus*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 102 (key), 80-81 (distribution).

2007. *Amphioplus (Lymanella) depressus*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 135.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, 4 specimens (st.1), eight specimens (st.2), seven specimens, d.d. = 5-6 mm, largest arm bit about 20 mm long. Two specimens (sts.3,5,6,7,13,14), seventeen specimens (st.9), three specimens (st.11), single specimen (sts.12,15,18) in October 2006. Four specimens (st.3), three specimens (st.9) in March 2007; single (sts.16,17,19) and two specimens (st.20) in November 2007; four specimens (st.14) in March 2008.

**Remarks:** Radial shields twice as long as broad; oral shield pointed orally, distally elongated and narrow, adoral shields meeting in front of the oral shield, four oral papillae, third larger than fourth, three lateral spines, pointed, smooth, dorsal arm plates broader than long, distal margin convex; ventral arm plates broader than long, two tentacle scales.

**Distribution:** India, ELSEWHERE: Bay of Bengal, East Indies, Philippine Islands, North Australia and South Pacific Islands.

**Family:** Ophiotrichidae

7. *Ophiocnemis marmorata* (Lamarck, 1816)

1971. *Ophiocnemis marmorata*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 106 (key), 84-85 (distribution).

2007. *Ophiocnemis marmorata*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 145.

**Material:** Andhra Pradesh: Guntur district,

Nizampatnam Bay, three specimens (st.1), six specimens (st.2), nine specimens (st.3), one specimen (sts.5,7,12), one specimen (st.17), d.d.=14 mm. Two specimens (sts.6,18), twenty (st.9), five (st.11), four (st.13) in October 2006. Seven (st.9) in March 2007, single (sts.12,20) two (sts.16,17,19) in November 2007, two (st.18) in March 2008.

**Remarks:** The specimens show extremely large radial shields, and naked ventral interradial regions devoid of scales typical of the specimens with disc granulation. The species is a new record from the coast of Andhra Pradesh.

**Distribution:** East Africa and Madagascar, Ceylon, East Indies, North Australia, Philippine Islands, China and South Japan.

8. *Ophiothrix* sp.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, nine specimens (st.9), two (sts.13,17) in October 2006; single specimen (st.17) in March 2007; single (st.16) in March 2008.

**Remarks:** Because of the bad condition of the arm, the specimens could not be identified with any specimens. However, no specimens of the genus was reported so far, from the coast of Andhra Pradesh

**Class:** Echinoidea

**Order:** Diadematoida

**Family:** Diadematidae

9. *Chaetodiadema granulatatum* Mortensen, 1903

1971. *Chaetodiadema granulatatum*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 152 (key), 140-141 (distribution).

2007. *Chaetodiadema granulatatum*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 164.

**Material:** Andhra Pradesh: Guntur district, off Nizampatnam Bay, 30 m, seven specimens (st.19, November 2007).

**Remarks:** The specimens measure 100-130 mm in diameter and 30-40 mm in height with D = 3.0-3.5H. The test is somewhat flexible. From Andhra Pradesh, the species was earlier known from Srikulam and Vizianagaram districts.

**Distribution:** India, ELSEWHERE: Red Sea, Maldives, East Indies, North Australia, Philippine Islands, China, South Japan.

**Order:** Temnopleuroida

**Family:** Temnopleuridae

10. *Salmaciella dussumieri* (L. Agassiz, 1846)

1971. *Salmaciella dussumieri*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 155 (key), 140-141 (distribution).



2007. *Salmaciella dussumieri*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 172.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, seven specimens (st.18) in October 2006, of which three specimens D/H = 20/7, 20/7 and 23/8 mm respectively. Five specimens (st.9), single (st.14) in October 2006; single (st.9) in March 2007, two (st.17), eight (st.19) in November 2007.

**Remarks:** The specimens show angular pits, primary tubercles one each on every ambulacral plate and primary spines banded green. The species is new record for Andhra Pradesh.

**Distribution:** Islands of the West Indian Ocean, East Africa and Madagascar, Red Sea, South-east Arabia, Ceylon, East Indies, North Australia, Philippine Islands, China and South Japan.

#### 11. *Salmacis virgulata* (L. Agassiz, 1846)

1846. *Salmacis virgulata* Agassiz, L. In: Agassiz, L. & E. Desor: *Ann. Sci. nat.* (3)6: 359.

1971. *Salmacis virgulata*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 156 (key), 140-141 (distribution).

2007. *Salmacis virgulata*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 174.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, eight specimens (st.9), single (st.18) in October 2006; single (st.9) in March 2007; single (st.17), four (st.19) in 2007.

**Remarks:** The specimens measure D/H = 50/25 mm. The spines are characteristically violet tipped.

**Distribution:** INDIA: Lakshadweep and Tamil Nadu. The species is newly recorded from Andhra Pradesh. ELSEWHERE: Bay of Bengal, East Indies, Philippine Islands and South China Sea.

#### 12. *Temnopleurus toreumaticus* (Leske, 1778)

1971. *Temnopleurus toreumaticus*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 154 (key), 142-143 (distribution).

2007. *Temnopleurus toreumaticus*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 176.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, thirty-two (st.1), two (st.19), fourteen (st.3), single (sts.4,5,19), two (sts.8,9,12) in October 2006; single (sts.1,18) in March 2007; ten (st.15), single (st.19) in November 2007; single (st.3) in March 2008.

**Remarks:** The specimens show large angular pits and crenulated tubercles on the test and pore pairs in arcs of three. The young ones occur in large aggregations in the subtidal depths, particularly around the river mouths.

**Distribution:** East Africa and Madagascar, Red Sea,

South-east Arabia, Persian Gulf, West India, Pakistan, Maldives, Ceylon, East Indies, North Australia, Philippine Islands, China and South Japan, South Pacific Islands.

**Order:** Clypeasteroidea

**Family:** Clypeasteridae

#### 13. *Clypeaster humilis* (Leske, 1778)

1894. *Clypeaster humilis*: Anderson, A.R.S.: *Jour. Asiat. Soc. Beng.* 62 (part II, No. 3): Andhra Pradesh: Numerous specimens from Off Coromandel; Kerala (Malabar Coast) and Sri Lankan coasts, 18-73 m (10-40 fms. (fms depth in fathoms)). The material probably belongs to *Clypeaster reticulatus* or *Clypeaster rarispinus*, there being no material of *C. humilis* available to Koehler (vide infra).

1922. *Clypeaster humilis*: Koehler, R.: Echinoderma of the Indian Museum, part IX: 51. No specimen of Investigator collection from Indian coast was available to Koehler; hence a specimen from Red Sea was described. This makes one doubt the identity of specimens reported by Anderson, 1894 (vide supra).

1971. *Clypeaster humilis*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 161 (key), 144-145 (distribution).

2007. *Clypeaster humilis*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 186.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, one specimen (st.18, October 2006), single specimen (st.17, November 2007), anterior radius = 40 mm, breadth = 70 mm, posterior region broken.

**Remarks:** In view of the non-availability of specimens to Koehler and consequent doubtful identity of specimens from Andhra Pradesh reported by Anderson as noted by Sastry (2007), this is the first report of the specimens from Andhra Pradesh.

**Distribution:** East Africa and Madagascar, Red Sea, South-east Arabia, Persian Gulf, Ceylon, East Indies, North Australia, Philippine Islands, South Pacific Islands.

#### 14. *Clypeaster rarispinus* de Meijere, 1903

1971. *Clypeaster rarispinus*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 160 (key), 144-145 (distribution).

2007. *Clypeaster rarispinus*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 187.

**Material:** Andhra Pradesh, one specimen; Guntur district, Nizampatnam Bay. Three (st.2), single (sts.8,9,11), four (st.14), thirteen (st.15), twenty-nine (st.19) in October 2006; five (sts.1,18), single (st.14), three (st.17) in March 2007. Single (st.15), forty-six (st.17), four (st.18), two



(st.19) in November 2007. Single (st.9), three (st.17) in March 2008. Two specimens (st.19, October 2006), 1 x b = 18 x 22 mm, longer than wide; one specimen (st. 17) in March 2007, 35 x 32 mm; and four specimens (st.17) in November 2007, 45 x 40 mm.

**Remarks:** The species was earlier known from Andhra Pradesh and Orissa coasts.

**Distribution:** East Africa and Madagascar, Red Sea, South-east Arabia, Persian Gulf, west India, Pakistan, Maldives, Ceylon and East Indies.

**Family:** Astriclypeidae

15. *Echinodiscus auritus* Leske, 1778

1971. *Echinodiscus auritus*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 162 (key), 144-145 (distribution).

2007. *Echinodiscus auritus*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 198.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, five specimens (st.17 = 95-120 mm), lunules about 35 mm long, single specimen (sts.9,18) in October 2006; two specimens (st.9) in March 2008.

**Remarks:** The species was earlier known from Andhra Pradesh and Orissa coasts.

**Distribution:** Mascarene Islands, East Africa and Madagascar, Red Sea, South-east Arabia, Persian Gulf, West India and Pakistan, Ceylon, East Indies, North Australia, Philippine Islands, China and South Japan.

**Order:** Spatangoida

**Family:** Brissidae

16. *Brissopsis luzonica* (Gray, 1851)

1971. *Brissopsis luzonica*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 165 (key), 146-147 (distribution).

2007. *Brissopsis luzonica*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 205.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, single (st.11), six (st.15) in October 2006; single (st.12), six (st.17), ten (st.18) in November 2007; three (st.14), four (st.18), single (st.19) in March 2008 (single specimen from st.19 measured 1 x b x h = 26 x 20 x 10 mm).

**Remarks:** Along the coast of Andhra Pradesh, the specimens were earlier reported from R.I.M.S. Investigator St. 98. Off Santapalli of Vizianagaram district.

**Distribution:** East Africa, Madagascar, Red Sea, West India, Pakistan, Maldives, East Indies, North Australia, Philippine Islands, China and South Japan, South Pacific Islands, Hawaiian Islands.

**Family:** Spatangidae

17. *Nacospatangus (Pseudomaretia) alta* (A. Agassiz, 1863)

1971. *Pseudomaretia alta*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 165 (key), 146-147 (distribution).

2007. *Nacospatangus (Pseudomaretia) alta*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 210.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, three specimens (sts.9,13,14), two specimens (st.17), five specimens (st.18) in October 2006; two specimens (sts.17,19) in November 2007; single specimen (st.17) in March 2008. One specimen, primary spines only two in a single row in lower area of postero lateral interamb; two specimen (st.18) in October 2006, 1 x b x h = 30 x 22 x 9 and 33 x 24 x 12 mm respectively.

**Remarks:** The species was earlier known from Andhra Pradesh and Orissa coasts.

**Distribution:** Islands of West Indian Ocean, Mascarene Islands, Maldives, Ceylon, East Indies, Philippine Islands, China and South Japan.

**Family:** Loveniidae

18. *Lovenia elongata* (Gray, 1845)

1971. *Lovenia elongata*: Clark, A.M. and F.W.E. Rowe: Monograph of shallow-water Indo-west Pacific echinoderms, 164 (key), 146-147 (distribution).

2007. *Lovenia elongata*: Sastry, D.R.K.: *Rec. zool. Surv. India, Occ. Papers* No. 271: 211.

**Material:** Andhra Pradesh: Guntur district, Nizampatnam Bay, seven specimens (st.14), four (st.17) in October 2006; single (sts.14,18,20), one specimen, 1 x b x h = 38 x 30 x 14 mm, highest at posterior inter-ambulacrum, flat and low anterior to apical system.

**Remarks:** The earlier reports of the specimens from India were from Tamil Nadu coast and the locality reported as Coromandel coast which falls within Andhra Pradesh coast is not known. As such, this is the first report of the specimens from Andhra Pradesh.

**Distribution:** East Africa and Madagascar, Red Sea, South-east Arabia, Persian Gulf, Maldives, Ceylon, East Indies, North Australia, Philippine Islands, China and South Japan.

## SUMMARY

During the present study, the asteroid *Astropecten velitaris* is added new to the fauna of India, the asteroids – *Luidia hardwicki*, *Echinaster purpureus* and *Goniodiscaster* sp., the ophiuroids – *Ophiocnemis marmorata*, and *Ophiothrix* sp. and the echinoids – *Salmaciella dussumieri*,



*Salmacis virgulata*, *Clypeaster humilis* and *Lovenia elongata* are new records for Andhra Pradesh.

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