Estuarine Ecosystem Series, 6

Fauna of

Vamsadhara and Nagavali Estuaries

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FAUNA OF VAMSADHARA AND NAGAVALI ESTUARIES, ANDHRA PRADESH

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FAUNA OF VAMSADHARA AND NAGAVALI ESTUARIES, ANDHRA PRADESH ESTUARINE ECOSYSTEM SERIES

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OVERVIEW

C.A. NAGESWARA RAO
Zoological Survey of India, Freshwater Biology Regional Centre, Hyderabad

INTRODUCTION

Studies on coastal and estuarine faunal diversity and ecology along the Indian coast line has been one of the major field of studies as these areas are rich in faunal diversity and productivity. The importance of coastal fisheries, its diversity and exploitation has added a new dimension to the importance of coastal and estuarine studies. Further the vast and long coast line interspersed with several rivers opening into the sea forming a unique estuarine ecosystem with vast areas of mudflats, swamps, and large areas of mangrove forests offer wide spectrum of habitats for the quantitatively rich faunal elements.

Due to its specialized habitat, commercial and social significance and aquaculture activities, the estuarine habitat has attracted the attention of biologists since long for exploring these areas for faunal inventorisation and their ecology. Though faunal studies on major estuaries viz., Ganges, Mahanadi, Godavari, Vellar, Kerala estuaries, Chilka and Pulicat lakes are available, information on minor and medium rivers and their estuaries are negligible.

Estuarine Biological Station of Zoological Survey of India has undertaken studies on faunal exploration of Chilika lake, Rushikulya, Mahanadi, Godavary and Krishna estuaries during 1983-2000, and undertook the studies on faunal diversity of Vamsadhara and Nagavali estuaries, two minor rivers of North Andhra Pradesh as a project of its continuing studies on Indian estuaries during 2000-2002.

STUDY AREA

Vamsadhara river, a minor and not perennial one originates from Eastern Ghats in Phulbani district of Orissa, passes through Orissa State and enters Pathapatnam taluk of Srikakulam district in. Andhra Pradesh. After flowing for about 30-40 kms. towards east, the river meets Bay of Bengal at Kalingapatnam situated north of Srikakulam town.

At a place called Gotta, a barrage on this river has been constructed which stores most of its water for irrigation. Since this river is not a perennial one, it is very shallow though

wide and its flow depends on rains. Very less water flowing through the river is seen during the year except in monsoon months. During rainy season heavy discharges from barrage leads to greater flows resulting in floods along its course. The river is quite wide of about 700 mts. and becomes much wider dividing into two branches about 2 kms. upstream from its mouth, with an island like land mass in between and joining again, forming a single stream with a narrow opening into the sea. A sand bar formation was noticed at mouth region, making the mouth shallow during most of the year except rainy season. Since this river originates and flows long distance in hilly terrain and flows short distance in plains with limited fresh water discharges, not much silt and clay are deposited at the mouth as seen in many estuaries. The river bed is completely sandy up to its mouth area except for small muddy areas formed before mouth area. As the fresh water discharge from the river is very limited, the estuarine conditions are noticed only for 2-3 km. upstream from mouth.

Shallow nature of the river, limited freshwater discharge and minimum estuarine area resulted in absence of marine faunal elements entering and settling in the estuarine part of the river. Thus a few marine nektonic forms are noticed in the estuarine area. Further lack of mud flats, swamps and mangroves resulted in colonization of a few benthic elements in the estuary. Therefore estuarine faunal diversity appears to be limited in this area. The Map (Fig. 1) depicts the rivers Vamsadhara-Nagavali opening into Bay of Bengal, and the mouth area of the rivers opening into the sea, are the areas of study from where the samples were collected.

Nagavali river, also a minor and seasonal one, originates in the Eastern Ghats of Orissa and enters plains of Andhra Pradesh at Parvatipuram, after flowing for about 50 kms. in plains of Srikakulam district and joins Bay of Bengal at Mofusbandar, 5 km.south of Srikakulam town (A.P). This river also exhibits similar conditions as in Vamsadara in its flow pattern, sediment accumulation, and salinity intrusion upstream. A barrage at Thotapalli about 30 km. upstream reduces the river flow to minimum levels through out the year except in rainy season during which floods are common.

Since both the rivers exhibit similar conditions and opening into Bay of Bengal within a distance of 15 km, survey and sampling of faunal material and related data from these two estuaries has been done simultaneously. Since estuarine conditions are noticed for a 1-2 km. stretch of the river course and freshwater discharges are very less during most of the year, development of habitat conducive for the sustenance of estuarine fauna is very less thus in the estuary only a few marine and estuarine fauna are noticed. Further, the shallow nature of the river and also at its mouth area is not conducive for the sustenance of faunal diversity both in qualitative as well as quantitative terms.

METHODOLOGY

A total of four faunistic surveys (June 2000, July 2001, March 2002 and January 2003) were conducted at estuarine areas of Vamsadhara-Nagavali estuaries of Srikakulam dist. (A.P). Since the estuarine areas in both the rivers are limited to 1-3 kms. upstream of the respective mouth areas, collections were made at localities close to the mouth areas and their vicinities only.

Faunal samples were collected through hand nets operated in shallow areas for nektonic material. Samples of fishes, crabs and prawns were collected through cast nets and from local fish market. Benthic samples were collected through sieving the sediment samples collected from intertidal and shallow areas exposed during low tides. At all the collection stations, plankton samples collected and pH. and salinity of water samples recorded.

COLLECTION LOCALITIES AND THEIR ECOLOGY

The location of mouth area of the Vamsadhara-Nagaveli river is shown in the Map given here. (Fig. 1) Collections from Vamsadhara were made at the following localities.

1. Vamsadhara estuary, mouth area, Kalingapatnam :

This point is very close to the mouth, with less freshwater discharge and sandy sediment. Tidal influx limited due to sand bar. Salinity ranging 3-37 ppt. and pH. 7-8 noted.

2. Vamsadhara estuary, near light house, Kalingapatnam :

This point is about 1 km. from mouth area; here the sediment is mixture of sand-silt; very shallow. Salinity ranging 5-25 ppt. and pH of 7-8 noticed.

3. Vamsadhara estuary, mouth area of northern branch :

This point is closer to mouth area, tidal inflow is high and sediment is sandy. Salinity ranging 1-34 ppt. and pH of 7.5 recorded.

At all the above localities very little estuarine fishing activity is observed except a few fishermen operating cast nets.

Collections at Nagavali river mouth were made at only two localities as estuarine area extends for a very limited area upstream from mouth. The river at its mouth area is deep as more fresh water inflows are seen and tidal effect is restricted due to sand bar formation.

1. **Gangalavanipeta (Mofazbandar)**

This is the mouth area of the river on northern side and a creek opens into the river at this point. At this locality the coast line is little muddy with fine sand. Oysters and other mollusc populations are noticed. Salinity ranging 0-16 ppt. and pH of 7 was recorded at this station.Estuarine fishery is seen with mullets and Prawns as main catch.

2. **Nagavali estuary mouth (Southern side)**

This point can be reached by crossing the river which is quite deep here. This area is also with muddy-sandy bottom and less sea water influence due to sand bar.Fishing through drag nets was observed. Salinity ranging 0-16 ppt. and pH of 7-7.5 recorded.

FAUNAL SAMPLES COLLECTED

A Total of 1722 exs., of different faunal groups were collected, Coelenterate populations appear very less. Among benthos, Polychaetes, Crabs, Hermit Crabs, Bivalves and Gastropods are predominant. Prawns and fishes were also collected from fishing boats.

OVERVIEW OF THE FAUNA

Of different faunal groups collected, only Polychaetes, Prawns, Crabs, Molluscs and Fishes are dealt herewith.

Polychaeta

This faunal group constitutes a major component along with other invertebrates, serving an important role in the food chain of estuarine habitats. From the two minor estuaries only 105 polychaete specimens could be collected which are found to belong to 13 species of 11 genera and 6 families.Polychaete population as well as its diversity appears poor since the estuarine areas extends to a very limited area of the river with no suitable sediment formation for Polychaete inhabitation due to less fresh water discharge, less tidal inflow and shallowness of the river. Absence of mud flats at the mouth areas of the two rivers is also a significant factor for less polychaete populations as estuarine polychaetes of families nereidae, nepthydidae, spionide, eunicidae, capitllidae and to some extent glyceridae and teribellidae prefers sediments containing silt- clay with some sand content. As such all the 13 species of polychaetes reported herein form first records from these two estuaries and species viz. *T. fauveli*, L.*notocirrata*, *L. tetraura, O.eremita* and *M.aberrans* are first records from coastal areas of Andhra Pradesh.

Prawns

Prawns and shrimps constitute an important and valuable fishery resource along both the coasts of India. It is one of the most important foreign exchange earners of the country. Although, prawn and shrimp fauna of Indian estuaries has been considerably worked out very little information is available about the group from Vamsadhara and Nagavali estuaries. The present work was, therefore, undertaken to fill up this gap. A total of 430 examples of both penaeid and non-paenid prawns were collected and examined. These belong to 10 species under 3 genera and 2 families.

Crabs

A total of 150 examples of crabs belonging to 17 species of Brachyuran crabs under 13 genera and 5 families have been recorded from Vamsadhara and Nagavali estuaries, Srikakulam, Andhra Pradesh. All species except *Doclea muricata* recorded herein are reported for the first time from these estuaries. Various factors like varying tidal inundation, hydrological factors, physical and chemical nature of the sediment etc. govern the nature and distribution of crab fauna in an estuary. The lower species diversity in Vamsadhara and Nagavali estuaries may be related to poor habitat diversity.

Mollusca

In this study a total of 56 species belonging to 44genera and 31 families representing 2 classes of phylum mollusca have been reported. The class Gastropoda is represented by 28 species belonging to 23 genera and 18 families. As many 28 species under 21 genera and 13 families are listed under the class Bivalvia. Present study shows two classes of phylum mollusca namely Gastropoda and Bivalvia have their representatives in this estuary, which includes true estuarine, marine and fresh water species. Most of the species reported from Vamsadhara and Nagavali estuaries are common either to Godavari Estuary or Krishna Estuary of Andhra coast, but species like *Phalium areola, Murex carbonnieri, Babylonia spirata, Oliva caerulea, Architectonica laevigata, Architectonica perspectiva, Haminoea elegans* among gastropods and *Barbatia bistrigata, Glycymeris tenuicostata, Lima vulgaris, Cardita antiquata, Tapes bruguieri, Gastrana polygona, Sunetta donacina, Sunetta meroe and Sunetta scripta* among bivalves are occurring in Vamsadhara and Nagavali Estuaries but not reported from Godavari and Krishna Estuaries.

Fishes

The study of Ichthyofaunal resources of Vamsadhara and Nagavali estuaries, revealed 98 species under 70 genera belonging to 40 families and 13 orders from 900 fish samples. The present paper forms the first report of the ichthyofaunal diversity of Vamsadhara and Nagavali estuaries of Srikakulam District in Andhra Pradesh. Only one species *Arius gagora* is reported here for extension of distributional range as it was reported only from Orissa and West Bengal, in India. About 71 percent of the fishes recorded here have commercial value.

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POLYCHAETA (ANNELIDA)

C.A. NAGESWARA RAO
Zoological Survey of India, Freshwater Biology Regional Centre, Hyderabad

INTRODUCTION

Polychaetous annelids though mostly are marine inhabitatants, several species inhabits mixed water habitats also such as estuaries, lagoons ,mangroves and backwaters as several polychaete species are euryhaline. Among the coastal and estuarine faunal groups, the important role of polychates as one of the major benthic component can be realized as this group occupies important position in its species diversity as well as in total numbers. About 175 species of polychaetes are reported from these habitats along Indian coasts.

Among benthos of estuarine habitats, polychaetes constitute as major component along with mollusca, crustacea and other lower and minor invertebrates serving an important role in the food chain of estuarine habitats.

Information on polychaete faunal diversity of the major Indian estuarine areas *viz.*, Gangetic delta, Mahanadi, Godavari, Krishna and Vellar along with some estuaries of west coast is well documented. Similarly polychaete faunal details of major lagoons *viz.* Chilika, Pulicat and Vembanad are also available. (Southern 1921, Rao & Ramsharma,1983; Sri. Krishana Das *et. al.,* 1987; Sanjeeva Raj, 1987, Misra, 1995, Rao, 1995, 1998, 2001 and 2009).

Along with many major river systems, several minor rivers exist along east and west coast of India forming small but important estuaries contributing faunal diversity, fishery resources and aquaculture potential. Though much information on ecology, faunal diversity, and fishery resources of major Indian estuaries are available, information on minor estuaries is meagere and negligible.

Some information pertaining pollution ecology, plankton and fishery of rivers *viz.*, Rushikulya (Orissa), Gosthani (A.P.), Adayar and some other minor rivers of Tamil nadu, Kerala and Karnataka are available. However the information on polychaete diversity of minor estuaries is very negligible except those of Rao (1992) from Rushikulya estuary and few others from west coast.

MATERIALS AND METHODS

Polychaete material reported in this paper was collected durig three surveys (2000-2002) in the estuarine areas of Vamsadhara-Nagavali estuaries (Srikakulam dist, A.P). The samples were collected by sieving the sediment samples collected from intertidal localities and shallow areas exposed during low tides. Samples were also collected by hand picking using forceps from under stones, logs and other substrata.

Polychaete population as well as its diversity appears poor since the estuarine areas extends to a very limited stretch of the river with no suitable sediment formation for polychaete inhabitation due to less fresh water discharge, lower tidal inflow and shallowness of the river. The brief details of collection localities from where the polychaetes are reported herein is given in introduction chapter indicating type of habitat and salinity.

A total of 105 examples were collected and identified and are reported here with a brief description and distribution for each species along with salinity of the collecting locality at the time of collection of the material.

SYSTEMATIC ACCOUNT

Famliy NEREIDAE

1. *Lycstonerei s indica* Rao, 1981

Material : 3 exs., mouth area, Vamsadhara estuary, Kalingapatnam; 23.6.2000, P-5987.

Description : Very narrow and long specimens of 3-4 cm.; prostomium with knob-like paired antennae and a pair of bulbous palps and 2 pairs of eyes; three pairs of small tentacular cirri; chitinous paragnaths absent; parapodia biramous, dorsal ligule with 1-2 spinigers and ventral ramus with spinigers and falcigers; dorsal ligule reduced towards posterior end and dorsal cirri not enlarged in the posterior segments; pair of anal cirri

Distribution : Hugli-Matla estuary, Baitarani estuary (Orissa) and Godavari estuary. The present material is collected at salinity of 10 ppt.

2. *Tylonereis bogoyawlenskyi* Fauvel, 1911

Material : 1 ex., south branch, Vamsadara estuary, Kalingapatnam; 4.3.2002, P-5988; 6 exs., Ganagalavaripeta, Nagavali estuary, Mofus Bandar; 25.6.2000, P-5989; 6 exs., near creak opening, Nagavali estuary, Mofus Bandar; 6.3.2002, P-5990.

Description : Specimens about 5-6 cm. in length; prostomium without chitinous paragnaths, and only soft paragnaths present; feet biramous with homogomph spinigers only; Notopodia with dorsal lobe expanded and triangular, while lower lobe which is elongated and expanded at its tip with setae in posterior feet; Neuropodia bilobed in anterior feet and trilobed in posterior feet; a pair of anal cirri.

Distribution : Hugli-Matla, Mahanadi, and Godavari estuaries. Tamil nadu coast and Vembanad lake (Kerala). Specimens reported here are collected at salinities of 1-25 ppt.

3. ***Tylonereis fauveli*** Southern, 1921

Material : 12exs., Ganagalavani peta, Ngavali estuary, Mofus Bandar; 26.6.2000. P-5991; 3 exs., Vamsadara estuary, Kalingapatnam; 5.3.2002, P-5992; 6 exs., middle region, Vamsadara estuary, Kalingapatnam; 4.3.2002, P-5993.

Description : Specimens large about 6-7 cm., proboscis with chitinous paragnaths absent and soft papillae only; some specimens with 5 pairs of tentacular cirri; parapodia bilobed; dorsal lobe of notopodia expanded and leaf like with dark pigmention;.lower lobe of the notopodia elongated and expanded at its tip; ventral ligule bilobed; Spinigerous setae only; A pair of anal cirri.

Distribution : Chilika lake, pulicat lake and pamban waters. This is first report from estuarine waters. The specimens reported here are collected at salinities 0-25ppt.

Family EUNICIDAE

4. ***Lumbrinereis notocirrata*** (Fauvel, 1932)

Material : 1 ex., mouth area Nagavali estuary, Mofus Bandar; 6.3.2002, P-5994; 10 exs., south branch, Vamsadara estuary, Kalingapatnam; 4.3.2002, P-5995.

Description : Very long and cylindrical worms of about 20 cm.; prostomium blunt; Feet with capillaries and simple hooks; no branchiae; Dorsal cirri small, knob-like in anterior feet and finger shaped in middle feet; Ventral ligule long and erect in mid and posterior feet.

Distribution : Gangetic delta and Rushikulya estuary specimens collected at salinities of 15-25 ppt.

5. ***Lumbrinereis tetraura*** (Schmarda, 1861)

Material : 5 exs., southern branch, Vamsadara estuary, Kalingapatnam; 4.3.2002, P-5996.

Description : Long, narrow and cylindrical worms of 15-20 cm; prostomium conical; Anterior lobe of parapodia short while posterior lobe long, cirriform and slightly erect; Anterior feet with capillary setae and hooks; posterior feet with only hooks.

Distribution : Mahanadi estuary and Porto Novo waters. Specimens are collected at salinity of 25 ppt.

6. ***Onuphis eremita*** Audouin & M. Edwards, 1833

Material : 2 exs., south branch, Vamsadara estuary, Kalingapatnam; 4.3 2002, P-5997.

Description : Specimens broad and measuring 10 cm. in length; prostomium rounded, paired pad-like palps, a pair of small frontal tentacles and 5 nos. of occipital tentacles with

ringed ceratophores; First segment achaetous with two small tentacular cirri. Simple gills from 1-10th segment and after wards gills pectinate with 5-6 filaments. Pseudo-compound bristles with bi or tri dentate terminal pieces in first four segments; remaining segments with simple setae, comb setae and acicular setae; Ventral cirri pad-like.

Distribution : Vellar estuary and Porto Novo waters. The specimens reported here are collected at salinity of 25 ppt.

7. ***Diopatra neapolitana*** Delle chiaje, 1841

Material : 7 exs., southern branch, Vamsadara estuary, Kalingapatnam; 4.3.2002, P-5998.

Description : Specimens measuring 4-6 cm. in leathery tubes; prostomium with two small frontal tentacles, a pair of small pad-like palps and 5 long occipital tentacles with ringed ceratophores; a pair of small tentacular cirri; branchia start from setiger 5-7 and continue upto 20-25th segment with branchial filaments arranged spirally; simple winged setae, pseudo compound bristles, comb setae, and acicular setae present.

Distribution : Widely distributed at river mouth areas along Indian coasts; found in long leathery tubes made of mud-clay sediments at inter-tidal regions; the specimens are collected at salinity of 25 ppt.

Family GLYCERIDAE

8. ***Glycera lancadivae*** Sshmarda, 1861

Material : 1 ex., mouth area, Vamsadara estuary, Kaligapatnam; 22.6.2000, P-5999.

Description : Long and cylindrical worms of 4 cm in length; flesh red in colour in preserved condition; prostomium conical with pointed tip; branchia absent; parapodia biramous with two slightly elongated equal anterior lobes and a single posterior lobe; dorsal capillaries and ventral spinigerous setae.

Distribution : Hugly-Matla estuary, Rushikulya estuary and Godavari estuary; the specimen was collected at salinity pf 32 ppt.

Family SPIONIDAE

9. ***Scolelepis squamata*** (Muller, 1806)

Material : 2 exs., southern branch, Vamsadara estuary, Klingapatnam; 22.6.2000, P-6000, 1 ex., Mofus Bandar, Nagavali estuary; 6.3.2002, P-6001; 1ex., Ganagalavaripeta, Nagavali estuary; 25.6.2000, P-6002.

Description : Specimens very narrow and measuring 4 cm in length; prostomium pointed with occipital keel; eyes present; body divided into flattened thorax and rounded abdomen; branchia from 2nd setigerous segment and present all through the body; notopodial lobe fused with branchia; thorax with capillary setae while abdomen with capillaries and bidentate hooks.

Distribution : Rushikulya estuary, Godavari estuary, Pulicat lake and Vellar estuary. The material reported here is collected at salinities of 1-32 ppt.

10. ***Maalcoceros indicus*** (Fauvel, 1928)

Material : 7 exs., Vamsadara estuary, Kalingapatnam; 23.6.2000, P-6003; 3 exs., middle region, Vamsadara estuary, Kalingapatnam; 4.3.2002, P-6004; 13 exs., mouth area, Vamsadara estuary, Kalingapatnam; 4-3-2002, P-6005.

Description : Specimens about 5-7 cm. in length; body dived into anterior flat thorax and rounded long abdomen; prostomium with lateral peaks and posterior crest "carina"; several small eye spots; long cirriform branchia from first setiger and continue to posterior part; dorsal ligule partly fused with branchia; ventral lamellae not notched; only capillary setae in dorsal ramus; capillary setae anteriorly and bidentate hooks posteriorly in ventral rami.

Distribution : Rushikulya estuary and PortoNovo waters. The specimens reported here are collected at salinities ranging 10-32 ppt.

11. ***Prionospio cirrifera*** Wiren, 1883

Material : 5 exs., Vamsadara estuary, Kalingapatnam; 5.3.2002, P-6006.

Description : Small and narrow specimens of 3 cm. in length; anterior part of body flat and posterior rounded; pointed prostomium with a posterior crest; paired eyes; branchia from 2nd setigerous segment and continue till 12-13th segment; dorsal lamellae of parapodia elongated but smaller than branchia; neuropodial lamellae small; capillary setae and hooded hooks.

Distribution : Gangetic delta, Godavari estuary, Rushikulya estuary, estuaries of Goa, Cochin estuary and Chilka lake. The reported material herein is collected at salinity of 25 ppt.

Family CAPITELLIDAE

12. ***Heteromastus similis*** Southern, 1921

Material : 1 ex., southern branch, Vamsadara estuary, Kalingapatnam; 22.6.2000, P-6007; 6 exs., southern branch, Vamsadara estuaty, Kaligapatnam; 23.6.2000, P-6008; 1 ex., southern branch, Vamsadara estuary, Kalingapatnam; 4.3. 2002, P-6009.

Description : Long, slender and cylindrical worms of 15-20 cm.; prostimium conical; body diveded into thorax of 11 swollen setigerous segments of which first 5 segments with only capillary setae and next 6 segments with long hooks; abdomen long and several segmented with short hooks situated on tori; posterior abdominal segments strobiliform and with several ciriform gills.

Distribution : Mahanadi estuary, Rushikulya estuary, Godavari estuary, Vellar estuary, Chilika laka and Pulicat lake; the specimens reported here are collected at salinities ranging 10-32 ppt.

Family AMPHARETIDAE

13. ***Melinna aberrans*** Fauvel, 1932

Material : 1 ex., Southern branch, Vamsadara estuary, Kalingapatnam; 23.6.2000, P-6010.

Description : Small and slender specimen of about 50 segments situated in a muddy tube; several buccal tentacles; four pairs of long subulate gills; palae absent; a large hook shaped yellowish spine behind gills on each side; 14 thoracic segments with dorsal capillary setae and ventral uncinni; abdomen with uncinigerous pinnules

Distribution : Mahanadi estuary and Vellar estuary. The specimen is collected at salinity of 10 ppt.

DISCUSSION

From this two minor estuaries only 105 polychaete specimens could be collected which are found to belong 13 species of 11 genera and 6 families; as seen in other estuaries members of the families nereidae, eunicidae and spionidae are dominant in numbers as well as in diversity; families glyceridae, capitellidae and ampharetidae are represented by single species and one example only with exception of capitellidae.

Though about 167 species of polychaetes are found inhabiting estuarine and brackish habitats along Indian coasts, major estuaries *viz.*, Gangetic delta, Mahanadi estuary, Godavari estuari, Krishna estuary, Vellar estuary, cochin estuary, Chilika and Pulicat lakes accounts for majority of species. At the above estuaries and lagoons not only the species diversity is very high and each species occurs in large populations; this is due to the availability of large areas of diverse estuarine habitats *viz.*, mud flats, mangrove forests, and swamps etc., suitable for different species in large populations to colonize.

The sparsely distributed populations of polychaetes with less diversity at Vamsadara–Nagavali estuaries might be due to the very small stretch of estuarine areas (less than 1 km. in length) at both rivers as very less fresh water flow and its discharges to the Sea is noticed during most of the year. Both the rivers at the mouth areas are very shallow with negligible tidal influx, not conducive for marine species to migrate and their populations to settle; further as there is less fresh water inflows and sea water incursion is restricted to minimum levels due to sand bar, the dispersal and community formation of coastal marine invertebrates into the estuarine regions of the two rivers is found to be at very low levels. Absence of mud flats at the mouth areas of the two rivers is also a significant factor for less polychaete populations as estuarine polychaetes of families nereidae, nepthydidae, spionide, eunicidae, capitllidae and to some extent glyceridae and teribellidae prefers sediments containing silt-clay with some sand content.

Rushikulya estuary, which is also a minor estuary, situated northern to these two estuaries also exhibits some what similar geo-morphological and physico-chemical features with Vamsadara-Nagavali estuaries and Rao (1992) reported 18 species of polychaetes; however at Vellar estuary, another minor one, Balasubramanian (1964) reported 29 species diversity as exhibited in major estuaries. Vellar estuary is a ppositive one with estuarine areas extending to large areas with mud flats and mangroves thus highly congenial for large and diverse populations to settle.

As such all the 13 species of polychaetes reported herein form first records from these two estuaries and species *viz., T. fauveli*, L.*notocirrata*, *L. tetraura*, *O.eremita* and *M.aberrans* are first records from coastal areas of Andhra Pradesh.

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REFERENCES

Balasubramaniam, K., 1964. Studies on the ecology of the Vellar estuary, 3. The intertidal and estuarine Polychaeta. *J. Annamalai Univ.*, **25** : 101-103.

Day, J.H. 1967. A monograph on the Polychaeta of Southern Africa, pts. I & II *Brit. Mus. (Nat. Hist).* Publ. No. **656** : 1-878.

Fauvel, P. 1953. The fauna of India including Pakistan, Ceylon, Burma and Malaya. Annelida : Polychaeta. The India Press Ltd., Allahabad.

Krishnamoorthi, B. 1963. On the distribution of six species of polychaetes in the Adayar estuary, Madras. *J. mar. boil. Ass. India*, **5**(1) : 97-102.

Misra, A., Soota, T.D. and Choudhary, A. 1984. On some polychaetes from Gangetic delta, West Bengal, India. *Rec. zool. Surv. India*, **81** : 41-54.

Misra, A. 1995. Hugli-Matla estuary, West Bengal : Polychaetes *Estuarine Ecosystem Series-***2** : 93-155. Zool. Surv. India.

Nageswara Rao, C.A. 1992. Polychaeta fauna of Rushikulya estuary, Gangam, Orrisa. *Environment & Ecology*, **10**(2) : 478-479.

Nageswara Rao, C.A. 1993. Polychaetous annelids from Mahanadi estuary, Orrisa. *Environment & Ecology*, **11**(4) : 993-995.

Nageswara Rao, C.A. 2001. Fauna of Godavari Estuary, Polychaeta : Annelida, *Estuarine Ecosystem Series*, **4** : 21-32. Zool. Surv. India.

Parulekar, A.K. 1971. Polychaeta from Maharashtra and Goa. *J. Bom. Nat. Hist. Soc.*, **68**(3) : 726-744.

Pillai, N.G.K. 2001. On some benthic polychaetes from Cochin estuary. *J. mar. boil. Ass. India*, **43**(1&2) : 120-135.

Radhakrishna,Y. and Ganapathi, P.N. 1969. Fauna of Kakinada Bay. *Bull. Natn. Inst. Sci. India*, **38** : 689-699.

Rao, C.A.N. 1981. On two new polychaetes (Nereidae) from estuarine waters of *India. Bull. zool. Surv. India*, **3**(3) : 213-217.

Rao, C.A.N. 1995. Fauna of Chilka Lake, Orissa, Annelida : Polychaeta. *Zool. Surv. India. Wetland Ecosystem Series*, **1** : 319-336.

Rao, C.A.N. 1998. Fauna of Mahanadi estuary, Orissa. Annelida : Polychaeta. *zool. Surv. India. Estuarine Ecosystm* Series, **3** : 199-209.

Soota, T.D. and Rao, C.A.N. 1977. On some polychaetes from Orissa coast. *Rec. Zool. Surv. India*, **73** : 327-336.

Southern, R. 1921. Polychaeta of the Chilka lake and also of fresh and brackish waters in other parts of India. *Mem. Indian Mus.*, **5** : 563-659.

Srikrishna Das, B., Ramamoorthi , K.& Balasubrahmanyam, K. 1987. Polychaetes of Portonovo waters. *J. mar. biol. Ass. India*, **29**(1&2) : 134-139.

Srinivasa Rao, D. and Rama Sarma, D.V. 1983. Abundance and distribution of intertidal polychaete fauna in the Vasistha Godavari estuary. *Mahasagar, Bull. nat. Inst. Oceangr.*, **16**(3) : 327-340.

Sunder Raj, S.K. and Sanjeeva Raj, P.J. 1987. Polychaeta of the Pulicat Lake (Tamil Nadu) *J. Bomb. nat. Hist. Soc.*, **84**(1) : 84-104.

Zool. Surv. India
Fauna of Vamsadhara and Nagavali estuaries, Andhra Pradesh, Estuarine Ecosystem Series, **6** : 2010 : 15-22

PRAWNS (CRUSTACEA : DECAPODA)

SHIBANANDA RATH AND M.K. DEV ROY*
Estuarine Biological Station, Zoological Survey of India, Gopalpur-on-Sea
**F.P.S. Building, Zoological Survey of India, Kolkata-700 016*

INTRODUCTION

Both Vamsadhara and Nagavali are two main riverine system of Srikakulam district of Andhra Pradesh. Both the rivers originate from Eastern Ghats of Orissa, Vamsadhara from Phulbani and Nagavali from Kalahandi districts. Both the river open into Bay of Bengal at Gangalavanipeta near Mehefuzbandar (Mopas Bandar). The estuarine tracts of Vamsadhara and Nagavali rivers form complex estuarine system. Prawns and shrimps constitute an important and valuable fishery resource along both the coasts of India. It is one of the most important foreign exchange earners of the country. Although, prawn and shrimp fauna of Indian estuaries has been considerably worked out (Reddy, 1995 and Deb, 1995, 1998), very little information is available about the group from Vamsadhara and Nagavali estuaries. The present work was, therefore, undertaken to fill up this gap. In the present communication, an account of penaeid and non-penaeid prawn fauna of Vamsadhara and Nagavali estuary has been dealt with based on intensive field surveys during 2000-2003. A total of 430 examples of both penaeid and non-paenid prawns were examined. These belonged to 10 species under 3 genera and 2 families. In the present paper the diagnosis of each species is mainly based on FAO Species Catalogue, Ravindranath (1977), Deb (1995-1998) and Reddy (1995).

MATERIAL AND METHODS

Prawns are mainly collected using fishing net, sometime small shrimps were collected by digging the mud from the inter tidal area of estuaries. Prawn specimens collected were preserved in 4% formaldehyde solution.

In the present paper, length measurements of prawns were taken from the tip of the rostrum to end of telson. The abbreviation 'L' is used here to indicate the total length. Other abbreviations used in this text are as under :

CANR-Dr. C.A. Nageswara Rao, SZS-Dr. S.Z. Siddiqi.

SYSTEMATIC LIST OF PRAWNS FROM VAMSADHARA AND NAGAVALI ESTUARIES, ANDHRA PRADESH

Class CRUSTACEA

Order DECAPODA

Family PENAEIDAE

1. *Penaeus (Penaeus) monodon* Fabricius, 1798.
2. *Penaeus (Penaeus) semisulcatus* De Haan, 1844.
3. *Penaeus (Fenneropenaeus) indicus* (H.Milne Edwards, 1837).
4. *Metapenaeus monoceros* (Fabricius, 1798).
5. *Metapenacus dobsoni* (Miers, 1878).

Family PALAEMONIDAE

6. *Macrobrachium equidens* (Dana,1852).
7. *Macrobrachium rude* (Heller, 1862).
8. *Macrobrachium banjarae.* (Tiwari, 1958).
9. *Macrobrachium scabriculam* (Heller,1862).
10. *Macrobrachium malcolmsonii* (H. Milne Edwards,1844).

1. ***Penaeus (Penaeus) morodon*** Fabricius, 1798

1798. *Penaeus monodon* Fabricius, *Srpp. Ent. Sqst. Hafniae Copenhagen.* p. 408

1969. *Penaeus monodon,* George, *Bull. Cent. Mar. Fish Res. Inst.,* **14** : 22.

1991. *Penaeus (penaeus) monodon,* Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo. CAS in Mar. biol, Ann. Univ., Parangipettai India* : 36, pt. 29, fig. 4.

Material examined : 2 ex., Nagavali, mouth, Gangalavanipetta, 04-07-2001, CANR, CR-5431; 26 ex., Vamsadhara, upper zone, Kalingapatnam, 05-03-2002, CANR, CR-5432; 5 ex., Vamsadhara, north branch, Kalingapatnam, 24-06-2000, CANR, CR-5433; 2 ex., Vamsadhara, confluence, 29-01-2003, SZS, CR-5434; 3 ex., Nagavali, Pukkalapetta, 07-03-2002, CANR, CR-5435; 9 ex., Vamsadhara, south branch, Kalingapatnam, 03-03-2002, CANR, CR-5436.

Mesurements : L-43.0-127.0.

Diagnosis : Carapace smooth. Rostrum very strong and armed with 7-8 dorsal and 3-4 ventral teeth. Hepatic carina straight. Adrostral crina and groove extending beyond epigastric tooth. Antennal crest prominent. Petasma with distomedian projection reaching distal margin of costae. Thelycum with large lateral plates forming a lip like structure, anterior plate small subcircular (concave) and sub triangular, posterior plate inserted in between lateral plates.

Distribution : ***India*** : East and West coasts, Andaman and Nicobar Island and Lakshadwip. ***Outside*** : Pakistan, Sri Lanka, China, Japan, East Africa, Gulf of Aden, Red Sea, West coast of Madagascar, Mauritius, Philippines, New Guinea and Australia.

Remarks : This species is not abundant in commercial catches but it is higher in weight and larger in size over other species.

2. *Penaeus (Penaeus) semisulactus* De Haan, 1844

1844. *Penaeus semisulcatus* De Haan, *In. Von Siebold, Fauna Japonica, Crustacea* (6/7) : pt. 46 fig. 1.

1969. *Penaeus semisulcatus*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 23.

1991. *Penaeus (Penaeus) semisulacatus*, Paulpandian and Ramasamy, *Guide to the Prawns of Portonove. CAS in Mar.biol., Ann. Univ, Parangipettai. India* : 36 pt. 29, fig. 4.

Material examined : 1 ex., Nagavali, Gangalavanipetta, 25-06-2000, CANR, CR-5457; 1 ex., Vamsadhara, light house, 28-01-2003, SZS, CR-5458.

Mesurements : L-62.0.

Diagnosis : Carapace smooth. Rostrum long strong and straight, dorsally armed with 5-8 teeth and ventrally with 2-4 teeth. Adrostral crest and groove extended beyond epigastric tooth. Gastrofrontal crest absent. Antennal crest prominent. Fifth pereopod with small but distinct exopod. Hepatic carina straight. Petasma with distomedian projections reaching as far as costae. Thelycum with large flap-like lateral plates joining at midpoint and forming a lip-like structure; anterior process semi-circular and concave, posterior process convex and partly inserted between lateral plates.

Distribution : *India* : East and West coasts.*Outside* : Sri Lanka, Japan, East Africa, Red Sea, Western Madagascar, Mauritius, Philippines, New Guinea, Northern Australia, Korea and Eastern Mediterranean.

Remarks : Closely resemble with *P. (P.) monodon.* In size and weight, the female appears to attend larger size than male.

3. *Penaeus (Fenneropenaeus) indicus* (H.Milne Edwards, 1837)

1837. *Penaeus indicus* H.Milne Edwards, *Hist.Nat.Crust., Paris.*, **2** : 415.

1906. *Penaeus indicus*, Alcock, *Cat. Indian Decapod Crust.*, pt. 3(1) : 12.

1991. *Penacus (fenneropenaeus) indicus*, Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo CAS in Mar. boil, Ann. Univ. Parangipettai. India* : 35, pt. 28, fig. 2.

Material examined : 5 ex., Vamsadhara, north bank, Kalingapatnam, 21-06-2000, CANR, CR-5420; 9 ex., Nagavali, south-east bank Gangalavanitippa, 26-06-2000, CANR, CR-5421; 2 ex., Nagavali, mouth, Gangalavanitippa, 04-07-2001, CANR, CR-5422; 2 ex., Vamsadhara, upper sream, Kalingapatnam, 05-03-2002, CANR, CR-5423; 3 ex, Vamsadhara, rest house, Kalingapatnam, 29-01-2003, SZS, CR-5424; 19 ex., Nagavali, confluence, 29-01-2003, SZS, CR-5425; 22 ex., Nagavali, down stream, Pukkalapeta, 30-01-2003, SZS, CR-5426; 45 ex.,

Vamsadhara, behind market, Kalingapatnam, 29-01-2003, SZS, CR-5427; 6 ex., Nagavali, Pukkalapeta, 07-03-2002, CANR, CR-5428; 14 ex., Vamsadhara, light house, Kalingapatnam, 23-06-2000, CANR, CR-5429; 1 ex., Vamsadhara, south branch, Kalingapatnam, 03-03-2002, CANR, CR-5430.

Mesurements : L-41.0-112.0.

Diagnosis : Carapace smooth. Rostrum very large and slender having 7-9 teeth dorsally and 4-6 teeth ventrally. Adrostral crest and groove extending to epigastric tooth. Gastrofrontal and hepatic crest absent. Gastro orbital carina occupying the posterior 2/3rd distance between hepatic spine and orbital angle. Petasma with distomedian projections over reaching the distal margin of costae, and ventral costae unarmed. Thelycum with large lateral plates joined to form a lip-like structure; anterior process rounded and poserior process vestigial type.

Distribution : *India* : East and West coasts, Andaman and Nicobar Island, Laksadwip. *Outside* : Sri Lanka, China, East African coast, Madagascar, Red Sea, Philippines and Northern Australia.

Remarks : Widely distributed throughout the Vamsadhara and Nagavali Estuaries.

4. *Metapenaeus monoceros* (Fabricius, 1798)

1798. *Penaeus monoceros* Fabricius, *Entom. Syst. Suppl.* : 409.

1906. *Metapenaeus monoceros*, Alcock, *Cat. India Decapod Crust.*, pt. 3(1) : 18.

1998. *Metapenaeus monoceros*, Deb, *Zool. Surv. India. Mahanadi Estuary, Estuarine Ecosystem Series*, 3 : 137.

Material examined : 4 ex., Nagavali, Gangalavanipeta, 25-06-2000, CANR, CR-5409; 10 ex., Vamsadhara, light house, Kalingapatnam, 23-06-2000, CANR, CR-5410; 1 ex., Vamsadhara,south branch, Kalingapatnam, 03-03-2000, CANR, CR-5411; 4 ex., Nagavali, Pukkalapeta, 06-03-2002, CANR, CR-5412; 11 ex., Vamsadhara, north branch, Kalingapatnam, 24-06-2000, CANR, CR-5413; 8 ex., Nagavali, Pukkalapeta, 04-07-2001, CANR, CR-5414; 5 ex., Nagavali, Pukkalapeta, 30-01-2003, SZS, CR-5415; 2 ex., Nagavali, confluence, 29-01-2003, SZS, CR-5416; 1 ex., Vamsadhara, rest house, Kalingapatnam, 27-01-2003, SZS, CR-5417; 5 ex., Vamsadhara, behind market, Kalingapatnam, 29-01-2003, SZS, CR-5418; 2 ex., Nagavali, mouth , 05-07-2001, CANR, CR-5419.

Mesurements : L-37.0-90.0.

Diagnosis : Body pubescent, often small patch/stripe present in larger specimen. Dorsal part of the rostrum armed with 9-12 evenly placed teeth. Adrostral crest extended beyond second rostral tooth, adrostral groove reaching behind epigastric tooth. Telson without spinules. Ischial spine of first walking leg distinct. Distomedian projections of petasma convoluted, swollen and bulbiform hiding the distolateral projection. Anterior plate of thelycum long and deeply grooved having small ball like structure at both end; lateral plates very small, egg shaped surrounded by large raised lateral margins.

Distribution : ***India*** : East and West coast. ***Outside*** : Sri Lanka, South Africa, Malay Peninsula, Red Sea, Madagascar, Mauritius and Mediterranean.

Remarks : Closely resemble *M. ensis.* This species available in plenty in Vamsadhara and Nagavali Estuaries.

5. *Metapenacus dobsoni* (Miers, 1878)

1878. *Penaeus dobsoni* Miers, *Proc. Zool. Soc. London* p; 302.

1906. *Metapenaeus dobsoni*, Alcock, *Cat. Indian Decapod Crust.*, pt. 3(1) : 21.

1995. *Metapenaeus dobsoni*, Reddy, *Zool. Surv. India* : *Hugli, Malla Estuary, Estuarine Ecosystem series,* 2 : 294.

Material examined : 4 ex., Vamsadhara, north branch, Kalingapatnam, 24-06-2000, CANR, CR-5437; 1 ex., Nagavali, mouth, Gangalavanipeta, 04-07-2001, CANR, CR-5438; 1 ex., Vamsadhara, upper zone, Kalingapatnam, 05-03-2002, CANR, CR-5439; 36 ex., Nagavali, Pukkallapeta, 07-03-2002, CANR, CR-5440; 2 ex., Nagavali, Pukkalapeta, 06-03-2002, CANR, CR-5441; 20 ex., Nagavali, Pukkallapeta, 30-01-2003, CANR, CR-5442; 62 ex., Vamsadhara, behind market, Kalingapatnam, 29-01-2003, CANR, CR-5443; 27 ex., Nagavali confluence, 29-01-2003, CANR, CR-5444.

Mesurements : L-35.0-56.0.

Diagnosis : Body pubscent with small patches. Rostrum long, extended beyond antennular peduncle and armed with 7-9 dorsal teeth, almost half of its distal half toothless. Adrostral crest reaching as far as epigastric tooth. Telson armed with spinules. Petasma with each distomedian projections form short filament or tubular structure culminating in a pair of simple distomedian spouts. Distolateral projections directed forward. Thelyum having long tongue shaped anterior plate bearing a groove, lateral plates horse shoe-shaped.

Distribution : ***India*** : South-West coast. ***Outside*** : Sri Lanka, Gulf of Thailand, Philippines and Indonesia.

Remarks : In Vamsadhara and Nagavali water the species present abundantly.

6. *Macrobrachium banjarae* (Tiwari, 1958)

2001. *Leptocarpus potamiscus*, Jayachandran, *Palaemonid Prawns Biodiversity, Taxonomy, Biology and Management Oxford and IBH* : 82.

Material examined : 4 ex., Vamsadhara, north branch, Kalingapatnam, 24-06-2000, CANR, CR-5445; 4 ex., Vamsadhara, north branch, Kalingapatnam, 07-07-2001, CANR, CR-5446; 15 ex, Vamsadhara, upper zone, Kalingapatnam, CANR, CR-5448; 18 ex, Vamsadhara, confluence, Kalingapatnam, CANR, CR-5449.

Mesurements : L-47.0-92.0.

Diagnosis : Carapace smooth, with antennal and hepatic spine. Rostrum long, extending to tip of antennal scale with 11-15 equidistant teeth dorsally out of which 2 is post-orbital and 4-6 teeth ventrally. Abdomen smooth, telson elongate reaching beyond level of spine of uropodal exopod. Uropodal exopod with accessory sub-apical spine.

Distribution : *India* : Madhya Pradesh, Karnataka, Maharashtra, Andhra Pradesh.

Remarks : This species fresh water in habitat and closely related to *M. kistenensis.*

7. *Macrobrachium rude* (Heller, 1862)

1862. *Palaemon rudis* Heller, *Verh. Zool. Bot. Ges.Wien,* **12** : 525.

1950. *Macrobrachium rude,* Holthuis, *Siboga Exped.*, pt. X, **39** : 150.

1998. *Macrobrachium rude,* Deb, *Zool. Surv India, : Mahanadi Estuary, Estuarine Ecosystem Series,* **3** : 133.

Material examined : 1 ex., Vamsadhara, south branch, Kalingapatnam 03-03-2002, CANR, CR-5453; 2 ex., Nagavali, Gangalavanipeta, 25-06-2000, CANR, CR-5454.

Mesurements : L-65.0-85.0.

Diagnosis : Body bulky, carapace swollen with very large head. Rostrum almost straight reaching the antennal scale, dorsally with 10-15 teeth; a small gap after 2-3 teeth from distal end followed by other teeth placed at a regular interval, posterior two teeth placed behind orbital margin; ventral margin bearing 3-6 teeth. Telson armed with 2 pair of spines dorsally. Apex of fingers acute and hooked. Hepatic spine situated at lower level than antennal spine.

Distribution : *India* : East coast.*Outside* : Sri Lanka, Bangladesh, Natal East coast Africa, Madagascar and South Somalia.

Remarks : This species both riverine and estuarine in habitat.

8. *Macrobrachium equidens* (Dana,1852)

1852. *Palaemon equidens* Dana, *Proc. Acad. Nat. Sci. Philad.*, **6** : 26.

1950. *Macrobrachium equidens,* Holthusis, *Siboga Exped.* **39** (a-9) : 162.

1995. *Macrobrachium equidens,* Reddy, *Zool. Surv. India, Hugli Matla Estuary Prawns and shriups (crustaces : decapoda) Estuarine Ecosystem series,* **2** : 310.

Material examined : 1 ex., Vamsadhara,mouth, Kalingapatnam, 22-06-2000, CANR, CR-5455; 2 ex., Nagavali, Gangalavanipeta, 25-06-2000, CANR, CR-5456.

Mesurements : L-60.0-75.0.

Diagnosis : Body robust. Rostrum strong and long reaching at end of antennal scale; dorsal margin armed with 10-11 teeth placed at a regular interval; ventral margin armed with 4-7 teeth. Ridge of antennal spine extending in the direction of hepatic spine. Out of 2 postero-lateral spines of telson, lower one over-reaching the telson tip.

Distribution : *India* : South-West coast, Kerala. *Outside* : Pakistan, Sri Lanka, China, East coast of Africa, Madagascar, Philippines and New Caledonia.

Remarks : This species found in small number.

9. ***Macrobrachium scabriculam*** (Heller, 1862)

1862. *Palaemon scabriculam* Heller, *Verh. Zool. Bot. Ges. Wien,* **12** : 527.

1910. *Palaemon scabriculam*, Henderson and Mathai, *Rec. Ind. Mus,* **5** : 300.

1998. *Macrobrachium scabriculam,* Deb, *Zool.Surv India, Estuarine Ecosystem Series* **3** : *Mahanadi Estuary:* 135.

Material examined : 10 ex., Vamsadhara,mouth, Kalingapatnam, 06-07-2001, CANR, CR-5460.

Mesurements : L-67.0-72.0.

Diagnosis : Rostrum short extending to tip of antennular peduncle. Upper margin of rostrum with 12-15 teeth of which 4-5 post orbital, ventral margin with 1-3 teeth. Carapace smooth or little scabrous. Telson robust. Rostral crest extend almost to the middle of thc carapace. Surface of arm, wrist rough with sharp pickles, little shorter than palm, widely gaping, meet at hooked tip, cutting edge evenly dentate.

Distribution : *India* : Indian Ocean. *Outside* : Pakistan, Sri Lanka, Juba, S. Italian Somaliland, Zanzibar, Mozambique, Madagascar, Kotri, Sumatra, "Regions des grands lacs, and Indonesia.

Remarks : This species is found in small number.

10. ***Macrobrachium malcolmsonii*** (H. Milne Edwards, 1844)

1844. *Palaemon malcolmsonii* H. Milne Edwards,*Voy inde Jacquemont,* **4**(2) : 8.

1950. *Macrobrachium malcolmsonii* : Holthuis, *Siboga Exped,* **39** a(9) : 121.

1995. *Macrobrachium malcolmsonii* Reddy, *: Fauna of Chilika Lake* : *Decapoda Wetland Ecosystem Series,* **1** : 380.

Material examined : 7 ex., Nagavali, Kunkupeta, 25-06-2000, CANR, CR-5461.

Diagnosis : Body symmetrical. Rostrum is strong and long reaching end of antennal scale,form a small crest like structure, dorsally armed with 7-11 teeth out of which 3 placed behind orbital margin and 1-2 sub-distal teeth also present rest are evenly placed. Hepatic spine situated at a lower level that antennal spine. Sharp telson tip over-reaching the postero lateral spines.

Distribution : *India* : South-West coast, Kerala. *Outside* : Pakistan, Sri Lanka, China, East coast of Africa, Madagascar, Philippines and New Caledonia.

Remarks : This species is found in small number.

SUMMARY

10 species of prawns under 3 genera and 2 families have been recorded from Vamsadhara and Nagavali Estuaries, Srikakulam, Andhra Pradesh.

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REFERENCES

Alcock, A. 1906. The prawns of the *Penaeus* group. Catalogue of the Indian Decapod Crustacea in the collection of the Indian Museum, Part-III Macrura, Fabricius.

Chiaki Koizumi (Ed. Chief) 2001. Prawns of Japan and the World (Translated from Japanese.) : 1-259.

Chanda and Roy, 2005. *Zool. Surv. India, Fauna of Andhra Pradesh* (Part-5) : *State Fauna Series,* **5** : 537-550.

Deb, M. 1998. Crustacea : Decapoda, *Zool. Surv. India, Fauna of Chilika Lake, Wetland Ecosystem Series,* **1** : 367-389.

FAO Species Identification sheets for fishery purposes, Western Indian Ocean, Fishing Area, 51.

George, M.J. 1969. Systemati Taxonomic considerations and general distributions. *In* : Prawn fiseries of India *Bull. Cent. Mar. Fish. Res. Inst.,* Cochin, **14** : 5-48.

Holthuis, L.B. FAO Species catalogue, Shrims and Prawns of the World, **1**(125) : 1-171.

Jayachandran, K.V. 2001. Palaemonid aprawns Biodiversity, Taxonomy, Biology and Management, *Oxford IBH* : 1-624.

Kemp, S. 1915. Fauna of Chilika Lake. Crustacea, Decapoda. *Mem Indian Mus.,* **5** : 201-325.

Rai, H.S. 1933. The Shell Fisheries of the Bombay Presidency. Part 2, *J. Bombay nat. Hist. Soc.,* **36** : 884-897.

Reddy, K.N. 1995. Prawns and Shrimps (Crustacea : Decapoda); *Hugli Matla Estuary, Estuarine Ecosystem Series,* **2** : 289-314.

Reddy, K.N. 1995. Crustacea : Decapoda, *Zool. Surv. India,*Wetland Ecosystem Series **1** : fauna of Chilika Lake : 367-389 auna of Vamsadhara and Nagavali Estuary, Srikakulam.

Zool. Surv. India
Fauna of Vamsadhara and Nagavali estuaries, Andhra Pradesh, Estuarine Ecosystem Series, **6** : 2010 : 23-45

CRABS (CRUSTACEA : DECAPODA : BRACHYURA)

SHIBANANDA RATH AND M.K. DEV ROY*
Estuarine Biological Station, Zoological Survey of India, Gopalpur-on-Sea
**F.P.S. Building, Zoological Survey of India, Kolkata-700 016*

INTRODUCTION

Though a good deal of information is available on the brachyuran fauna of Godavari (Dev Roy and Bhadra, 2001; Dev Roy and Nandi, in press) and Krishna estuary (Rath and Dev Roy, 2009) so far nothing is known from Vamsadhara and Nagavali estuaries. The present work was, therefore, undertaken with a view to filling up this gap. In this communication, a total of 150 examples of crabs belonging to 12 genera under 5 families has been studied. All species except *Doclea muricata* recorded herein are reported for the first time from these estuaries. Distribution of estuarine crabs of Andhra Pradesh is also dealt with in this communication.

MATERIALS AND METHODS

The present account is based on intensive collections made by Estuarine Biological Station, Zoological Survey of India, Berhampur during 2000-2003 as a part of the current research programme. All material for the present study were collected around Kalingapatnam (mouth area of Vamsadhara river) and Mofaz bander (mouth area of Nagavali river) of Srikakulam district. Methodology of collection, preservation and measurement etc. adopted in this work are after Dev Roy and Das (2000) and Rath and Dev Roy (2009). Section, family and generic diagnosis followed herein are after Barnard (1950), Sakai (1976) and Dev Roy and Das (2000). The abbreviations L and W are used here to indicate carapace length and carapace width respectively. Other abbreviations used in this text are as under :

CANR–Dr. C.A. Nageswara Rao and SZS–Dr. S.Z. Siddiqi

SYSTEMATIC LIST OF CRABS FROM VAMSADHARA-NAGAVALI ESTUARY, ANDHRA PRADESH

Phylum, Sub-Phylum or Superclass CRUSTACEA Pennant, 1777
Class MALACOSTRACA Latreille, 1806
Subclass EUMALACOSTRACA Grobben, 1892

Superorder EUCARIDA Calman, 1904
Order DECAPODA Latreille, 1803
Suborder PLEOCYEMATA Burkenroad, 1963
Infraorder BRACHYURA Latreille, 1803
Section OXYSTOMATA H. Milne Edwards, 1834
Superfamily LEUCOSIOIDAE Samouelle, 1819
Family CALAPPIDAE de Haan, 1833
Subfamily MATUTINAE de Haan, 1835

1. *Ashtoret lunaris* (Forskål, 1775)

Section OXYRHYNCHA, Latreille, 1803
Superfamily MAJOIDEA Samouelle, 1819
Family MAJIDAE Samouelle, 1819
Subfamily PISINAE Dana, 1851

2. *Doclea muricata* (Fabricius, 1787)

Section BRACHYRHYNCHA Borradaile, 1907
Superfamily PORTUNOIDEA Rafinesque, 1815
Family PORTUNIDAE Rafinesque, 1815
Subfamily PORTUNINAE Rafinesque, 1815

3. *Scylla serrata* (Forskål, 1775)
4. *Portunus pelagicus* (Linnaeus, 1758)
5. *Portunus sanguinolentus* (Herbst, 1783)
6. *Charybdis (Charybdis) rostrata* (A. Milne Edwards, 1861)
7. *Thalamita crenata* (A. Milne Edwards, 1829)
8. *Thalamita prymna* (Herbst,1803)

Superfamily GRAPSIDOIDEA MacLeay, 1838
Family GRAPSIDAE MacLeay, 1838
Subfamily GRAPSINAE MacLeay, 1838

9. *Metopograpsus messor* (Forskål, 1775)

Subfamily SESARMINAE Dana, 1852

10. *Episesarma tetragonum* (Fabricius, 1798)

Subfamily VARUNINAE H. Milne Edwards, 1853

11. *Varuna litterata* (Fabricius, 1798)

Superfamily OCYPODOIDEA Rafinesque, 1815

Family OCYPODIDAE Rafinesque, 1815

Subfamily OCYPODINAE Rafinesque, 1815

12. *Ocypode macrocera* A. Milne Edwards, 1837
13. *Ocypode platytarsis* H. Milne Edwards, 1852
14. *Uca lactea* (de Haan, 1835)

Subfamily DOTILLINAE Stimpson, 1858

15. *Dotilla intermedia* de Man, 1888
16. *Scopimera globosa* Kemp, 1919

SYSTEMATIC ACCOUNT

Infraorder BRACHYURA Latreille, 1803

1803. Brachyures brachyuri Latreille, *Hist. Nat. Crust.*, **3** : 347.

2000. Brachyura, Dev Roy and Das, *Rec. zool. Surv. India, Occ. Paper*, **185** : 17.

Diagnosis : Carapace fused with the epistome at the sides and almost always at the middle; last thoracic sternites fused with the anterior sternites. Abdomen brachyurous (i.e., short, flattened and straight), symmetrical and tucked under the cephalothorax. Third maxillipeds broad. Basis and ischium of cheliped and leg immovably articulated. First pereiopods invariably chelate, third one never chelate.

Key to the sections of Brachyuran Crabs of Vamsadhara and Nagavali estuaries

1. Mouth frame (buccal cavity) triangular ..... OXYSTOMATA
   Mouth frame somewhat quadrate 2
2. Carapace triangular, narrowed in front and usually provided with a distinct rostrum, ... OXYRHYNCHA
   orbits generally incomplete
   Carapace broad in front, rostrum either
   reduced or absent, orbits well developed ..... BRACHYRHYNCHA

Section OXYSTOMATA H. Milne Edwards, 1834

1834. Oxystomata H. Milne Edwards, *Hist. Nat. Crust.*, **1** : 265.

1976. Oxystomata, Sakai, *Crabs of Japan and the Adjacent Seas* : 59.

2000. Oxystomata, Dev Roy and Das, *Rec. zool. Surv. India, Occ. Paper*, **185** : 18.

Diagnosis : Carapace oval, subcircular or polygonal in outline. Epistome rudimentary or absent. Buccal frame elongate, triangular. Gills 6-9 on each side. Last pair of leg normal or subdorsal, no epipodite on pereiopods. First abdominal somite of female without any appendage.

Family CALAPPIDAE de Haan, 1833

1833. Calappidea de Haan, In : Siebold, *Fauna japon. (Crust.)* (1) : xiii and 67 (1837), 119, 124 (1841).

2005. Calappidae, Dev Roy and Bhadra, *Zool. Surv. India State Fauna Series* **5** : *Fauna of Andhra Pradesh* (Part 5) : 377.

Diagnosis : Carapace oval or circular, lateral borders either with a small tooth or a strong spine at the junction of antero-lateral and postero-lateral borders. Chelipeds massive, palm enormous. Male abdomen five-segmented, female abdomen consisting of seven distinct segments.

MATUTINAE de Haan, 1833

1833. Matutoidea de Haan, In: Siebold, *Fauna japon. (Crust)* : xiii and 119, 126(1941).

2005. Matutinae, Dev Roy and Bhadra, *Zool. Surv. India State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 380.

Diagnosis : Carapace circular with a strong spine at the junction of antero-and postero-lateral borders. Merus of external maxillipeds elongate with acute tip.

Genus ***Ashtoret*** Galil and Clark, 1994

1994. *Ashtoret* Galil and Clark, *Zool. Verh. Leiden,* **294** : 4.

2005. *Ashtoret,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 381.

Diagnosis : Carapace sub-circular and strongly convex bearing tubercles centrally. Front trilobed, middle one prominent and broad. Anterolateral margin acute and tuberculate Postero-lateral border convergent, with a spine at the junction of antero and postero lateral borders. Eye-stalks strong, elongate. Chelipeds massive, subequal; palm compressed. Legs adapted for swimming and burrowing.

1. ***Ashtoret lunaris*** (Forskål, 1775)

1775. *Cancer lunaris* Forskål, *Desc. Anim.* : 91.

1896. *Matuta banski,* Alcock, *J. Asiat. Soc. Bengal,* **65**(2) : 158.

2005. *Ashtoret lunaris,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 382 : pl.1, fig. 2.

Material Examined : 1 ex., Vamsadhara, Rest house, Kalingapatnam, 27-01-03, SZS, CR-5401; 1 ex., Nagavali, Pukkalapetta, 30-01-03, SZS, CR-5402.

Mesurements : L-21.0-23.0 W-20.0-23.0.

Diagnosis : Carapace convex, sub-circular with six tubercles on its surface, anterior two tubercles almost obsolete. Front distinctly bilobed. Outer surface of arm of cheliped smooth, upper border crenulated; a strong dentiform process at the angle between palm and arm.

Distribution : India : East coast : Orissa; Andhra Pradesh. *Outside* : Aden, Red Sea, Malaysia, Singapore, Philippines, Indonesia, New Guinea and Australia.

Remarks : This crab is frequently found in Vamsadhara and Nagavali estuaries. It has also been recorded from Godavari (Dev Roy and Bhadra, 2001) and Krishna (Rath and Dev Roy, 2009) estuaries.

Section OXYRHYNCHA Latreille, 1803

1803. Oxyrinques Latreille, *Hist. Nat. Crust.*, **6** : 85.

1976. Oxyrhyncha, Sakai, *Crabs of Japan and the Adjacent Seas* : 145.

2001. Oxyrhyncha, Dev Roy and Bhadra, *Zool. Surv India. Estuarine Ecosystem Series,* **4** : *Fauna of Godavari Estuary*: 38.

Diagnosis : Carapace triangular, narrowed in front and usually provided with a distinct rostrum. Branchial regions considerably developed. Hepatic region small. Epistome large. Buccal cavity quadrate.

Family MAJIDAE Samouelle, 1819

1819. Maiadae Samouelle, *Entom. Useeful Compend.* : 88[corrected to Majidae by Neumann, 1878 : 5].

2005. Majidae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 401.

Diagnosis : Chelipeds hardly longer than other legs and mobile. Second article of antenna well developed and fused with epistome. Hooked hairs present. Orbits incomplete.

Subfamily PISINAE Dana, 1851

1851. Pisinae Dana, *Amer. J. Sci. Art.*, ser. 2, **II** : 424.

2005. Pisinae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 404.

Diagnosis : Basal antennal joint broad. Post-ocular cupped process hollowed for retention of the short eye stalk.

Genus ***Doclea*** Leach, 1815

1815. *Doclea* Leach, *Zool. Miscell.*, **2** 41.

2005. *Doclea,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 404.

Diagnosis : Carapace globular with dorsal and lateral spines. Rostrum bifid. Eyes and antenna small. Chelipeds long and stout.

2. ***Doclea muricata*** (Fabricius, 1787)

(Pl. I, Fig. 1-3)

1787. *Cancer muricatus* Fabricius, *Mantisa Ins.*, **1** : 324.

2005. *Doclea muricata,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 405.

Material Examined : 1 ex., Nagavali confluence, 29-01-03, SZS, CR-5403.

Mesurements : L-36.0 W- 28.0.

Diagnosis : Carapace longer than broad, thick, sub globular bearing 8 very large prominent median spines. Antero-lateral spines 4 : first two small, last one the largest. Chelipeds slender.

Distribution : India : East coast : Orissa; Andhra Pradesh; Tamil Nadu. West coast-Kerala; Maharashtra. *Outside* : South Africa, Sri Lanka, Malaysia, Myanmar and Indonesia.

Remarks : This crab appears to be rare in this estuary.

Section BRACHYRHYNCHA Borradaile, 1903

1903. Brachyrhyncha Borradaile, *Ann. Mag. nat. Hist.*, (7), **19** : 481.

1976. Brachyrhyncha, Sakai, *Crabs of Japan and the Adjacent Seas* : 321.

2000. Brachyrhyncha, Dev Roy and Das, *Rec. Zool. Surv. India, Occ. Paper*, **185** : 23.

Diagnosis : Carapace broad, front more or less oval, round or square in outline, generally broader than long. Rostrum almost reduced. Epistome well developed. Buccal frame square-cut. Orbits complete.

Key to families of the section Brachyrhyncha

1. Last pair of leg adapted for swimming ..... PORTUNIDAE
   Last pair of leg not adapted for swimming 2
2. A rhomboidal gap left in between third maxillipeds, carapace square-cut GRAPSIDAE
   No such gap in between third maxillipeds, Carapace squarish or transversely oblong ..... OCYPODIDAE

Family PORTUNIDAE Rafinesque, 1815

1815. Portunidia Rafinesque, *Analyse Nature* : 97.

2005. Portunidae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 418.

Diagnosis : Carapace flattened or convex, hexagonal, subquadrate, elongate ovate or subcircular, generally broader than long, regions usually not well outlined. Front broad, horizontal and cut in to 2-6 teeth or lobes. Antero-lateral borders cut in to 4-9 teeth or lobes. Last pair of legs usually modified for swimming.

Subfamily PORTUNINAE Rafinesque, 1815

1815. Portunidia Rafinesque, *Analyse Nature* : 97.

2005. Portuninae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* : 419.

Diagnosis : Carapace distinctly broad and of typical portunid-shape. Front broad. Antero-lateral teeth varying from 4-9.

Key to the genera of the subfamily Portuninae

1. Carapace oval, antero-lateral borders cut into 9 teeth ..... 2.
— Carapace hexagonal, antero-lateral teeth less than 9 ..... 3.
2. Carapace smooth, regions ill defined, propodus of chelipeds smooth and inflated ..... ***Scylla***
— Carapace not smooth, regions well defined, propodus of chelipeds prismatic and costate ..... ***Portunus***
3. Antero-lateral border of carapace cut into 6 teeth ..... ***Charybdis***
— Antero-lateral border of carapace cut into 5 teeth, 4th tooth often small or rudimentary ..... ***Thalamita***

Genus ***Scylla*** de Haan, 1833

1833. *Scylla* de Haan, In : Siebold, *Fauna Japon. (Crust.)* : 11.

2005. *Scylla,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 419.

Diagnosis : Carapace broad, convex. Front cut into 4 equal teeth. Antero-lateral borders cut into 9 sub-equal teeth, including outer orbital tooth. Epistome not produced, buccal cavity squarish. Chelipeds massive. Legs stout, last pair modified for swimming.

3. ***Scylla serrata*** (Forskål, 1775)

1775. *Cancer serratus* Forskål. *Desc. Anim.*, : 90.

2005. *Scylla serrata,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 420.

Material examined : 3 ex., Vamsadhara, light houe, Kalingapatnam, 23-06-2000, CANR, CR-5277; 1 ex., Vamsadhara, north branch, Kalingapatnam 24-06-2000, CANR, CR-5278; 2 ex., Nagavali, south east bank, Gangalavanipeta 25-06-2000, CANR, CR-5279; 1 ex., Nagavali, Mouth, Gangalavanipeta, 03-07-2000, CANR, CR-5280; 4 ex., Vamsadhara, Kalingapatnam,06-07-2001, CANR, CR-5281; 7 ex., Vamsadhara, upper zone, Kalingapatnam, 05-03-2002, CANR, CR-5282; 4 ex., Vamsadhara, south branch, Kalingapatnam, 12-02-97, CANR, CR-5283; 2 ex., Nagavali, Pukkalapeta, 6-03-2002, CANR, CR-5284; 2 ex., Vamsadhara, rest house, Kalingapatnam, 27-01-2003, SZS, CR-5285; 8 ex., Vamsadhara, behind market, Kalingapatnam, 29-01-2003, SZS, CR-5286, 1 ex., Nagavali, down stream, Pukkalapeta, 30-01-2003, SZS, CR-5287.

Mesurements : L- 19.0-55.0 W- 27.0-89.0.

Diagnosis : Carapace broad, transverse, moderately convex with an almost even surface. Front quadridentate with high lobes, their tips bluntly pointed. Antero-lateral teeth narrow.

Distribution-India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. West coast : Karnataka; Goa; Maharastra; Gujarat. Islands : Andamans and Nicobars. *Outside* : South Africa, Red Sea, Pakistan, Mergui, Myanmar, Taiwan, Japan, Australia, Tahiti and New Zealand.

Remarks : This crab inhabits muddy bottoms along estuarine waters of Vamsadhara and Nagavali rivers. It is the most important edible crab of the region which is exploited in large quantities especially from the mangrove areas. This species is also recorded from Godavari (Dev Roy and Bhadra, 2005) and Krishna estuaries (Rath and Dev Roy, 2009).

Genus ***Portunus*** Weber, 1795

1795. *Portunus* Weber, *Nomencl. ent. Syst. Fabr.* : 93.

1899. *Neptunus*, Alcock, *J. Asiat. Soc. Bengal* 68(2) : 28.

2005. *Portunus*, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, 5 : *Fauna of Andhra Pradesh* (Part 5) : 422.

Diagnosis : Carapace transversely broad, depressed or convex. Front broad and cut into 3-6 teeth. Antero-lateral border cut into 9 teeth including outer orbital tooth, last tooth enlarged. Epistome linear and prolonged to form a spine. Chelipeds long and stout. Legs flattened.

Key to species of the genus *Portunus*

— Carapace marked with three large blood red spots, posterior border of merus of chelipeds devoid of any spine ..... ***P. sanguinolentus***

— No such spots on carapace but surface studded with miliary granules, posterior border of merus of chelipeds armed with a spine at its distal end ..... ***P. pelagicus***

4. ***Portunus pelagius*** (Linnaeus, 1758)

1758. *Cancer pelagicus* Linnaeus, *Syst. Nat.* 10th ed., 1 : 626.

1899. *Neptunus pelagicus*, Alcock, *J. Asiat. Soc. Bengal*, 68(2) : 34.

2000. *Portunus pelagicus*, Dev Roy and Das, *Rec. zool. Surv. India, Occ. Paper No.*, 185 : 41.

Material examined : 2 exs., Vamsadhara, rest house, Kalingapatnam, 27-01-2003, SZS, CR-5356; 1 ex., Vamsadhara, behind market, Kalingapatnam, 29-01-2003, SZS, CR-5357; 2 exs., Nagavali, down stream, Pukkalapeta, 30-01-2003, SZS, CR-5358.

Mesurements : L-24.0-53.0, W-40.0-92.0.

Diagnosis : Carapace studded with whitish or bluish miliary granules. Posterior border of arm of cheliped with a spine at its distal end; palm bearing three spines–two side by side just behind finger-joint and one near apex of wrist-joint.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. West coast : Kerala; Karnataka; Maharashtra; Gujarat. Islands : Andamans. *Outside* : East and South coasts of Africa, Red Sea, Persian Gulf, Karachi, Mergui Archipelago, Singapore, Philippines, Hong Kong, China, Japan, Australia, New Zealand and Tahiti as far as Hawaiian Islands.

Remarks : This species also occurs in Godavari (Dev Roy and Bhadra, 2005) and Krishna (Rath and Dev Roy, 2009) estuaries.

5. *Portunus sanguinolentus* (Herbst, 1796)

1796. *Cancer sanguinolentus* Herbst, *Krabben und Krebse,* **1** (2) : 161. pl. 8 figs. 56.57.

1899. *Neptunus sanguinolentus,* Alock, *J. Asiat. Soc. Bengal,* **68** (2) : 32.

2000. *Portunus sanguinolentus,* Dev Roy and Das, *Rec. Zool Surv. India. Occ. Paper No.,* **185** : 33, pl. 2, fig. 2.

Material examined : 2 ex., Vamsadhara, southern flank, Kalingapatnam, 28-01-2003, SZS, CR-5398.

Mesurements : L-28.0-40.0 W-50.0-75.0.

Diagnosis : Carapace marked with three blood-red spots on its surface. No spine on posterior border of arm of cheliped; a single spine on palm just behind the finger-joint.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. West coast : Kerala; Karnataka. Islands : Nicobars. *Outside* : East coast of Africa, Red Sea, Persian Gulf, Pakistan, Sri Lanka, Hongkong, Phillippine, Taiwan, Japan, Australia, New Zealand and Hawaii.

Remarks : This crab is landed in appreciable quantities in this estuary. It is also recorded from Godavari (Dev Roy and Bhadra, 2001) and Krishna estuaries (Rath and Dev Roy, 2009).

Genus *Charybdis* de Haan, 1833

1833. *Charybdis* and *Oceanus* de Haan, In : Siebold, *Fauna Japon (Crust.)* : 9,10.

1899. *Charybdis,* Alcock, *J. Asiat. Soc. Bengal,* **68** (2) : 47.

2005. *Charybdis,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 428.

Diagnosis : Carapace hexagonal, depressed or convex, with distinct transverse granular ridges in anterior half. Front cut in to 6 lobes or teeth. Antero-lateral border commonly cut in to 6 teeth. Epistome long. Cheliped stout, legs flattened.

Subgenus *Charybdis* de Haan, 1833

1833. *Charybdis* de Haan, In : Siebold, *Fauna japon. (Crust)* : 9, 10.

2005. *Charybdis,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* : 428.

Diagnosis : Four median tooth of the front nearly of same size. Antero-lateral teeth usually six, often seven. Posterior border of arm of cheliped devoid of spine.

6. *Charybdis (Charybdis) rostrata* (A. Milne.Edwards, 1861)

1861. *Goniosoma rostratum* A Milne Edwards, *Archs. Hist. nat. Paris, sér.* 1, **10** : 379, 385 pl. 35 : fig. 2.

1899. *Charybdis (Goniosoma) rostrata,* Alcock, *J. Asiat. Soc. Bengal,* **68**(2) : 59.

2005. *Charybdis (Charybdis) rostrata,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 435.

Material examined : 1 ex., Vamsadhara, Kalingapatnam, 25-06-2000, CANR, CR-5452.

Mesurements : L- 12.0 W- 15.0.

Diagnosis : Front hexadentate, middle two most prominent projecting far beyond the others. First antero-lateral tooth very acute, last one spiniform and much larger than the others.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. Islands : Andamans. *Outside* : Sri Lanka, Myanmar, Thailand and Indonesia.

Remarks : This is not a common crab in this estuary.

Genus ***Thalamita*** Latreille, 1829

1829. *Thalamita* Latreille, In : Cuvier's, *Règne Anim. Crust.*, (ed 2), **4** : 33.

2005. *Thalamita,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 439.

Diagnosis : Carapace almost hexagonal, depressed or convex and marked with transverse ridges. Front cut in to 2-6 rounded lobes. Antero lateral borders cut in to 5 teeth, fourth one often small or rudimentary. Epistome long. Chelipeds stout. Legs compressed.

Key to species of the genus *Thalamita*

— Antero-lateral border of carapace cut in to 5 sub-equal teeth, crest of basal antennal segment with some granules ..... ***T. crenata***

— Antero-lateral border of carapace cut in to 5 teeth, 4th tooth rudimentary, crest of basal antennal segment with few spines ..... ***T. prymna***

7. ***Thalamita crenata*** (Latreille, 1829)

1829. *Portunus crenatus* Latreille, *Collection du Museum* : 33.

2005. *Thalamita crenata,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 440, pl. 2, fig. 6.

Material examined : 4 ex., Vamsadhara, south branch, Kalingapatnam 3-03-2002, CANR, CR-5359; 2 ex., Nagavali, Gangalavanipeta 25-06-2000, CANR, CR-5405.

Mesurements : L-21.0-30.0 W-25.0-35.0.

Diagnosis : Carapace smooth, convex, distinctly broader than long; surface crossed by fine transverse granular ridges. Front cut in to six sub-equal lobes. Antero lateral margins of carapace cut in to five claw-shaped sub-equal teeth, of which, first tooth the largest, 4th and 5th much smaller. Chelipeds unequal, palm armed with four spines in two rows and one near apex of wrist-joint.

Distribution : India : East coast : Andhra Pradesh; Orissa; Tamil Nadu; Pondicherry. West coast : Maharastra. Islands : Andamans and Nicobars. *Outside* : East Coast of Africa, Red Sea, Pakistan, Sri Lanka, Mergui, Archipelago, Singapore, Phillippines, Japan, Indonesia, Australia, New Zealand, Saoma, Hawaii and Society Islands.

Remarks : Also occurs in Krishna estuary (Rath and Dev Roy, 2009.).

8. ***Thalamita prymna*** (Herbst, 1803)

1829. *Portunus crenatus* Latreille, *Collection du Museum* : 33.

1899. *Thalamita crenata,* Alcock, *J. Asiat. Soc. Bengal,* **68**(2) : 76.

2005. *Thalamita crenata,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 440, pl. 2, fig. 6.

Material examined : 1 ex., Vamsadhara, behind market, Kalingapatnam 29-01-2003, CANR, CR-5360, 3 ex., Vamsadhara, light house, Kalingapatnam 23-06-2000, CANR, CR-5361.

Mesurements : L-12.0-29.0 W-17.0-42.0.

Diagnosis : Fourth tooth of antero-lateral border of carapace rudimentary. Crest of basal segment of antenna traversed by 2-3 spines. Outer surface of palm granular. Sixth segment of male abdomen almost as long as broad.

Distribution : India : East coast : Tamil Nadu. West coast : Gujarat. Islands : Andamans and Nicobars.

Remarks : This species is not very common in this estuary.

Family GRAPSIDAE MacLeay, 1838

1838. Grapsidae MacLeay, In : Smith, *Illustr. Zool. S. Afr. (Invert.)* : 63, 65.

2005. Grapsidae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 473.

Diagnosis : Carapace thick or flat, quadrilateral, lateral borders straight or convex. Front very broad. Buccal cavern square-cut, a rhomboidal gap left between the external maxillipeds. Chelipeds massive.

Key to subfamilies of the family Grapsidae

1. No oblique hairy ridge on the exposed surface of third maxilliped 2

   An oblique hairy ridge on the exposed surface of third maxilliped..... SESARMINAE

2. A wide gap left between third maxillipeds, exopod narrow. Infra-orbital margin extending uninterruptedly to buccal cavity. Male abdomen occupying all space between bases of last ambulatory legs ..... GRAPSINAE

   A moderate gap left between third maxillipeds, exopod broad. Infra-orbital margin incomplete, supplemented by a sub-orbital crest. Male abdomen hardly occupying all space between bases of last ambulatory legs ..... VARUNINAE

Subfamily GRAPSINAE MacLeay, 1838

1838. Grapsidae MacLeay, In : Smith, *Illustr. Zool. S. Afr. (Invert.)* : 63, 65.

1900. Grapsinae, Alcock, *J. Asiat. Soc. Bengal*, **69**(2) : 288, 295, 390.

2005. Grapsinae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* : 474.

Diagnosis : Carapace depressed. External maxillipeds not traversed by any oblique hairy crest. Male abdomen filling entire space between the last pair of ambulatory legs.

9. *Metopograpsus messor* (Forskål, 1775)

1775. *Cancer messor* Forskål, *Desc. Anim.* : 88.

1900. *Metopograpsus messor*, Alcock, *J. Asiat. Soc. Bengal*, **69**(2) : 397.

2005. *Metopograpsus messor*, Dev Roy & Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 477.

Material Examined : 2 ex., Vamsadhara, south branch, Kalingapatnam, 03-03-2002, CANR, CR-5459.

Mesurements : L-10.0-12.0 W-12.0-14.0.

Diagnosis : Carapace broader than long, lateral borders distinctly convergent posteriorly. Front broad, margins beaded, slightly sinuous at the middle. Terminal segment of male abdomen triangular.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. West coast : Gujarat; Maharashtra; Karnataka; Malabar. Islands: Andamans and Nicobars. *Outside* : Suez canal, Red Sea, Aden, Madagascar, Pakistan, Sri Lanka, Bangladesh, Myanmar, Australia and Hawaiian Islands.

Remarks : This crab was collected from mangroves.

Subfamily SESARMINAE Dana, 1852

1852. Sesarminae Dana, *U. S. Explor. Exped.*, **13**(1) : 333.

2005. Sesarminae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* : 482.

Diagnosis : Carapace thick. External maxillipeds traversed by an oblique hairy crest across ischium and merus. Male abdomen may or may not be filling entire space between the last pair of ambulatory legs.

Genus *Episesarama* de Man, 1895

1895. *Episesarma* de Man , *Zool. Jb. (Syst.)*, **9** : 181..

1970. *Neoepisesarma*, Serene and Soh, *Treubia*, **27**(4) : 395, 405.

2005. *Episesarma*, Dev Roy and Bhadra *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 484.

Diagnosis : Carapace and front narrow. Antero-lateral tooth strongly marked behind outer orbital angle. Anterior border of male cheliped armed with a sub distal triangular dentate process. A longitudinal pectinated crest on upper part of male cheliped running parallel to its margin.

10. *Episesarma tetragonum* (Fabricius, 1798)

1798. *Cancer tetragonum* Fabricius, *Ent. Syst. Suppl.* : 341.

1900. *Sesarma tetragonum*, Alcock, *J. Asiat. Soc. Bengal*, **69**(2) : 355.

1995. *Sesarma tetragonum*, Deb, *Zool. Surv. India. Wetland Ecosystem Series*, **1** : *Fauna of Chilka Lake* : 362.

2000. *Neoepisesarma (Muradium) tetragonum*, Dev Roy and Das, *Rec. Zool. Surv. India. Occ. Paper No.* **185** : 97.

2005. *Episesarma tetragonum*, Dev Roy & Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 485.

Material Examined : 4 ex., Vamsadhara, north branch, Kalingapatnam24-06-2000, CANR, CR-5396; 1 ex., Vamsadhara, north branch, Kalingapatnam, 07-07-2001, CANR, CR-5397.

Mesurements : L-11.0-32.0 W-15.0-40.0.

Diagnosis : Carapace squarish, little convex and covered with thick hairs. A sharp tooth in antero-lateral region just behind the outer orbital angle. Cheliped strong and unequal, inner angle of the wrist dentiform. Propopdus and dactylus of legs covered with hairs. Dactylus of male bearing 9-10 tubercles.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. Islands : Andamans. *Outside* : Sri Lanka.

Remarks : The density of this crab was noted to be very poor in small mangroves of the study area. Also recorded from Krishna estuary (Rath and Dev Roy, 2009).

Subfamily VARUNINAE H. Milne Edwards, 1853

1853. Varunacea H. Milne Edwards, *Annls. Sci. nat. (Zool.)*, sér. 3, **20** : 175.

1900. Varuninae, Alcock, *J. Asiat. Soc. Bengal*, **69**(2) : 288, 296, 400.

2005. Varuninae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* : 479.

Diagnosis : Carapace depressed. Front moderately or slightly deflexed, often sublaminar. Exopod of third maxilliped broad.Male abdomen rarely occupy all space between the last pair of legs.

Genus *Varuna* H. Milne Edwards, 1830

1830. *Varuna* H. Milne Edwards, *Dict. Hist. Nat.*, **16** : 511.

1900. *Varuna*, Alcock, *J. Asiat. Soc. Bengal*, **69**(2) : 400.

2005. *Varuna*, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 479.

Diagnosis : Carapace squarish, flattened, regions fairly distinct. Front broad, straight and deflexed. Antero-lateral border cut into 3 teeth (including the outer orbital angle). Epistome well defined. Chelipeds equal, massive in male. Legs compressed.

11. *Varuna litterata* (Fabricius, 1798)

1798. *Cancer litteratus* Fabricius, *Entom. Syst. Suppl* : 342.

1899. *Varuna litterata,* Alcock, *J. Asiat. Soc. Bengal,* **69**(2) : 401.

2005. *Varuna litterata,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 480.

Material Examined : 5 ex., Vamsadhara, southern flank, Kailingapatnam 03-03-2000, CANR, CR-5399; 6 ex., Vamsadhara, upper zone, Kailingapatnam, 05-03-2002, CANR, CR-5400.

Mesurements : L-12.0-36.0 W-13.0-39.0.

Diagnosis : Carapace smooth, depressed with a H-shaped groove at its middle. Antero-lateral borders arched and cut into 3 teeth including the outer orbital angle. Terminal three leg joints compressed and adapted for swimming. Inner border of arm denticulate, inner corner of wrist with a large sharp spine.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. West coast : Kerala; Maharashtra. *Outside* : Myanmar, Bangladesh, Phillipines, Hong Kong, Japan, New Zealand, New Guinea, Singapore, Australia, East Africa.

Remarks : This crab is very common in Vamsadhara and Nagavali estuary. The species has also been reported from Godavari (Dev Roy and Bhadra, 2001) and Krishna estuaries (Rath and Dev Roy, 2009).

Family OCYPODIDAE Rafinesque, 1815

1815. Ocypodia Rafinesque, *Analyse de la Nature* : 96.

2005. Ocypodidae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 497.

Diagnosis : Carapace sub-quadrangular, subcubical or subglobose, deep or flat and broader than long. Front narrow, deflexed. Orbit occupying almost 90% of carapace border. Eye stalk slender and elongated to form a style. Chelipeds unequal. Legs strong.

Key to subfamilies of the family Ocypodidae

— Carapace sub-cubical, anteriorly side walls have sculpture resembling brain convolutions. No hairy ridge pouch between bases of 2nd and 3rd pair of legs ..... Dotillinae

— Carapace sub-qudrilateral, anteriorly side walls have no sculpture. A hairy ridge pouch between bases of 2nd and 3rd pair of legs ..... Ocypodinae

Subfamily OCYPODINAE Rafinesque, 1815

1815. Ocypodia Rafinesque, *Analyse Nature* : 96.

2005. Ocypodinae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 199.

Key to the genera of the subfamily Ocypodinae

Antennular flagella concealed under front.

Eyes large occupying major part of eye stalk ..... ***Ocypode***

Antennular flagella small but not concealed.

Eyes small, eye stalk long and slender ..... ***Uca***

Genus *Ocypode* Weber, 1795

1795. Ocypode Weber, *Nomencl. ent. Syst. Fabr.*, : 92.

1900. Ocypoda, Alcock, *J. Asiat. Soc. Bengal,* **69**(2) : 342.

2005. Ocypode, Dev Roy & Bhadra, *Zool. Surv. India State Fauna Series* **5** : *Fauna of Andhra Pradesh* (Part 5) : 499.

Diagnosis : Carapace sub-quadrilateral, deep, regions ill defined. Front narrow, deflexed. Lateral border with or without tooth behind the outer orbital angle. Eye stalk prolonged to form a style. Epistome short. Chelipeds unequal. Palm of larger chela short with a stridulating ridge. Legs strong.

Key to species of the genus *Ocypode*

— Carapace and its appendages characteristically red in colour, anterior border of first two pair of legs covered with dense hair, finger of smaller cheliped expanded and flattened at tip ..... ***O. macrocera***

— Carapace and its appendages yellow or whitish in colour, anterior border of propodus of leg joints not covered with brushes of hair, finger of smaller chela with a pointed tip ..... ***O. platytarsis***

12. *Ocypode macrocera* H. Milne Edwards, 1837

1837. *Ocypode macrocera* H. Milne Edwards, *Hist. Nat. Crust.,* **2** : 49.

1900. *Ocypoda macrocera,* Alcock, *J. Asiat. Soc. Bengal,* **69**(2) : 432

2005. *Ocypode macrocera,* Dev Roy & Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 502.

Material Examined : 1 ex., Nagavali, south-east flank, Ganagavanipeta, 20-06-2000, CANR, CR-5375; 2 ex., Vamasadhara, light house, Kalingapatnam, 28-06-2000, CANR, CR-5376; 6 ex., Nagavali, mouth, Ganagavanipeta , 05-07-2001, CANR, CR-5377, 2 ex.; Nagavali, Pukkalapeta, 06-03-2002, CANR, CR-5378; 4 ex., Nagavali, Pukkalapet, 07-03-2002, CANR, CR-5379; 4 ex., Nagavali, Pukkalapeta, 28-01-2003, SZS, CR-5380; 4 ex., Nagavali, Mehefuzbandhar, Ganagavanipeta, 25-06-2000, CANR, CR-5406.

Mesurements : L-11.0-28.0 W-15.0-34.0.

Diagnosis : Carapace thick, squarish in outline, granular and reddish in colour. Stridulatory ridge comprising of striations. Eyes large, style prolonged. Finger tip of smaller chela spatula-shaped.

Distribution : India : East coast-West Bengal; Orissa; Andhra Pradesh; Pondicherry; Tamil Nadu. *Outside* : Myanmar, Gulf of Thailand.

Remarks : This is a very common Ocypodid crab occurring in the sandy parts of the estuary. It is also recorded from Krishna estuary (Rath and Dev Roy, 2009).

13. *Ocypode platytarsis* H. Milne Edwards, 1852

1852. *Ocypode platytarsis* H. Milne Edwards, *Annls. Sci. nat. (Zool.),* ser. 3, **18** : 141.

1900. *Ocypoda platytarsis,* Alcock, *J. Asiat. Soc. Bengal,* **69**(2) : 432.

2005. *Ocypode platytarsis,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 504.

Material Examined : 2 ex., Vamsadhara, mouth, Kalingapatnam, 22-06-2000, CANR, CR-5374; 3 ex., Nagavali, down stream, Pukkalapeta, 30-01-2003, SZS, CR-5381; 4 ex., Vamsadhara, rest house, Kalingapatnam, 27-01-2003, SZS, CR-5390.

Mesurements : L-9.0-11 W-12.0-15.0.

Diagnosis : Carapace broader than long, deep and convex. Stridulatory ridge without hairs, consisting of small tubercles. Palm of small cheliped pointed. Dactyli of legs compressed.

Distribution-India : East coast : Orissa; Andhra Pradesh; Tamil Nadu; Pondicherry. West coast : Kerala. Islands : Nicobars. *Outside* : Sri Lanka

Remarks : Also recorded from Krishna estuary (Rath and Dev Roy 2009).

Genus *Uca* Leach, 1814

1814. *Uca* Leach, In : D. Brewester, *The Edinburgh Encyclopedia,* **7**(2) : 430.

1975. *Celuca,* Crane, *Fiddler Crabs of the World. Ocypodidae* : Genus *Uca* : 211.

2005. *Uca,* Dev Roy & Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 499.

Diagnosis : Carapace sub-quadrilateral or sub-hexagonal, deep and smooth, regions indistinct. Front narrow, deflexed. Antero-lateral border absent. Male chelipeds remarkably unequal.

14. *Uca lactea* (de Haan, 1835)

1835. *Ocypode (Gelasiums) lacteus* de Haan, *Faun Japon. (Crust.)* : 54.

1900. *Gelasiums lacteus,* Alcock, *J. Asiat. Soc. Bengal* **69** (2) : 355.

1975. *Uca (celuca) lactea lcactea,* Crane, *Fiddler Crabs of the world : Ocypodidae* : Genus *Uca* : 300.

2005. *Uca lactea,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 508.

Material Examined : 7 ex., Vamsadhara, mouth, Kalingapatnam, 22-06-2000, CANR, CR-5382; 3 ex., Vamsadhara, light house, Kalingapatnam, 23-06-2000, CANR, CR-5383; 9 ex., Vamsadhara, north branch, Kalingapatnam, 24-06-2000, CANR, CR-5384; 5 ex., Vamsadhara, south branch, Kalingapatnam, 03-03-2002, CANR, CR-5385; 5 ex., Nagavali, Pukkalapeta , 06-03-2002, CANR, CR-5386; 9 ex., Vamsadhara, rest house, Kalingapatnam, 27-01-2003, SZS, CR-5387; 1 ex., Vamsadhara, behind market, Kalingapatnam, 29-01-2003, CANR, CR-5398; 5 ex., Nagavali, Pukkalapeta , 30-01-2003, SZS, CR-5389; 2 ex., Nagavali, mouth, Srikakulam 29-01-2003, SZS, CR-5404; 3 ex., Vamsadhara, light house, Kalingapatnam, 28-06-2000,CANR, CR-5405.

Mesurements : L-6.0-10.0 W-10.0-15.0.

Diagnosis : Carapace somewhat rectangular in outline. Outer orbital angle projecting outwardly in a diagonal manner. Larger cheliped porcelain white in male, tip of fixed finger notched or truncated.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Pondicherry; Tamil Nadu. West coast : Kerala; Karnataka; Goa; Maharashtra; Gujarat. Islands : Andamans and Nicobars. *Outside* : South Africa, Madagascar, Mauritius, Red Sea, Persian Gulf, Pakistan, Singapore, Malaya Peninsula, Thailand, Philippines, China, Japan, Indonesia, New Guinea and Australia.

Remarks : This crab occurs in sandy mud substratum of mangroves in Vamsadhara and Nagavali estuary. It is also recorded from Godavari (Dev Roy and Bhadra, 2005) and Krishna estuaries (Rath and Dev Roy, 2009).

Sub-family DOTILLINAE Stimpson, 1858

1858. Dotillidae Stimpson, *Proc. Acad. nat. Sci. Philad.* : 44.

2005. Dotillinae, Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 510.

Diagnosis : Carapace very deep and subglobose in outline. Front narrow, deflexed. Lateral borders with or without tooth. Buccal cavern large, often enormous, closing the external maxillipeds fully. A tympanum present on merus of legs and often on chelipeds and some of the sternal segments.

Key to genera of the subfamily Dotillinae

Merus of third maxillipeds larger than ischium, fourth abdominal segment of male fringed with bristles distally overlapping the fifth segment ..... ***Dotilla***

Merus of third maxillipeds shorter than ischium, fourth abdominal segment normal in male, fifth segment constricted in part or all of its extent giving the abdomen a wasp-like appearance ..... ***Scopimera***

Genus *Dotilla* Stimpson, 1858

1858. *Dotilla* Stimpson, *Proc. Acad. nat. sci. Philad.* : 98.

1900. *Dotilla,* Alcock, *J. Asiat. Soc. Bengal,* **69**(2) : 363.

2005. *Dotilla,* Dev Roy & Bhadra, *Zool. Surv. India. State Fauna Series,* **5** : *Fauna of Andhra Pradesh* (Part 5) : 511.

Diagnosis : Carapace subqubical, deep, surface sculptured. Front narrow, deflexed lobe. lateral border with or without teeth. Eyes small, stalk prolonged to form a style and present terminaly. Epistome short. Chelipeds equal. Fingers slender acute slightly deflexed. Legs moderate.

15. *Dotilla intermedia* de Man, 1888

1852. *Dotilla intermedia* de Man, *J. Linn. Soc. Zool.,* **22** : 135, pl. 9, figs. 4-6.

1899. *Dotilla clepsydrodactylus,* Alcock, *J. Asiat. Soc. Bengal,* **69**(2) : 365.

1995. *Dotilla intermedia,* Bairagi, *Zool. Surv. India. Estuarine Ecosystem Series, Part-2, Hugli Matla Estuary* : 274.

2005. *Dotilla intermedia,* Dev Roy and Bhadra, *Zool. Surv. India. State Fauna Series* **5** : *Fauna of Andhra Pradesh* (Part 5) : 512.

Material Examined : 2 ex., Vamsadhara, light house, Kalingapatnam, 27-01-2003, SZS, CR-5407.

Mesurements : L-6.0-7.0 W-7.0-8.0.

Diagnosis : Carapace distinctly broader than long. Frontal grooves reaching up to gastric region. Gastric region bearing 4 minute tubercles.

Distribution : India : East coast : West Bengal; Orissa; Andhra Pradesh; Tamil Nadu. *Outside* : Mergui Archipelagi, Tavoy.

Remarks : Also recorded from Krishna estuary (Rath and Dev Roy, 2009).

Genus *Scopimera* de Haan, 1835

1858. *Scopimera* de Haan, In : Siebold, *Faun. Japon. (Ctust.),* : 24.

1995. *Scopimera,* Bairagi, *Zool. Surv. India. Estuarine Ecosystem Series, Part-2, Hugli Matla Estuary* : 276.

Diagnosis : Carapace cubical, broader than long, sculptured like *Dotilla.* Maxillipeds unsculptured. Abdomen of male wasp like.

16. *Scopimera globosa* de Haan, 1835

1835. *Scopimera globosa* de Haan, *In : Siebold, Fauna Japan (Crust.)* : 53, pl.11, fig. 3, 3 a-b.

1995. *Scopimera globosa,* Bairagi, *Zool. Surv. India, Estuarine Ecosystem Series, Part-2, Hugli Matla Estuary* : 276.

Material Examined : 1 ex., Vamsadhara, Light house, Kalingapatnam, 27-01-2003, SZS, CR-5408.

Mesurements : L-9.0 W-9.0.

Diagnosis : Carapace divergent posteriorly and covered with tubercles on its surface. Front narrow, pointed. Orbits with strong dorsal inclination, upper orbital margin ending with an extra orbital tooth. Lateral borders of carapace crenulated. Chelipeds subequal and long. Fourth and fifth abdominal segment of male fused.

Distribution : India : East coast : West Bengal; Andhra Pradesh. *Outside* : Malaysia, Hong Kong, North China, Taiwan, Korea and Japan.

Remarks : Also recorded from Krishna estuary (Rath and Dev Roy, 2009).

GENERAL REMARKS

In the present investigation, 17 species of crabs has been recorded from the estuarine tracts of Vamsadhara and Nagavali. The distribution data of crabs from four major estuaries of Andhra Pradesh as presented in Table 1 shows maximum diversity in Krishna (35 species) followed by Godavari (24 species), Vamsadhara (13 species) and Nagavali (6 species). Various factors like varying tidal inundation, hydrological factors, physical nature of the bottom, soil, sediment chemistry etc. govern the nature and distribution of crab fauna in an estuary. As such, it is apparent that an estuarine system should be taken up as a separate entity for the purpose of biological investigations as different estuary represents variation in the faunal composition. The occurrence of higher species diversity in the first two estuaries (Godavari and Krishna) may be attributed to density and diversity of mangroves which offer suitable microhabitats for the sustenance of larger number of species. The relatively lesser number of species in Godavari estuary than Krishna estuary needs further specific research on this aspect. The lower species diversity in Vamsadhara and Nagavali estuaries may be related to degraded mangroves and poor habitat diversity.

In the present study, seven species namely, *Ashtoret lunaris*, *Scylla serrata*, *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis (Charybdis) rostrata*, *Varuna litterata* and *Uca lactea* have been recorded to occur commonly in Godavari, Krishna and Vamsadhara. estuaries. Similarly, five species viz. *Scylla serrata*, *Portunus pelagicus*, *Thalamita crenata*, *Ocypode macrocera* and *O. platytarsis* have been found to be common among Krishna, Vamsadhara and Nagavali estuaries. The study also reveals that *Scylla serrata* and *Portunus pelagicus* are the only two crab species which occur commonly among these four estuaries.

In the present investigation, five species namely, *Parilia alcocki*, *Parthenope longipes*, *Charybdis (Charybdis) annulata*, *Podophthalmus vigil*, *Nectopanope rhodobaphes* and *Ocypode ceratophthalma* have been found to occur only in the Godavari estuary while twelve species viz. *Neodorippe callida*, *Matuta planipes*, *Philyra globulosa*, *Charybdis (Charybdis) callianassa*, *Charybdis (Charybdis) helleri*, *Charybdis (Goniohellenus) hoplites*, *Eurycarcinus*

orientalis, *Myomenippe hardwickii*, *Cardisoma carnifex*, *Episesarma tetragonum*, *Metaplax distincta* and *Dotilla myctiroides*, two species namely, *Thalamita prymna* and *Metopograpsus messor* and one species namely, *Doclea muricata* have been found to occur exclusively in Krishna, Vamsadhara and Nagavali estuaries respectively. Further, it is also revealed that the benthic forms outnumber the swimming forms and the inter-tidal areas bordering mangroves support rich crab species diversity. This corroborates the earlier observation of Dev Roy and Nandi (in press).

Table 1 : Distribution of brachyuran crabs in four major estuaries of Andhra Pradesh

Sl. No.	Group and Species	1*	2**	3+	4+
	Family **Dorippidae**				
1.	*Neodorippe callida* **MacLeay, 1838**	-	+	-	-
	Family **Calappidae**				
2.	*Ashtoret lunaris* (Forskål, 1775)	+	+	+	-
	Matuta planipes Fabricius, 1798	-	+	-	-
	Family **Leucosiidae**				
3.	*Philyra globulosa* H. Milne Edwads, 1837	-	+	-	-
4.	*Philyra sexangula* Alcock, 1896	+	+	-	-
5.	*Parilia alcocki* Wood-Mason, 1891	+	-	-	-
	Family **Parthenopidae**				
6.	*Parthenope longimanus* (Linnaeus, 1764)	+	-	-	-
	Family **Majidae**				
7.	*Doclea muricata* (Fabricius, 1787)	-	-	-	+
	Family **Portunidae**				
8.	*Scylla serrata* (Forskål, 1775)	+	+	+	+
9.	*Portunus pelagicus* (Linnaeus, 1758)	+	+	+	+
10.	*Portunus sanguinolentus* (Herbst, 1803)	+	+	+	-
11.	*Charybdis (Charybdis) annulata* (Fabricius, 1798)	+	-	-	-
12.	*Charybdis (Charybdis) callianassa* (Herbst, 1790)	-	+	-	-
13.	*Charybdis (Charybdis) feriatus* (Linnseus, 1758)	+	+	-	-
14.	*Charybdis (Charybdis) helleri* A. Milne Edwards, 1873	-	+	-	-
15.	*Charybdis (Charybdis) rostrata* (A. Milne Edwards, 1861)	+	+	+	-
16.	*Charybdis (Goniohellenus) hoplites* Wood-Mason, 1877	-	+	-	-
17.	*Thalamita crenata* (A. Milne Edwards, 1829)	-	+	+	+
18.	*Thalamita prymna* (Herbst, 1803)	-	-	+	-
19.	*Podophthalmus vigil* (Fabricius, 1798)	+	-	-	-

Sl. No.	Group and Species	1*	2**	3+	4+
	Family **Xanthidae**				
20.	*Nectopanope rhodobaphes* Wood-Mason, 1891	+	-	-	-
	Family **Pilumnidae**				
21.	*Eurycarcinus orientalis* A. Milne Edwards, 1867	-	+	-	-
	Family **Eriphiidae**				
22.	*Myomenippe hardwickii* (Gray, 1831)	-	+	-	-
	Family **Gecarcinidae**				
23.	*Cardisoma carnifex* (Herbst, 1794)	-	+	-	-
	Family **Grapsidae**				
24.	*Metopograpsus* sp.	-	+	-	-
25.	*Metopograpsus messor* (Forskål, 1775)	-	-	+	-
26.	*Chiromantes bidens* (de Haan, 1835)	-	+	-	-
27.	*Parasesarma plicatum* (Latreille, 1803)	+	+	-	-
28.	*Episesarma taeniolata* (White, 1847)	+	+	-	-
29.	*Episesarma tetragonum* (Fabricius, 1798)	-	+	-	-
30.	*Metaplax crenulata* (Gerstaecker, 1856)	+	+	-	-
31.	*Metaplax distincta* (H. Milne Edwards, 1852)	-	+	-	-
32.	*Metaplax elegans* de Man, 1888	+	+	-	-
33.	*Metaplax intermedia* de Man, 1888	+	+	-	-
34.	*Metaplax indica* H. Milne Edwards, 1852	-	+	-	-
35.	*Varuna litterata* (Fabricius, 1798)	+	+	+	-
	Family **Ocypodidae**				
36.	*Ocypode ceratophthalma* (Pallas, 1772)	+	-	-	-
37.	*Ocypode macrocera* H. Milne Edwards, 1837	-	+	+	+
38.	*Ocypode platytarsis* H. M. Edwards, 1852	-	+	+	+
39.	*Uca dussumieri* (H. M. Edwards, 1852)	+	-	-	-
40.	*Uca lactea* (de Haan,1835)	+	+	+	-
41.	*Uca triangularis* A. Milne Edwards, 1873	-	+	-	-
42.	*Dotilla intermedia* de Man, 1888	-	+	+	-
43,	*Dotilla myctrioides* (H, Milne Edwards, 1852)	-	+	-	-
44.	*Scopimera globosa* Kemp, 1919	-	+	+	-

1 = Godavari estuary 2 = Krishna estuary 3 = Vamsadhara estuary 4 = Nagavali estuary

Source: *Dev Roy and Bhadra, 2005; ** Rath and Dev Roy (in press); + Present study

SUMMARY

17 species of brachyuran crabs under 13 genera and 5 families have been recorded from Vamsadhara and Nagavali Estuary, Srikakulam, Andhra Pradesh. Distribution of crabs in four major estuarine habitats of the state is also discussed.

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REFERENCES

Alcock, A. 1895. Materials for a Carcinological Fauna of India. No. 1. The Brachyura Oxystomata. *J. Asiat. Soc. Bengal*, **64**(2) : 157-291.

Alcock, A. 1896. Materials for a Carcinological Fauna of India. No. 4. The Brachyura Oxystomata. *J. Asiat. Soc. Bengal*, **65**(2) : 134-296.

Alcock, A. 1899. Materials for a Carcinological Fauna of India. No. 4. The Brachyura Cyclometopa. Part II A revision of Cyclometopa with an account of the Families Portunidae, Cancridate and Corystidae. *J. Asiat. Soc. Bengal*, **68**(2) : 1-104.

Alcock, A. 1900. Materials for a Carcinological Fauna of India. No. 6. Brachyura Cyclometopa or Grapsoidea. *J. Asiat. Soc. Bengal*, **69**(2) : 280-456.

Bairagi, N. 1995. Crustacea : Ocypodidae. *Zool. Surv. India.* Hugli Matla Estuary, *Estuarine Ecosystem Series,* **1** : 263-287.

Deb, M. 1995. Crustacea : Xanthidae. *Zool. Surv. India.* Hugli Matla Estuary, *Estuarine Ecosystem Series,* **1** : 217-328.

Deb, M. 1998. Crustacea : Decapoda : Crabs. *Zool. Surv. India. Fauna of* West *Bengal, State Fauna Series,* **3**(Part-10) : 345-403.

Dev Roy, M.K. and Das. A.K. 2000. Taxonomy, ecobiology and *Distribution* pattern of the Brachyuran Crabs of the mangrove ecosystem in Andaman Islands. *Rec. zool. Surv. India, Occ. Paper No.,* **185** : 1-211, pls. 1-21.

Dev Roy, M.K. and Bhadra, S. 2001. Brachyuran Crabs (Crustacea : Decapoda : Brachyura) *Zool. Surv. India. Fauna of Godavari Estuary, Estuarine Ecosystem Series,* **4** : 35-54.

Dev Roy, M.K. and Bhadra, S. 2005.Marine and estuarine crabs (Crustacea : Decapoda : Brachyura). *Zool. Surv. India,* : *Fauna of Andhra Pradesh State Fauna Series,* **5**(Part-5) : 357-535.

Dev Roy, M.K. and Nandi, N.C. (in press). Brachyuran Diversity in Estuarine Environments of India.

Ghosh, S.K. 1995. Crustacea : Grapsidae. *Zool. Surv. India, Hugli Matla Estuary, Estuarine Ecosystem series,* **1** : 229-248.

Rath, S. and Dev Roy, M.K. 2009. Brachyuran Crabs (Crustacea : Decapoda : Brachyura), *Zool. Surv. India, Fauna of Krishna Estuary, Estuarine Ecosystem Series,* **5** : 1-298.

Wood-Mason, J. and Alcock, A. 1891. Note on the Result's of the Last Season's Deep-Sea Dredging : Natural History Notes from H.M. Indian Marine Survey Steamer "Investigator", Commander R.F. Hskyn, R.N., Commanding. No. 21. *Ann. Mag. nat. Hist.*, Ser. 6, **7** : 258-272.

Zool. Surv. India
Fauna of Vamsadhara and Nagavali estuaries, Andhra Pradesh, Estuarine Ecosystem Series, **6** : 2010 : 47-72

MOLLUSCA

A. MOHAPATRA*
Estuarine Biological Station, Zoological Survey of India,
Gopalpur-on-Sea, Orissa

INTRODUCTION

Since southern part of India itself is the largest peninsula in the world, it has vast coast line. Among different biotopes of coastal zone, estuary provides unique habitats with diversified ecological niche.

Phylum mollusca is a highly diversified group of animals with variations in shape, size as well as habit and habitats. Molluscs of Indian estuaries have been studied inadequately. However attention have been given to the estuaries and back waters of India on the east coast.

Estuarine molluscs are important economically, besides their biological significance. Several species of molluscs occurring in large beds in estuaries and back waters support lime industry by providing raw material, as important constituent of the poultry feed and as feed for brackish water aquaculture. Some of the species are also consumed as staple diet by people along the coast.

The estuarine tracts of river Vamsadhara and Nagavali form complex system at their lower reaches providing suitable habitats for estuarine animals. Both Vamsadhara and Nagavali after flowing in two states of Orissa and Andhra Pradesh opens in to Bay of Bengal along Andhra coast near Srikakulam.

Perusal of literature shows no studies have been made so far on mollusca of Vamsadhara and Nagavali estuaries. Along the east coast of India, the estuaries of which malacofauna have been studied in detail are Rishikulya estuary, Chilika lagoon, Hugli-Matla estuary, Mahanadi estuary, Godavari estuary and Krishna estuary. (Rama Rao *et al.*, 1992, Subba Rao *et.al.*, 1995, Subba Rao *et.al.*, 1995, Surya Rao and Mitra, 1998, Mahapatra, 2001 and 2009).

The present study is based on the collection of several surveys conducted by the scientists of Estuarine Biological Station, ZSI during 2000-2003. Specimens have been collected from different regions of estuaries around Kalingapatnam & Ganagalavanipeta of Srikakulam district.

*Present address : FPS Building, Kolkata-700 016

Dry and preserved collections have been deposited with Estuarine Biological Station, Zoological Survey Of India, Gopalpur on-Sea.

Classification followed is as given in Vaught (1989). Systematic accounts of each species. have been dealt with the details of material, which includes serially as no. of exam; le: examined, date of collection of material, collection site, name of the collector/tour party and identification registration number. Distribution pattern and additional information as remarks have been provided for each spcies, Other details of most of the spcies reported in this communication have been already dealt by the author in Fauna of Godavari Estuary and Fauna Of Krishna Estuary publications (2001, 2009).

ABBREVIATIONS USED

CANR & P = C.A. Nageswara Rao & Party ; SZS & P = S.Z. Siddiqi & Party ; ey. = example; ZSI = Zoological Survey Of India; no. = number & nr. = near.

MATERIAL AND METHODS

Several faunistic surveys were conducted during different seasons to collect specimens from different regions of the estuaries (Mouth area, Upper reaches and connecting channels). Both dead and live specimens were hand picked on exposed mud flats, sandy and muddy shores of the estuaries. Most of the materials collected for study were dry collections. Live specimens have been preserved in 4% formaldehyde.

SYSTEMATIC LIST

Class GASTROPODA

Subclass PROSOBRANCHIA

Order NERITOIDEA

Family NERITIDAE

Genus ***Neritina*** Lamarck, 1816

Subgenus ***Dostia*** Gray, 1847

1. *Neritina (Dostia) violacea* (Gmelin, 1791)

Genus ***Theodoxus*** Mont fort, 1810

Subgenus ***Clithon*** Mont fort, 1810

2. *Theodoxus (Clithon) oualaniensis* (Lesson, 1831)

Order MESOGASTROPODA

Superfamily LITTORINOIDEA

Family LITTORINIDAE

Subfamily LITTORININAE

Genus ***Littoraria*** Grifth & Pidgeon, 1834

Subgenus ***Littoraria*** s.st.

3. *Littoraria (Littoraria) undulata* (Gray, 1839)

Superfamily RISSOIDEA

Family ASSIMINEIDAE

Subfamily ASSIMINEINAE

Genus ***Assiminea*** Fleming, 1828

4. *Assiminea brevicula* (Pfeiffer, 1854)

Superfamily CERITHIOIDEA

Family POTAMIDIDAE

Subfamily POTAMIDINAE

Genus ***Cerithidea*** Swainson, 1840

Subgenus ***Cerithideopsilla*** Thiele, 1929

5. *Cerithidea (Cerithideopsilla) cingulata* (Gmelin, 1791)

Genus ***Telescopium*** Montfort, 1810

6. *Telescopium telescopium* (Linnaeus, 1758)

Family TURRITELLIDAE

Subfamily TURRITELLINAE

Genus ***Turritella*** Lamarck, 1799

7. *Turritella acutangula* (Linnaeus, 1758)

8. *Turritella attenuata* Reeve, 1869

Superfamily NATICOIDEA

Family NATICIDAE

Subfamily NATICINAE

Genus ***Natica*** Scopoli, 1777

9. *Natica tigrina* (Roeding, 1798)

Genus ***Polinices*** Montfort, 1810

Subgenus Polinices s.st.

10. *Polinices (Polinices) mammilla* (Linnaeus, 1758)

Superfamily TOMMOIDEA

Family FICIDAE

Genus ***Ficus*** Roeding, 1798

11. *Ficus gracilis* (Sowerby, 1825)

Family CASSIDAE

Subfamily PHALIINAE

Genus ***Phalium*** Link, 1807

Subgenus Phalium s.st.

12. *Phalium (Phalium) areola* Linnaeus, 1758

Family RANELLIDAE

Subfamily RANELLINAE

Genus ***Gyrineum*** Link, 1807

13. *Gyrineum natator* (Roeding, 1798)

Family BURSIDAE

Genus ***Bursa*** Roeding, 1798

14. *Bursa echinata* (Link, 1807)

Genus ***Bufonaria*** Schumacher, 1817

15. *Bufonaria rana* (Linnaeus, 1758)

Order NEOGASTROPODA

Superfamily MURICOIDEA

Family MURICIDAE

Subfamily MURICINAE

Genus ***Murex*** Linnaeus, 1758

16. *Murex carbonnieri* (Jousseaume, 1881)

17. *Murex tribulus* (Linnnaeus, 1758)

18. *Murex trapa* Roeding, 1798

Subfamily RAPANINAE

Genus ***Rapana***, Schumacher, 1817

19. *Rapana rapi formes* (Born, 1778)

Family BUCCINIDAE

Subfamily BUCCININAE

Genus ***Babylonia*** F. Schluter, 1838

20. *Babylonia spirata* (Linnaeus, 1758)

Family NASSARIIDAE

Subfamily DORSANIINAE

Genus ***Bullia*** Gray in Griffith & Pidgeon, 1834

21. *Bullia vittata* (Linnaeus, 1767)

Family MELONGENIDAE

Genus ***Pugilina*** Schumacher, 1817

Subgenus ***Hemifusus*** Swainson, 1840

22. ***Pugilina (Hemifusus) cochlidium*** (Linnaeus, 1758)

Family OLIVIDAE

Subfamily OLIVIDAE

Genus ***Olivancillaria*** d'Orbigny, 1840

23. ***Olivancillaria gibbosa*** (Born, 1778)

Genus ***Oliva*** Bruguiere, 1789

24. ***Oliva caerulea*** (Roeding, 1798)

Superfamily CONOIDEA

Family TURRIDAE

Subfamily TURRICULINAE

Genus ***Turricula*** Schumacher, 1817

25. ***Turricula javana*** (Linnaeus, 1767)

Subclass HETROBRANCHIA

Superorder ALLOGASTROPODA

Superfamily ARCHITECTONICOIDEA

Family ARCHITECTONICIDAE

Genus ***Architectonica*** (Bolten) Roeding, 1798

26. ***Architectonica laevigata*** (Lamarck, 1822)

27. ***Architectonica perspectiva*** (Linnaeus, 1758)

Subclass OPHISTHOBRANCHIA

Order CEPHALASPIDEA

Superfamily PHILINOIDEA

Family HAMINEIDAE/ATYIDAE

Genus ***Haminoea***

28. ***Haminoea elegans*** A. Adams 1850

Class BIVALVIA

Order ARCOIDA

Superfamily ARCOIDEA

Family ARCIDAE

Genus ***Anadara*** Gray, 1847

29. ***Anadara granosa*** (Linnaeus, 1758)

30. *Anadara rhombea* (Born, 1780)

Genus ***Barbatia*** Gray, 1842

31. *Barbatia bistrigata* (Dunker, 1866)

Genus ***Scapharca*** Gray, 1847

32. *Scapharca deyrollei* (Joussaeume, 1893)

33. *Scapharca inaequivalvis* (Bruguiere, 1789)

Superfamily LIMOPSOIDEA

Family GLYCYMERIDIDAE

Genus ***Glycymeris*** De Costa, 1778

34. *Glycymeris tenuicostata* (Reeve, 1843)

Order MYTILOIDA

Superfamily MYTILOIDEA

Family MYTILIDAE

Subfamily MYTILINAE

Genus ***Perna***, Philipsson, 1788

35. *Perna viridis* (Linnaeus, 1758)

Superfamily LIMOIDEA

Family LIMIDAE

Genus ***Lima*** Bruguiere, 1797

36. *Lima vulgaris* (Link, 1807)

Order VENEROIDA

Superfamily CARDITOIDEA

Family CARDITIDAE

Subfamily CARDITINAE

Genus ***Cardita*** Bruguiere, 1792

37. Cardita antiquata (Linnaeus, 1758)

Superfamily CARDIOIDEA

Family CARDIIDAE

Subfamily CARDIINAE

Genus ***Acanthocardia*** Gray, 1851

38. *Acanthocardia coronata* (Schroeter, 1786)

Genus ***Cardium Linnaeus***, 1758

39. *Cardium* sp.

Superfamily MACTRAOIDEA
Family MACTRIDAE
Genus ***Mactra*** Linnaeus, 1767

40. *Mactra sp.*

Superfamily SOLENOIDEA
Family SOLENIDAE
Genus ***Solen*** Linnaeus, 1758

41. *Solen brevis* Gray, 1842

Superfamily Tellinoidea
Family Tellinidae
Subfamily Macominae
Genus ***Macoma***, Leach, 1819
Subgenus ***Psammacoma***, Dall, 1900

42. *Macoma (Psammacoma) birmanica* (Phillipi, 1849)

Genus ***Gastrana*** Schumacher, 1817

43. *Gastrana polygona* (Gmelin, 1791)

Family DONACIDAE
Genus ***Donax*** Linnaeus, 1758

44. *Donax cuneatus* (Linnaeus, 1758)

Subgenus ***Hecuba*** Schumacher, 1817

45. *Donax (Hecuba) scortum* (Linnaeus, 1758)

Family PSAMMOBIIDAE
Subfamily SANGUINOLARIINAE
Genus ***Sanguinolaria*** Lamarck, 1799
Subgenus ***Soletellina*** Blainville, 1824

46. *Sanguinolaria (Soletellina) acuminata* (Deshayes, 1857)

Superfamily CORBICULOIDEA
Family CORBICULIDAE
Genus ***Geloina*** Gray, 1842

47. *Geloina erosa* (Solander, 1786)

Superfamily VENEROIDEA
Family VENERIDAE
Subfamily SUNETTINAE
Genus ***Sunetta*** Link, 1807

48. *Sunetta donacina* (Gmelin, 1791)

49. *Sunetta meroe* (Linnaeus, 1758)

50. *Sunetta scripta* (Linnaeus, 1758)

51. *Sunetta sp.*

Subfamily MERETRICINAE

Genus ***Meretrix*** Lamarck, 1799

52. *Meretrix casta* (Gmelin, 1791)

53. *Meretrix meretrix* (Linnaeus, 1758)

Subfamily TAPETINAE

Genus ***Marcia*** H & A. Adams, 1857

54. *Marcia pinguis* Schroeter, 1788

Genus ***Tapes*** Megerle, 1811

55. *Tapes bruguieri* (Hanley, 1845)

Genus ***Paphia*** Roeding, 1798

56. *Paphia sp.*

SYSTEMATIC ACCOUNT

Class GASTROPODA

Family NERITIDAE

1. ***Neritina (Dostia)*** violacea, Gmelin, 1791

Material examined : 1 ex., 29-1-03, (Nagavali-Upper reaches), SZS & P, M-5617; 1 ex, Kalingapatnam, (Vamadhara-south bank), CANR & P, M-5655.

Distribution : India : Andhra Pradesh : Kakinada, Godavari Estuary, Krishna Estuary; Andaman & Nicobar Islands; Goa; Karnataka : Netravati Estuary nr. Manglore, Kumta, Kodibag nr. Manglore, Kumta, Karwar; Kerala : Cochin backwater; Maharastra : Ratnagiri; Orissa : Mahanadi Estuary nr., Paradeep; Tamil Nadu : Porto Novo, Killai Estuary; West Bengal : Sagar Island, Digha Coast, Hugli-Malta Estuary, Port Canning, Calcutta. Elsewhere : Myanmar; Mergui arhipelago; Philippines; China; Japan; SriLanka; Australia; Thailand; Indonesia; New Calendenia.

Remarks : Found in estuaries & back waters (attached to mangrove vegetation & other substratum). Some times extends into fresh water.

2. ***Theodoxus (Clithon) oualaniensis*** (Lesson, 1831)

Material examined : 03 ex., 28-1-2003, Kalingapatnam (Vamsadhara-near light house), SZS & P, M-5636; 03 exs, 28-1-2003, Kalingapatnam (Vamsadhara-near confluence), SZS & P, M-5642.

Distribution : India : Andhra Pradesh : Godavari Estuary, Bhimilipatnam, Krishna Estuary; Andaman & Nicobar Island; Karnataka : Netravati Estuary nr. Mangalore, Murdeswar, Kodibag; Kerala : Quilon; Orissa : Kushabhadra Estuary near Konark, Arakakuda nr. Chilika mouth, Brahmagiri at Chilika, Gopalpur, Mahanadi Estuary; Tamil Nadu : Vellar Estuary nr. Portonovo, Mandapam, Rameswaram, Kundugal point. Elsewhere : Indonesia : Java, Sumatra; Sri lanka; Thailand.

Remarks : Found on mud flats along running water or on sand patches near estuary. Exhibit polymorphism.

Family LITTORNIDAE

3. ***Littoraria (Littoraria) undulata*** (Gray, 1839)

Material examined : 7 exs, 24-6-2000, Kalingapatnam (Vamsadhara-north branch), CANR & P, M-5684.

Distribution : India : Andhra Pradesh : Krishna Estuary; Andaman & Nicobar Islands; Goa; Karnataka; Kerala; Gujarat; Lakshadweep; Orissa; Tamil Nadu; West Bengal : Hugli-Malta Estuary Medinipur, North & South 24 Parganas. Elsewhere : Indo-pacific, Madagascar to Philippines.

Remarks : Usually occurs in the intertidal region attached to rocks in clusters. Active during night.

Family ASSIMINEIDAE

4. ***Asseminea brevicula*** (Pfeiffer, 1854)

Material examined : 8 exs., 24-6-2000, Kalingapatnam (Vamsadhara–north branch), CANR & P, M-5683; 09 exs., 23- 6-2000, Kalingapatnam (Vamsadhara–near light house).

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Andaman & Nicobar Islands; Tamilnadu; West Bengal : Hugli Malta Estuary. Elsewhere : Borneo; Cebu; Malacca; Philippines & Singapore.

Remarks : An estuarine gastropod. Usually found either crawling on the mud or attached to grasses.

Family POTAMIDIDAE

5. ***Cerithidea (Ceritheopsilla) cingulata*** (Gmelin, 1791)

Material examined : 1 ex., 6-7-2001, Kalingapatnam (Vamsadhara), CANR&P, M-5562; 2 ex., 29-1-03, Kalingapatnam (Vamsadhara), SZS & P, M-5576; 5 exs., 24-6-2000, Kalingapatnam–mouth area (Vamsadhara), CANR & P , M5599; 7 exs., 30-1-03, Kalingapatnam-upper reaches (Vamsadhara), SZS & P, M-5627, 4 exs., 28-1-03, Kalingapatnam–near light house, SZS & P, M-5635; 3 exs., 28-1-03, Kalingapatnam–near confluence (Vamsadhara), SZS & P, M-5641; 2 exs., 4-3-02, Kalingapatnam-south branch (Vamsadhara); CANR & P,

M-5653; 17 exs., 23-6-2000, Kalingapatnam–Near light house (Vamsadhara), CANR&P, M-5681.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Orissa : Chilika lake; Goa; Gujarat; Karnataka; Kerala; Maharastra; Pondichery; Tamil Nadu; West Bengal. Elsewhere : Pakistan, Sri Lanka, Myanmar, Indonesia, Japan.

Remarks : A common estuarine gastropod found in large groups in the mud flats. Common in the estuaries, back waters and mangrove swamps along east & west coast of India. Used as raw material for manufacture of lime.

6. ***Telescopium telescopium*** (Linnaeus, 1758)

Material examined : 1 ex., 6-7-2001, Kalingapatnam–mouth area (Vamsadhara), CANR & P, M-5561; 1 ex, 3-7-2001, Ganagalavanipeta–mouth area (Nagavali), CANR & P, M-5566; 1 ex., 4-3-02, Kalingapatnam–South branch (Vamsadhara), CANR & P, m-5573; 1 ex., 29-1-03, Kalingapatnam (Vamsadhara), SZS & P, M-5574; 5 exs., 24-6-2000, Kalingapatna-mouth area (Vamsadhara), CANR & P, M- 5600 ; 1 ex. , 30-1-03, Kalingapatnam–upper reaches (Vamsadhara), SZS&P, M-5626; o3 exs., 28-1-03, Kalingapatnam–near light house (Vamsadhara), SZS & P, M-5634; 2 exs., 28-1-03, Kalingapatnam–near confluence (Vamsadhara), SZS & P, M-5640; 3 exs., 6-3-02, Pukkalapeta, CANR & P, M-5645; 2 exs., 4-3-02, Kalingapatnam-south branch (Vamsadhara), M-5652; 5 exs., 5-3-02, CANR & P, M-5658.

Distribution : India : Andhra Pradesh : Bhimilipatnam, Godavari and Krishna Estuaries; Andaman & Nicobar Islands; Gujarat : Gulf of Kutch, Kandla Port, Salya beach, Murdeswar; Kerala : Cochin; Pondichery : Karaikal; Orissa : Chandipur, Mahanadi Estuary, Paradeep, Chilika lagoon, Gopalpur, Konark; West Bengal : Hugli-Matla Estuary. Elsewhere: Mayanmar; Indonesia; Malaya Peninsula; Madagascar; North Australia; Philippines; Singapore; Sri Lanka.

Remarks : A common estuarine gastropod. Usually seen partly buried in the soft mud on mud flats. During unfavourable condition it burrows deep in to the mud flats for long time. Commonly known as Horn Shell. Used as raw material for manufacture of lime poultry feed.

Family TURRITELLIDAE

7. ***Turitella acutangula*** (Linnaeus, 1758)

Material examined : 1 ex., 26-6-2000, Ganagalavanipeta, CANR & P, M-5473.

Distribution : India : Andhra Pradesh : Godavari Estuary, Kakinada, Krishna Estuary; Gujarat : Gulf of Kutch; Maharastra : Bombay, Devgarh; Pondichery : Karaikal; Orissa : Chandipur, Chandrabhaga nr. Konark, Ganjam Coast, Mahanadi Estuary, Paradep; Tamilnadu : Madras, Mandapam, Rameswaram, Calimere, Tranquebar. Elsewhere : Myanmar : Maungamagon; Indonesia; Madagascar; Philippines; Sri Lanka.

Remarks : A marine gastropod. Generally occurs buried in the sandy bottom of marine litoral region. Empty shells might have entered in to the estuary by hermit crabs or thrown out by the fisher men collected during trawling.

8. ***Turitella attenuata*** Reeve, 1869

Material examined : 1 ex., 3-7-2001, Ganagalavanipeta–mouth area (Nagavali), CANR & P, M-5567.

Distribution : India : Andhra Pradesh : Krishna Estuary; Orissa; Tamil Nadu; West Bengal : Medinipur. Elsewhere : Eastern Sea.

Remarks : A marine gastropod. Generally found in marine littoral region.

Family NATICIDAE

9. ***Natica tigrina*** (Roeding, 1798)

Material examined : 1 ex., 26-6-2000, Ganagalavanipeta (Nagavali), CANR&P, M-5477.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Andaman & Nicobar Island; Gujarat : Pirotan Island (Gulf of Kutch); Kerala : Cochin; Maharastra : Bombay; Orissa: Mahanadi Estuary, Baleswar, Chandipur, Cuttack Coast; Tamil Nadu; West Benga : Digah, Muriganga Estuary, Ganga Sagar in Sundarban, Medinipur, North & South 24 Parganas. Elsewhere : Australia; China; Fiji; Pakistan; Phillipines; Japan; Persian Gulf; Sri Lanka; Malaysia : Penag; Myanmar: Akyab; Singapore; Hongkong; Indonesia: Java.

Remarks : Generally found in areas of estuariès and sandy/mud in intertidal shallow coastal area. Most of the shells are inhabited by hermit crabs.

10. ***Polinices (Polinices) mammilla*** (Linnaeus, 1758)

Material examined : 4 exs., 6-3-02, Pukkalapetta (Nagavali), CANR&P, M-5489; 2 exs., 29-1-03, Upper reaches/confluence (Nagavali), SZS&P, M-5619.

Distribution : India : Andhra Pradesh : Krishna Estuary; Andaman & Nicobar Islands; Goa; Kerala; Lakshadweep; Maharastra; Orissa : Chandipur, Paradeep, Puri Coast; Tamil Nadu : Madras, Krusadai Island, Kundugal point, shingle Island, Rameswaram, Tuticorin, Tranquebar, Tiruchendur. Elsewhere : Indo-West Pacific.

Remarks : A marine gastropod. Common in shallow waters.

Family FICIDAE

11. ***Ficus gracilis*** (Sowerby, 1825)

Material examined : 1 ex., 26-6-2000, Ganagalavanipeta–South East bank (Nagavali), CANR & P, M-5475.

Distribution : India : Andhra Pradesh : Krishna Estuary; Andaman & Nicobar Islands; Orissa; West Bengal : South 24 Parganas. Elsewhere : Persian Gulf; China; Madgascar; Scychelles; South Japan.

Remarks : A marine gastropod. Resemblance with ***Ficus reticulate*** in its sculpture but differs in having more elevated spire, elongated canal & slender body whorl with axial brown streaks. Synonym : ***Ficus dussumieri*** Chenu.

Family CASSIDAE

12. ***Phalium (Phalium) areola*** Linnaeus, 1758

Material examined : 1 ex., 29-1-03, Upper reaches (Nagavali), SZS&P, M-5622.

Distribution : India : Andhra Pradesh : Visakhapatnam; Andaman Islands; Kerala : Cochin; Orissa : Chandipur, Chatrapur, Gopalpur, Cuttack coast; Tamil Nadu : Madras, Pamban. Elsewhere: South Africa; Sri Lanka; Thailand; Indonesia; Phillipines; Australia.

Remarks : A marine gastropod, prefers sandy bottom of the sea.

Family RANELLIDAE

13. ***Gyrineum natator*** (Roeding, 1798)

Material Examined : 1 ex., 6-3-02, Pukkalapeta, CANR & P, M-5673.

Distribution : India : Andaman and Nicobar Islands; Andhra Pradesh; Maharastra; Tamil Nadu; West Bengal : South 24 Praganas. Elsewhere; Persian Gulf; Red Sea; Pakisthan coast; Sri Lanka; Myanmar; Singapore; Indonesia; Phillipines; China; Japan; New Guinea; Timor; Malacca; New Caledonia.

Remarks : Marine in its habitat and prefers rocky shores. Generally found in under surface of the stones & their crevices. Dead shells are inhabited by hermit crabs.

Family BURSIDAE

14. ***Bursa echinata*** (Link, 1807)

Material examined : 2 exs., 26-6-2000, Ganagalavanipeta–South East bank (Nagavali), CANR & P, M-5474.

Distribution : India : Andaman & Nicobar Island; Gujarat; Kerala; Maharastra; Orissa Mahanadi Estuary; Tamil Nadu. Elsewhere : Myanmar; Java; Philippines.

Remarks : A deep water marine species. Prefers sandy bottom. Empty shells are washed in to the estuary either by tidal waters or carried by the hermit crab.

15. ***Bufonaria rana*** (Linnaeus, 1758)

Material examined : 3 exs., 25-6-2000, Ganagalavanipeta-near Mopasu bundar (Nagavali), CANR & P, M- 5501.

Distribution : India : Andhra Pradesh : Krishna Estuary; Orissa : Baleswar Bay, Chandipur, Cuttack coast, Puri Coast; Tamil nadu : Madras, Porto Novo, Pamban; West Bengal : Sand Heads nr. Hoogly mouth; Elsewhere : Persian Gulf; Indo–Pacific region.

Remarks : Marine in their habitat. An offshore species and prefers sandy bottom.

Family MURICIDAE

16. ***Murex carbonnieri*** (Jousseaume, 1881)

Material examined : 1 ex., 4-3-02, Kalingapatnam–South branch (Vamsadhara), CANR & P, M-5657.

Distribution : India : East & West coasts; Lakshadweep; Andaman & Nicobar Islands. Indo-West Pacific.

Remarks : A marine species. Occurs in sandy bed of the sub litoral zone. Usually caught in the fishermen nets and thrownout on the shore. Empty shells are some time carried in to the estuary.

17. ***Murex tribulus*** (Linnaeus, 1758)

Material examined : 1 ex., 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5500.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; very common on both the coasts of India. Elsewhere : Red sea to Philippines & Japan.

Remarks : A marine species. Occurs in the ittoral region. Highly variable in colour & shows polymorphism. This species has resemblance with *M. trapa* but differ in having more spines on the entire length of the canal & blunt labial teeth.

18. ***Murex trapa*** Roeding, 1798

Material examined : 1 ex., 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5487.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Andaman Islands; Orissa : Mahanadi Estuary; common to east-coast of India from sand heads in Hoogly mouth to Madras coast.

Remarks : Marine in their habitat. Usually caught in fishermen's nets in shallow waters. This species has resembalance with *M. tribulus* but differ in having angular whorls & long labial tooth on outer margin.

19. ***Rapana rapiformes*** (Born, 1778)

Material examined : 2 exs., 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5488.

Distribution : India : Andhra Pradesh : Krishna Estuary ; Andaman & Nicobar Islands; Gujarat; Orissa : Mahanandi Estuary ; Pondichery; Tamil Nadu; West Bengal : Medinipur.

Remarks : A marine species. Occur on the sea bottom of deep inshore waters. Generally caught in the fishermen's net and thrown out on the shore. Empty shells are washed in to the estuary.

Family BUCCINIDAE

20. ***Babylonia spirata*** (Linnaeus, 1758)

Material examined : 2 exs., 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5486; 2 exs., 26-6-2000, Ganagalavanipeta, South-East bank (Nagavali) CANR & P, M-5473; 3 exs., 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5646.

Distribution : India : Andhra Pradesh : Vishakhapatnam; Andaman Islands; Goa ; Gujarat : Gulf of Kutch (Beyt Island); Maharastra : Bombay; Orissa; Tamil Nadu. Indian Ocean.

Remarks : A marine species & occurs in sandy beaches on the intertidal zone & beyond. Empty shells thrown out are often carried in to the estuary by hermit crabs.

Family NASSARIDAE

21. ***Bullia vittata*** (Linnaeus, 1767)

Material examined : 1 ex., 29-1-03, Near confluence (Nagavali), SZS & P, M- 5618; 1 ex., 4-1-03, Upper reaches (Nagavali), SZS & P, M-5639.

Distribution : India : Andhra Pradesh : Visakhapatnam, Krishna Estuary; Maharastra : Bombay; Orissa : Mahanandi Estuary, Chilika lagoon, Puri Coast (Near Konark), Cuttack Coast; Chatrapur, Gopalpur; Tamilnadu : Madras. Elsewhere : Tanzania : Zanzibar; Iran : Makran coast; Mauritius; Sri Lanka; Philippines.

Remarks : A common marine species & ocurs buried in the sandy shores of surf beaten inter-tidal zone. The massive foot of this species help in burrowig quickly.

Family MELONGENIDAE

22. ***Pugilina (Hemifusus) cochlidium*** (Linnaeus, 1758)

Material examined : 1 ex., 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5485, 1 ex., 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5499.

Distribution : India : East & West Coast; Andhra Pradesh : Kakinada Bay, Godavari Estuary, Krishna Estuary. Elsewhere : Indian ocean.

Remarks : An estuarine species. Occurs in the shallow muddy areas of estuaries & back waters. Common in both East & West coast of India including Andamans. The shells are caught by fishermen in large quantity for selling in the market as decorative items.

Family OLIVIDAE

23. ***Olivancillaria gibbosa*** (Born, 1778)

Material examined : 5 exs., 6-3-02, Aukkalapetta (Nagavali), CANR & P, M-5491; 1 ex., 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5503; 1 ex., 26-6-2000, Ganagalavanipeta, CANR & P, M-5601.

Distribution : India : Andhra Pradesh : Visakhapatnam, Kakinada, Krishna Estuary, Pulicat lake; Andaman & Nicobar Island; Gujarat : Gulf of Kutch; Maharastra : Bombay; Orissa : Mahanadi Estuary, Chandipur, Cuttack Coast (Lion's Rump, Paradeep), Puri Coast, Chilika Lagoon, Ganjam Coast (Chatrapur); Tamil Nadu : Madras, Pamban, Krusadai Island, Palk Bay. Elsewhere : East & West Africa; Sri Lanka; Myanmar : Akyab, Maungmagan; Gulf of Thailand; Philippines.

Remarks : A marine species. Prefers sandy beaches in the inter tidal zone. Sometimes empty shells are carried into the estuary.

24. ***Oliva caerulea*** (Roeding, 1798)

Material examined : 1 ex., 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5490.

Distribution : India : Andaman Island; Tamil Nadu. Indo Pacific.

Remarks : Marine in its habitat and is a sand dweller near low tide mark. Some times empty shells are carried into the estuary.

Family TURRIDAE

25. ***Turricula javana*** (Linnaeus, 1767)

Material examined : 1 ex., 26-6-2000, Ganagalavanipeta–South East bank (Nagavali), CANR & P, M-5476.

Distribution : India : Andhra Pradesh : Visakhapatnam, Krishna Estuary; Andaman & Nicobar Islands; Gujarat : Gulf of Kutch; Goa; Kerala; Maharastra : Bombay, Devgarh; Orissa : Mahanadi Estuary, Chandipur, Cuttack Coast, Lion's Rump, Puri coast, Chatrapur (Ganjam Coast); Tamil Nadu : Madras, Tranquebar; West Bengal : Sand heads. Elsewhere : Tanzania : Dar es Salam; Persian Gulf; Pakistan : Karachi; Sri Lanka; Malacca; Penang; Thailand; China; Philippines. Ranges from South West India to Southern China (Powell, 1969).

Remarks : A marine species inhabiting sub littoral zone. Prefers sandy bed. Not common. Empty shells are some time carried in to the estuary by hermit crabs.

Family ARCHITECTONICIDAE

26. ***Architectonica laevigata*** (Lamarck, 1822)

Material examined : 1 ex., 29-1-03, Upper reaches (Nagavali), SZS & P, M-5620.

Distribution : India : Gujarat : Gulf Of Kutch; Maharastra : Bombay; Orissa : Gopalpur, Puri beach, Chandrabhaga beach near Konark, Paradip; Pondichery; Tamil Nadu. Elsewhere : Persian Gulf to Myanmar.

Remarks : A marine species. Distinguished from *A. perspectiva* in having deep suture, beaded margined umbilicus with two groves, brown blotches below suture & four groves.

27. ***Architectonica perspectiva*** (Linnaeus, 1758)

Material examined : 2 exs., 29-1-03, Upper reaches (Nagavali), SZS & P, M- 5621.

Distribution : India : Andhra Pradesh : Visakhapatnam; Tamil Nadu : Porto Novo, Point Calimere, Pamban. Indo-Pacific.

Remarks : A marine species.

Subclass OPHISTHOBRANCHIA

Order CEPHALASPIDEA

Superfamily PHILINOIDEA

Family HAMINOEIDAE

Genus HAMINEA

28. ***Haminoea elegans*** A. Adams

Material examined : 06 exs., 4-3-02, Kalingapatnam-South branch (Nagavali), CANR & P, M-5656.

Distribution : India : Andhra Pradesh : Visakhapatnam, Masulipatnam.

Remarks : A marine species. Inhabits shallow waters of the sandy intertidal zone. Uncommon.

Class BIVALVIA

Family ARCIDAE

29. ***Anadara granosa*** (Linnaeus, 1758)

Material examined : 1 valve, 30-1-03, Pukkalpeta-Lower reaches (Nagavali), SZS & P, M-5509; 3 valves, 29-1-03, Pukkalpeta-towards upper reaches (Nagavali), SZS & P, M-5518; 01 valve, 29-1-03, Kalingapatnam-near market (Vamsadhara), SZS & P, M-5586; 4 valve, 7-2-02, Pukkalpeta, CANR & P, M-5665.

Distribution : India : Andhra Pradesh : Godavari Estuary, Kakinada, Krishna Estuary; Gujarat; Kerala; Malabar Coast; Maharastra : Bombay; Orissa : Chandipur, Mahanadi Estuary, Chilika lagoon, Puri Coast; Tamil Nadu : Ennur Back Waters, Tranquebar; West Bengal : Hugli Matla estury, Medinipur, North & South 24 Paraganas. Elsewhere : Indo Pacific.

Remarks : An estuarine species. Occur in soft mud in estuaries & back waters. Commercially cultured for its edible soft parts and shell is used as raw material for the manufacture of lime.

30. ***Anadara rhombea*** (Born, 1780)

Material examined : 2 valves, 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5495; 2 valve, 29-1-03, Pukkalpeta, SZS & P, M-5519; 1 valve, 5-7-01, Ganagalavanipeta (Nagavali), CANR & P, M-5539.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Andaman & Nicobal Islands; Gujarat : Gulf of Kutch; Maharastra : Ranagiri, Bombay; Orissa : Mahanadi Estuary, Chandipur, Hukitola, Puri Coast (Konark), Gopalpur; Tamil Nadu : Coromandal Coast, Madras, Tranquebar, Elsewhere : China Sea; Indonesia : Salong, Sumatra, Java, Philippines, Pakistan : Karachi : Sri Lanka.

Remarks : A marine species. Occuring attached to rocks & boulders on the coast. Empty valves some times enter in to the estuary & back water by the tidal water. The species can be distinguished from *A .granosa* in having more number of ribs which are nodulose except for posterior slope & with angulate postero-ventral margin.

31. ***Barbatia bistrigata*** (Dunker, 1866)

Material Examined : 1 valve, 29-1-2003, Pukkalapeta-Upper reaches (Nagavali), SZS & P, M-5529.

Distribution : India : Gujarat : Veraval; Maharastra : Bombay; Orissa : Chandipur, Chandrabhaga beach near Konark, Off Ganjam coast; Tamil Nadu : Madras. Elsewhere : China.

Remarks : A marine species. Inhabit in shallow water near low tide mark on sandy shore.

32. ***Scapharca deyrollei*** (Jaussaeume, 1893)

Material examined : 1 valve, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5466; 3 valves, 29-1-03, Pukkalpeta (Nagavali), SZS & P, M-5525; 1 valve, 7-2-02, Pukkalapeta (Nagavali), CANR & P, M-5666.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Orissa : Mahanadi Estuary, Chandipur, Puri Coast, Chatrapur; Maharastra : Bombay, Alibag, Ratnagiri; Tamil Nadu : Madras, Coromandal Coast; West Bengal : Sand Heads, Medinipur; Elsewhere : Sri Lanka; Myanmar : Tavoy; Malaysia : Penang; Indonesia : Sumatra, Java & China sea.

Remarks : A marine species, empty valves might have washed in to the estuary.

33. ***Scapharca inaequivalvis*** (Bruguiere, 1792)

Material examined : 2 valves, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5465; 5 valves, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5520; 1 valve, 3-7-2001, Ganagalavanipeta (Nagavali); M-5550

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Goa; Gujrat : Pirotan Island in Gulf of Kutch; Kerala : Cochin; Maharastra : Bombay; Orissa : Mahanadi Estuary, False Point, Konark Coast, Ganjam Coast; Tamil Nadu : Madras, Krusdai, Kundugal Point, Tranquebar, West Bengal : Medinipur, South 24 Parganas, Elsewhere : Myanmar : Mergui-Archipelago; China; Indonesia; Japan; Philippines; Persian Gulf.

Remarks : Marine in its habitat. Empty valves are found on the shore & some of them might have entered in to the estuary by the tidal water.

Family GLYCYMERIDIDAE

34. ***Glycymeris tenuicostata*** (Reeve, 1843)

Material examined : 2 valves, 29-1- 03, Pukkalapeta (Nagavali), SZS & P, M-5528; 1 valve, 29-1-03, Pukkalapeta, SZS & P, M-5537; 1 valve, 3-7-2001, Ganagalavanipeta (Nagavali), M-1546.

Distribution : India : Orissa : Chilika Lagoon. Elsewhere : Indo-Pacific region.

Remarks : A marine species. Empty valves commonly found washed along the shore & some of them might have entered in to the estuary. Live buried in the shallow sandy bottom. Resemblance to those of family Arcidae. About 150 species are known & of which 3 species under the genus *Glycymeris* are reported from India.

Family MYTILIDAE

35. ***Perna viridis*** (Linnaeus, 1758)

Material examined : 1 valve, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5517.

Distribution : India : Andhra pradesh : Visakhapatnam, Bhimilipatnam, Kakinada; Gujarat : Gulf of Kutch; Goa; Kerala : Cochin, Allepy; Maharastra : Malvan, Ratnagiri, Bombay; Orissa : Mahanadi Estuary, Chandipur, Chilika Lagoon (Manikapatna), Chatrapur, Goppalpur, Sunupur; Pondichery; Tamil Nadu : Madras, Pamban, Porto Novo West Bengal, Medinipur. Elsewhere : From Hong Kong to Arabian sea.

Remarks : A brackish water species, generally found attached to the substratum in estuary & back waters. Also occur on rocky shores near low tide mark & in rock crevices,. Commonly known as "Green mussel" and is cultured commercially for its edible flesh.

Family LIMIDAE

36. ***Lima vulgaris*** (Link, 1807)

Material examined : 1 valve, 3-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5557.

Distribution : India : Andaman Islands. Elsewhere : Japan, Indo-Pacific.

Remarks : A marine species. Synonym : *Lima souerbuyi (Wellens).*

Family CARDITIDAE

37. ***Cardita antiquata*** (Linnaeus, 1758)

Material examined : 2 valves, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5527; 2 valves, 3-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5552.

Distribution : India : Gujarat : Gulf Of Kutch; Goa; Maharastra : Mumbai; Andhra Pradesh : Visakhapatnam; Orissa : Paradip, Chilika lagoon, Chandrabhaga near Konark,

Chatrapur, Gopalpur; Pondichery; Tamil Nadu : Kundugal Point, Tuticorin, Chennai, Krusadai Island. Elsewhere : Sri Lanka; Myanmar.

Remarks : A marine species. Occur in shallow water near low tide level on sandy shore. Empty valves are some time carried in to the estuary. Resembles *Anadara granosa* apparently but differ in having widely separated radial ribs and in hinge structure.

Family CARDIIDAE

38. ***Acanthocardia coronata*** (Schroeter, 1786)

Material examined : 1 valve, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5516.

Distribution : India : Andhra pradesh : Godavari Estuary, Visakhapatnam; Andamans & Nicobar Islands; Gujarat : Gulf of Kutch; Maharastra : Deogarh, Bombay; Orissa : Mahanadi Estuary, Chandipur, Paradeep, Konark; Tamil Nadu : Madras, Kundugal Point, Krusadai, Palk Bay, Mandapam. Elsewhere : Myanamar : Arakan Coast, Maungamagan; Indonesia : Sumatra; Persian Gulf.

Remarks : Inhabits in marine waters, prefers muddy soil near estuary & back Water. Grows to fairly large size. Occur on both East & West coasts of India. Extensively collected by fishermen from knee deep mud on the Bombay coast.

Genus ***Cardium*** Linnaeus, 1758

39. ***Cardium*** sp.

Material examined : 2 valves, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5534; 1 valve, 3-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M–5553.

Descriptions : Sculptured with radial ribs; cardinal teeth lucinoid type; cardinals two in each valve; lateral teeth present. Measurements : Length = 26-31 mm; Height = 20-23 mm.

Family MACTRIDAE

40. ***Mactra*** sp.

Material examined : 1 valve, 5-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5543; 1 valve, 6-7-2001, Kalingapatnam (Vamsadhara), CANR & P, M-5556; 1 valve, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5531, 5 valves, 29-1-03, Pukkalapeta, SZS & P, M-5526.

Descriptions : Shell ovately trigonal in shape, whitish in colour & with more than one cardinal teeth in the left valve; hinge is "inverted V-shaped"

Measurements : Length = 21-40 mm.; Height = 15-30 mm.

Family SOLENIDAE

41. ***Solen brevis*** Gray, 1842

Material examined : 1 ex., 4-3-02, Kalingapatnam (Vamsadhara), CANR & P, M-5670.

Distribution : India : Andhra Pradesh : Krishna Estuary; Orissa; Tamil Nadu; West Bengal : Hugli Matla Estuary, Medinipur, North & South 24 Parganas.

Remarks : A marine species. Only one cardinal tooth is present in solen. Posses large & powerful foot to borrow vertically. This species is edible.

Family TELLINIDAE

42. ***Macoma (Psammacoma) birmanica*** (Philippi, 1849)

Material examined : 2 ex., 30-1-03, Pukkalapeta-Lower reaches (Nagavali), SZS & P, M-5511; 1valve, 27-1-03, Kalingapatnam—near light house (Vamsadhara), SZS & P, M- 5580; 2 valve, 5-3-02, Kalingapatnam (Upper reaches of Vamsadhara), CANR & P, M-5590, 2 valve, 28-1-03, Kalingapatnam (Vamsadhara), SZS & P, M-5595; 11 ex., 24-6-2000, Kalingapatnam-north branch (Vamsadhara), CANR & P, M-5607; 1 ex., 25-6-2000, Ganagalavanipeta–near Nehru bundar (Nagavali), CANR & P, M-5612; 2 ex., 6-3-02, Pukkalpeta (Nagavali), CANR & P, M-5651; 2 ex., 4-3-02, Kalingapatnam (Vamsadhara), CANR & P, M-5669; 1 ex., 6-3-02, Pukkalpeta (Nagavali), CANR & P, M-5675; 1 ex, 28-1-03, Kalingapatnam–near light house (Vamsadhara), SZS & P, M-5680.

Distribution : India : Andhra Pradesh : Godavari Estuary, Kakinada Bay, Krishna Estuary; Orissa : Mahanadi Estuary, Baleswar Coast, Talasari; West Bengal : Digha, Chemaguri nr. Sagar Island, Port Canning, Hugli Matla Estuary, Elsewhere Myanmar.

Remarks : An estuarine species, occur buried in the sub surface soft mud of the mudflat. Siphons are long & golden yellow in colour in live condition.

43. ***Gastrana polygona*** (Gmelin, 1791)

Material examined : 1 valve, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5534.

Distribution : India : Gujarat; Kerala : Maharastra; Nicobar Islands; Tamil Nadu. Elsewhere : Pakisthan.

Remarks : A marine species.

Family DONACIDAE

44. ***Donax cuneatus*** (Linnaeus, 1758)

Material examined : 2 valves, Ganagalavanipeta (Nagavali), CANR & P, M-5545; 2 valves, 7-7-2001, CANR & P, M-5564.

Distribution : India : Andaman & Nicobar Islands; Gujarat; Karnataka; Maharastra; Pondichery; Tamil Nadu. Elsewhere : Sri Lanka, New Caledonia. Indo-Pacific.

Remarks : A marine species inhabiting beach slopes.

45. ***Donax (Hecuba) scortum*** (Linnaeus, 1758)

Material examined : 3 valves, 29-1-03, Pukkalapeta-Upper reaches (Nagavali), SZS & P, M-5514; 1 valve 26-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5604.

Distribution : India : Andhra Pradesh : Visakhapatnam, Godavari Estuary, Krishna Estuary; Goa; Gujarat : Gulf of Kutch; Karnataka; Kerala : Malabar Coast; Maharastra: Bombay; Orissa: Mahanadi Estuary, Chandipur, Puri Coast, Ganjam Coast; Pondichery; Tamilnadu : Madras, Krusadai Island, Shingle Island, Kundugal Point; West Bengal : Medinipur, Digha. Elsewhere : South Africa; Persian Gulf; Pakistan; Sri Lanka; Myanmar, Indonesia; China.

Remarks : Prefers sandy bed admixed with mud near estuary.

Family PSAMMOBIIDAE

46. ***Sanguinolaria (Soletellina) acuminata*** (Deshayes, 1857)

Material examined : 1 valve, 7-7-2001, Kalingapatnam (Vamsadhara), CANR & P, M-5563.

Distribution : India : Andhra Pradesh : Godavari Estuary; Kerala : Astamudi nr. Travancore; Maharastra; Orissa: Mahanadi Estuary, Chandipur, Puri Coast, Ganjam Coast; Tamil Nadu; West Bengal : Hugli Matla Estuary, Digha, Sagar Island, Medinipur, North & South 24 Parganas. Elsewhere : Pakistan : Karachi; Bangladesh; Sri Lanka; Myanmar; Malasiya: Malacca; Philippines; China & Japan.

Remarks : Occurs on mud flats near estuary along the coast. Prefers sandy bed admixed with mud within intertidal zone.

Family COBICULIDAE

47. ***Geloina erosa*** (Solander, 1786)

Material examined : 1 valve, 5-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5544.

Distribution : India : Andhra Pradesh : Godavari Estuary; Orissa; West Bengal : Gangetic delta. Elsewhere : Common in Indo-Pacific regions.

Remarks : Inhabits in fresh waters, estuaries & back waters.

Family VENERIDAE

48. ***Sunetta donacina*** (Gmelin, 1791)

Material examined : 1 valve, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M–5530.

Distribution : India : Andhra Pradesh : Vishakhapatnam, Bhimilipatnam; Gujarat : Gulf Of Kutch; Karnataka : Mangalore; Maharastra : Mumbai; Orissa : Cuttack coast, Chilika lagoon (Kalupada Ghat, Balugaon). Elsewhere : Persian Gulf; Red Sea; Sri Lanka; Myanmar : Maungmagan, Mergui Archipelago; Indonesia : Sumatra, Moluccas.

Remarks : A marine species. Prefers sandy shores of shallow intertidal regions.

49. ***Sunetta meroe*** (Linnaeus, 1758)

Material examined : 3 valves, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5515; 1 valve, 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5614.

Distribution : India : Andhra Pradesh : Bhimilipatnam, Visakhapatnam; Maharastra : Mumbai; Orissa : Chandipur, Paradip, Chilika lagoon (Satapada, Manikpatana), Chandrabhaga beach near Konark, Chatrapur, Gopalpur; Pondichery; Tamil Nadu : Porto Nov, Tranquebar. Elsewhere : Indian Ocean.

Remarks : A marine species. Inhabits littoral region by burrowing in to sand or mud substratum.

50. ***Sunetta scripta*** (Linnaeus, 1758)

Material examined : 1 valve, 5-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5541.

Distribution : India : Andhra Pradesh : Visakhapatnam; Goa; Gujarat : Gulf Of Kutch ; Kerala : Tranvancore; Karnataka : Suratkal, St Mary Island, Mangalore; Maharastra : Mumbai; Orissa : Chandipur, Paradip, Puri beach, Chandrabhaga near Konark, Chilika lagoon (Satapada, Barakuda, Arakhakuda, Manikpatna, Tonda), Chatrapur, Gopalpur. Elsewhere : Sri Lanka; Indonesia; Myanma : Maungmagan; Philippines; Moluccas.

Remarks : A marine species. Prefers sandy beaches of intertidal region.

51. ***Sunetta*** sp.

Material examined : 1 valve, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5467; 2 valves, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5532; 1 valve, 5-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5540, 1 valve, 28-1-03, Kalingapatnam—near light house (Vamsadhara), SZS & P, M-5597.

Descriptions : Shell flattened, smooth & whitish in colour; ligament deeply excavated. Measurements : Length = 15-20 mm.; Height = 12-15 mm.

52. ***Meretrix casta*** (Gmelin, 1791)

Material examined : 2 valves, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5471; 4 valves, 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5492; 2 valves, 30-1-03, Pukkalapeta (Nagavali), SZS & P, M-5512; 2 valves, 29-1-0 Pukkallapeta (Nagavali), SZS & P, M-5523; 2 valves, 3-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5548; 1 valve,

27-1-03, Kalingapatnam–near Light house (Vamsadhara), SZS & P, M-5579; 3 ex., 27-1-03, Kalingapatnam–side of rest house (Vamsadhara), SZS & P, M-5582; 1 valve, 29-1-03, Kalingapatnam–behind market (Vamsadhara) SZS & P, M-5587; 1 valve, 5-3-02, Kalingapatnam (Vamsadhara), CANR & P, M-5591; 3 valves, 28-1-03, Kalingapatnam–near light house (Vamsadhara), SZS & P, M-5593; 5 exs., 26-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5603; 10 ex., 24-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5605; 2 ex., 23-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5609; 2 exs., 23-6-2000, Kalingapatnam–near light house (Vamsadhara), M–5609; 2 exs., 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5611; 1 ex., 27-1-03, Kalingapatnam-near confluence (Vamsadhara), SZS & P, M-5629; 3 exs., 28-1-03, Kalingapatnam-near light house (Vamsadhara), SZS & P, M-5632; 2 exs., 28-1-03, Kalingapatnam-near light house (Vamsadhara), SZS & P, M-5644; 1 valve, 6-3-02, Pukkalapeta (Nagavali), CANR & P, M-5668; 1 valve, 28-1-03, Kalingapatnam–south branch (Vamsadhara), CANR & P, M-5668 ; 1 valve, 28-1-03, Kalingapatnam–southern flank near light house (Vamsadhara), SZS & P, M–5677.

Distribution : India : occurs in both coasts in back waters & connecting canals, Elsewhere; Myanmar : Arkan; Malaysia; Malacca; Signapore; Sri Lanka.

Remarks : An estuarine species. Prefers sandy bed mixed with mud near estuaries & back waters. Remains buried at sub surfaces level. Variable in its shape, colouration & thickness. As per revisionary work of Hornell (1917) on Indian species of *Meretrix*, "typical form" occurs from Chilika lagoon to Cape Comrin on east coast and a variety *satparaensis* occurs in sub fossil condition in shell deposits in Chilika lagoon, Sunupur (Orissa), Pulicat & Madras back waters (Tamilnadu).

53. ***Meretrix meretrix*** (Linnaeus, 1758)

Material examined : 2 valves, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M–5470; 2 valves, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5496; 2 valves, 30-1-03, Pukkalapeta (Nagavali), SZS & P, M –5513; 2 valves, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5524; 3 ex., 3-7-2001, Ganagalavanipeta, CANR & P, M-5548; 2 valves, 6-7-2001, Kalingapatnam (Vamsadhara), CANR & P, M-5554; 3 exs., 4-3-02, Kalingapatnam (Vamsadhara), CANR & P, M-5571; 2 exs., 27-1-03, Kalingapatnam–infront of rest house (Vamsadhara), SZS & P, M-5581; 3 valves, 29-1-03, Kalingapatnam-near market (Vamsadhara), SZS & P, M-5584; 2 valves, 5-3-02, Kalingapatnam (Vamsadhara), CANR & P, M–5588; 1 valve, 28-1-03, Kalingapatnam–near light house (Vamsadhara), SZS & P, M-5592; 1 valve, 26-6-2000, Ganagalavani petta, CANR & P, M-5602; 4 exs., 24-6-2000, Kalingapatnam-north branch (Vamsadhara), CANR & P, M-5606; 10 exs., 23-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5608; 6 exs., 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5610; 8 exs., 27-1-03, Kalingapatnam– Light house, SZS & P, M-5630, 16 exs., 28-1-03, Kalingapatnam–near light house (Vamsadhara), SZS & P, M-5631; 31 exs., 28-1-03,

Kalingapatnam–near light house, SZS & P, M–5643; 1 ex., 6-3-02, Pukkalapeta—near Mopasa Bundar (Nagavali), CANR & P, M-5649; 4 exs., 7-2-02, Pukkalapeta (Nagavali), CANR & P, M-5664; 1 ex., 4-3-02, Kalingapatnam–South branch (Vamsadhara), M-5667; 4 ex., 28-1-03, Kalingapatnam-south flank near light house (Vamsadhara), SZS & P, M–5676.

Distribution : India : Andhra Pradesh : Godavari Estuary, Krishna Estuary; Andaman & Nicobar Islands; Goa; Gujarat; Kerala; Maharastra; Orissa : Chandipur, Mahanadi Estuary, Paradip, Puri Coast, Chilika Lagoon (Satpada, Outer Channel, Arakhakuda), Chatrapur (Ganjam Coast); Pondichery; Tamil Nadu; West Bengal : Hugli Matla Estuary, Medinipur, North & South 24 Praganas. Elsewhere : Red Sea; Aden; Sri Lanka; Siam; Java; Sumatra; Borneo; Philippines; China; Japan; Myanmar.

Remarks : An estuarine species. Commonly occurs buried in sandy beds mixed with mud. Due to variation in its shape and coloration, there are descriptions of several varities viz., *morphina, impudica, zonaria, castanea & durora.* It can be distinguished from *M. casta* by its ventricose shape, narrow hinge & very distinct anterior cardinal teeth on left valve. This species is collected in large numbers as the shell is used as raw material for lime manufacture & for its flesh which is edible.

54. ***Marcia pinguis*** Schroeter, 1788

Material examined : 8 valves, 22-6-2000, Kalingapatnam (Vamsadhara), CANR & P, M-5472; 1 valve, 22-6-2000, Kalingapatnam, CANR & P, M-5493; 2 valve, 29-1-03, Pukkalapeta (Nagavali), SZS & P, M-5522; 1 valve, 5-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5538; 1 valve, 4-3-02, Kalingapatnam (Vamsadhara), CANR & P, M-5572; 2 valves, 27-1-2003, Kalingapatnam–Light house (Vamsadhara), SZS & P, M-5578, 2 valves, 29-1-03, Kalingapatnam–behind market (Vamsadhara), M-5585; 1 valve, 5-3-02, Kalingapatnam (Vamsadhara), CANR & P, M-5589; 4 valves, 28-1-03, Kalingapatnam–near light house (Vamsadhara), SZS & P, M-5595; 1 valve, 25-6-2000, Ganagalavanipeta (Nagavali), CANR & P, M-5615; 1 valve, 7-2-02, Pukkalapeta (Nagavali), CANR & P, M-5663; 3 ex., 28-1-03, Kalingapatnam (Vamsadhara), SZS & P, M-5678.

Distribution : India : Andhra Pradesh : Krishna Estuary; Kerala : Cochin; Orissa : Baleswar, Chandipur, Chatrapur (Ganjam Coast); Tamil Nadu : Pamban; West Benga : Digha, Medinipur, North & Sourth 24 Parganas.

Remarks : An estuarine species. Commonly occur in back waters near estuary. Prefers fine sandy bed mixed with mud.

55. ***Tapes bruguieri*** (Hanley, 1845)

Material examined : 1 valve, 5-7-2001, Ganagalavanipeta (Nagavali), CANR & P, M-5542.

Distribution : India : Andhra Pradesh; West Bengal : South 24 Praganas. Elsewhere : Sri Lanka.

Remarks : White in colour with broadly rayed reddish fulvous.

56. ***Paphia*** sp.

Material examined : 1 ex., 28-1-03, Kalingapatnam—near light house (Vamsadhara), SZS & P, M-5633.

Description : Shell elongate & compressed; lunule narrow & elongate; margin smooth; lateral teeth absent. Measurements : Length = 17 mm; Height = 13 mm.

DISCUSSION

Tropical estuaries support wide range of species. Estuarine molluscs of tropical areas are mainly recent immigrants from the sea. The transition of marine molluscs to brackish water or fresh water form is easy under tropical conditions. In an estuary, for the dispersal of the molluscs, temperature is the most essential factor & is specific for a particular species. In a particular niche of the estuary, increase of individuals of a species with the related number of other species is due to sharp competetion among the species leading to either dispersal of some species to the other parts or total extinction of the species.

Molluscs inhabit estuarine areas associated with vegetation, among mud flats and attached to hard substratum. In the estuary molluscs inhabit mainly the intertidal and littoral zones near the sea and occasionally descend to a greater depth Resident fauna of an estuary are mainly benthic fauna of intertidal habitats & can be further grouped under either epifauna or infauna.

Epifauna includes mainly gastropods and some sessile bivalves which constitute the bulk of resident fauna. Burrowing bivalves are grouped under Infauna. The intertidal burrowing bivalves remain active during high tide and burrow deep into the soil when the habitat is exposed to air. Due to mechanical process involved during burrowing, thick shelled species occur in the sand while the smooth shelled one inhabit mudy bed. Besides soil type other factors like temperature, rainfall & salinity also influence the choice for a particular species.

Present study shows two classes of Phylum mollusca namely Gastropoda & Bivalvia have their representatives in this estuary, which includes true estuarine, marine & fresh water species.

Most of the species reported from Vamsadhara & Nagavali estuaries are common either to Godavari Estuary or Krishna Estuary of Andhra coast, But species like *Phalium areola, Murex carbonnieri, Babylonia spirata, Oliva caerulea, Architectonica laevigata, Architectonica perspectiva, Haminoea elegans* among gastropods and *Barbatia bistrigata, Glycymeris tenuicostata, Lima vulgaris, Cardita antiquate, Tapes bruguieri, Gastrana polygona, Sunetta*

donacina, Sunetta meroe and Sunetta scripta among bivalves are occurring in Vamsadhara and Nagavali Estuary but not reported from Godavari and Krishna Estuary.

SUMMARY

In this study a total of 56 species belonging to 44 genera & 31 families representing 2 classes of Phylum mollusca have been reported. The class Gastropoda is represented by 28 species belonging to 23 genera and 18 families. As many as 28 species under 21 genera & 13 families are listed under the class Bivalvia.

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REFERENCES

Dey, A. and Ramakrishna 2007. Fauna of Andhra Pradesh, *State Fauna Series*, **5**(7)–Marine Molluscs : 149-260. Published by *Zool. Surv. India.*

Mohapatra, A. 2001. Mollusca. *Fauna of Godavari Estuary, Estuarine Ecosystem Series,* **4** : 55-82. Zoological Survey of India.

Mohapatra, A. 2009. Mollusca. *Fauna of Krishna Estuary, Estuarine Ecosystem Series,* **5** : 105-173. Zoological Survey of India.

Ramakrishna, Dey, A. Barua, S. and Mukhopadhya, A. 2007. *Fauna of Andhra Pradesh, State Fauna Series*, **5**(7)(Marine Molluscs) : 1-148. Published by Zool. Surv. India.

Subba Rao, N.V. 1989. Fresh Water Molluscs of India, *Hand Book* : 282 pp. Zoological Survey of India.

Subba Rao, N.V., Surya Rao, K.V. and Manna, R.N. 1995. Mollusca. *Fauna of Chilika Lake, Wetland Ecosystem Series,* **1** : 391-468, Zoological Survey of India.

Subba Rao, N.V., Dey, A., Maitra, S. and Barua, S. 1995. *Mollusca. Hooghly-Matlah Estuary, Estuarine Ecosystem Series,* **2** : 41-91. Zoological Survey of India, Calcutta.

Subba Rao, N.V. and Dey, A. 2000. Catalogue of Marine Molluscs of Andaman and Nicobar Islands. *Rec. zool. Surv. India, Occ. Paper,* **187** : 323 pp.

Surya Rao, K.V and Mitra., S. 1998. Mollusca. *Fauna of Mahanadi Estuary, Estuarine Ecosystem Series* **3** : 161-197. Zoological Survey of India, Calcutta.

Vaught, K.C. 1989. A classification of living Mollusca. Edited by T. Abbott and K.J. Boss, American Malacologists Inc., Melbourne, Florida, U.S.A. : 1-189.

Zool. Surv. India
Fauna of Vamsadhara and Nagavali estuaries, Andhra Pradesh, Estuarine Ecosystem Series, **6** : 2010 : 73-113

FISHES

S.S. MISHRA
Zoological Survey of India, F.P. Spirit Building, Kolkata-700017

INTRODUCTION

The river Vamsadhara and the river Nagavali are originated from the Eastern Ghat hills in southern Orissa and the run south-easterly into the Srikakulam district of Andhra Pradesh to join the Bay of Bengal along the east coast of India. River Nagavali is known as Langulya in Andhra Pradesh. The Vamsadhara estuary opens into the sea at 18° 21′ N and 84° 08′ E near Kalingapatnam and the Nagavali estuary, at 19° 05′ N and 83° 56′ E near Mehfuzbandar. Both the estuaries are of mixed type and small in size with less tidal influence that felt hardly five km up the stream. Like other estuaries of east coast of India, these estuaries are characterized with formation of sand bars on southern side which is caused in northward drifting of the river mouth.

A consolidated account on the marine and estuarine fish fauna of Andhra Pradesh was documented by Barman *et al.* (2004) and Barman (1993) has published the fresh water fish fauna of Andhra Pradesh. An exhaustive report on the fish fauna of the Godavari estuary of Andhra Pradesh was given by Krishnan and Mishra (2001) and that of the Krishna estuary (Andhra Pradesh) by Mishra (in press). But no separate document is available for the fish resources of these two major estuaries of Srikakulam district. Under the Annual Plan of work of the Zoological Survey of India an attempt was made to study the ichthyofaunal resources of the Vamsadhara and Nagavali estuary. That resulted in listing of the following 98 species under 70 genera belonging to 40 families and 13 orders.

The identification of specimens was effected with the help of available standard literature (Day, 1875-78 (1888); Munro, 1955; Fischer and Whitehead, 1974; Fischer and Bianchi, 1984; Talwar and Kacker, 1984; Smith and Heemstra, 1986; Talwar and Jhingran, 1991; Jayaram, 1999). Other relevant literatures consulted during the study are given under respective species.

MATERIAL AND METHODS

Four surveys have been undertaken during the year 2000-01 to 2002-03 to asses the fish diversity of the Vamsadhara-Nagavali estuary. About 900 examples of fishes were collected

from the brackish water region as random samples and these were studied by the author. All identified samples were preserved, registered and deposited with the Estuarine Biological Station, Zoological Survey of India, Gopalpur-on-Sea, Orissa.

This paper provides a systematic list of 98 species of fishes recorded from these two estuaries. In the systematic account part all the species were described with first and recent citations (the type locality is given within parentheses), details of the materials examined, the geographical distribution of each species and remarks, if any.

These are the following abbreviations used while describing the species in order to reduce the size of the text : D-dorsal fin; A-Anal fin; P-pectoral fin; V-pelvic fin; C-caudal fin; GR-gill rakers; LL-Lateral line scales; LS-lateral scale series; Ltr-lateral transverse scales; pre D-predorsal scales; SL-standard length, CANR-C.A. Nageswara Rao; SZS-S. Z. Siddiqi.

SYSTEMATIC LIST

Class OSTEICHTHYES

Order ANGUILLIFORMES

Family OPHICHTHIDAE

1. *Bascanichthys deraniyagalai* Menon
2. *Pisodonophis boro* (Hamilton)

Family MURAENIDAE

3. *Strophidon sathete* (Hamilton)

Order CLUPEIFORMES

Family CLUPEIDAE

4. *Hilsa kelee* (Cuvier)
5. *Nematalosa nasus* (Bloch)
6. *Sardinella fimbriata* (Valenciennes)

Family PRISTIGASTERIDAE

7. *Opisthopterus tardoore* (Cuvier)

Family ENGRAULIDIDAE

8. *Stolephorus andhraensis* Rao
9. *Stolephorus commersoni* Lacepede
10. *Stolephorus indicus* (van Hasselt)
11. *Thryssa sussumieri* (Valenciennes)

12. *Thryssa mystax* (Schneider)
13. *Thryssa purava* (Hamilton)

Order GONORHYNCHIFORMES
Family CHANIDAE

14. *Chanos chanos* (Forsskal)

Order CYPRINIFORMES
Family CYPRINIDAE

15. *Barilius barila* (Hamilton)
16. *Chella laubuca* (Hamilton)
17. *Cirrhinus reba* (Hamilton)
18. *Labeo boga* (Hamilton)
19. *Purluciosoma daniconius* (Hamilton)
20. *Puntius ticto* (Hamilton)

Order SILURIFORMES
Family BAGRIDAE

21. *Mystus gulio* (Hamilton)

Family ARIIDAE

22. *Arius gagora* (Hamilton)
23. *Arius gogora* (Hamilton)
24. *Arius jella* Day

Order MUGILIFORMES
Family MUGILIDAE

25. *Liza macrolepis* (Smith)
26. *Liza melinoptera* (Valenciennes)
27. *Liza parsia* (Hamilton)
28. *Liza tade* (Forsskal)
29. *Mugil cephalus* Linnaeus
30. *Valamugil cunnesius* (Valenciennes)
31. *Valamugil speigleri* (Bleeker)

Order BELONIFORMES
Family HEMIRAMPHIDAE

32. *Hyporhamphus limbatus* (Valenciennes)

Order SYNGNATHIFORMES

Family SYNGNATHIDAE

33. *Microphis brachyrus* (Bleeker)

Order CYPRINODONTIFORMES

Family ADRIANICHTHYIDAE

34. *Oryzias dancena* (Hamilton)

Order SCORPAENIFORMES

Family PLATYCEPHRLIDAE

35. *Platycephalus indicus* (Linnaeus)

Family TETRAROGEDAE

36. *Tetraroge niger* (Cuvier)

Order PERCIFORMES

Family AMBASS DAE

37. *Ambassis ambassis* (Lacepede)

38. *Ambassis gymnocephalus* (Lacepede)

Family SERRANIDAE

39. *Epinephalus coioides* (Hamilton)

Family TERAPONIDAE

40. *Terapon jarbua* (Forsskal)

41. *Terapon theraps* (Cuvier)

Family SILLAGINIDAE

42. *Sillago intermedius* Wongratana

43. *Sillago lutea* McKay

44. *Sillago sihama* (Forsskal)

45. *Sillago vincenti* McKay

Family LEIOGNATHIDAE

46. *Leiognathus equulus* (Forsskal)

47. *Leiognathus splendens* (Cuvier)

Family CARANGIDAE

48. *Alepes kleinii* (Bloch)

49. *Atropus atropos* (Bloch)

50. *Caranx carangus* (Bloch)

51. *Caranx ignobilis* (Forsskal)

52. *Caranx sexfasciatus* Quoy & Gaimard
53. *Megalaspis cordyla* (Linnaeus)
54. *Scomberoides lysan* (Forsskal)

Family GERREIDAE

55. *Gerres filamentosus* Cuvier
56. *Gerres limbatus* Cuvier
57. *Gerres longirostris* (Lacepede)

Family HAEMULIDAE

58. *Plectorhynchus gibbosus* (Hombron & Jaquinot)
59. *Pomadasys kaakan* (Cuvier)

Family LUTJANIDAE

60. *Lutjanus argentimaculatus* (Forsskal)
61. *Lutjanus fulviflamma* (Forsskal)
62. *Lutjanus johnii* (Bloch)
63. *Lutjanus russelli* (Bleeker)

Family SPARIDAE

64. *Acanthopagrus berda* (Forsskal)
65. *Rhabdosargus sarba* (Forsskal)

Family SCIAENIDAE

66. *Johnieops dussumieri* (Cuvier)
67. *Johnius macropterus* (Bleeker)

Family SCATOPHAGIDAE

68. *Scatophagus argus* (Linnaeus)

Family MULLIDAE

69. *Upeneus sulphureus* Cuvier

Family POLYNEMIDAE

70. *Eleutheronema tetradactylum* (Shaw)
71. *Filimanus xanthonema* (Valenciennes)

Family SPHYRAENIDAE

72. *Sphyraena jello* Cuvier

Family ELEOTRIDIDAE

73. *Butis melanostigma* (Bleeker)
74. *Eleotris fusca* (Schneider)

75. *Eleotris melanosoma* Bleeker

Family GOBIIDAE

76. *Acentrogobius viridipunctatus* (Valencien.)
77. *Chiramenu fluviatilis* Rao
78. *Favonigobius reichei* (Bleeker)
79. *Glossogobius giuris* (Hamilton)
80. *Oligolepis acutipennis* (Valenciennes)
81. *Oxyurichthys formosonus* McKay
82. *Oxyurichthys microlepis* (Bleeker)
83. *Parapocryptes rictuosus* (Valenciennes)
84. *Psammogobius biocellatus* (Valenciennes)

Family GOBIOIDIDAE

85. *Taenioides anguillaris* (Linnaeus)

Family TRYPAUCHENIDAE

86. *Caragobius urolepis* (Bleeker)
87. *Trypauchen vagina* (Bloch & Schneider)

Family SIGANIDAE

88. *Siganitsjavus* (Linnaeus)

Family SCOMBRIDAE

89. *Scomberomorus guitatus* (Bloch & Schn.)

Family ACANTHURIDAE

90. *Acanthurm mala* (Cuvier)

Family CHANNIDAE

91. *Channa orientalis* Bloch & Schneider

Order PLEURONECTIFORMES

Family CYNOGLOSSIDAE

92. *Cynoglossus punticeps* (Richardson)
93. *Paraplagusia bilineata* (Bloch)

Order TETRAODONTIFORMES

Family TETRAODONTIDAE

94. *Arothron hispidus* (Linnaeus)
95. *Arothron immaculatus* (Bloch & Schneider)

96. *Aroihron reticularis* (Bloch & Schneider)

97. *Chelonodon patoca* (Hamilton)

98. *Lagocephalus spadiceus* (Richardson)

SYSTEMATIC ACCOUNT

1. *Bascanichlhys deraniyugalai* Menon

1961. *Bascanichihys deraniyagutai* Menon, *J. zoo/. Soc. India,* 13(1) : 13, fig. (Arasalar river at Karaikal, Tamil Nadu).

Material examined : 1 ex., 305 mm SL, SZS, 30.01.03, Pukkalapeta (Nagavali), F-3637; 2 ex., 68-230 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3746; 3 ex., 83-320 mm SL, CANR, 03.03.02, Vamsadhara estuary, F-5391; 2 ex., 290-300 mm SL, CANR, 07.03.02, Nagavali estuary, F-5392.

Diagnostic features : Body slender, cylindrical; trunk slightly longer than tail. Snout blunt; eyes small; mouth small; small, conical, uniserial teeth on jaws. Gill opening lateral, nearly horizontal. D origin well forward on head, a little before gill opening. P vestigial, as a flap of skin. Olive brown dorsally, yellow ventrally.

Distribution : East coast of India in estuaries.

Remarks : This species seems to be well distributed along east coast of India in estuaries.

2. *Pisodonophis boro* (Hamilton)

1822. *Ophisurus boro* Hamilton, *Fishes of Canges* : 20, 363, pi. 5 (Hooghly estuary near Calcutta).

1991. *Pisodonophis boro* : Talwar and Jhingran. *Inland Fishes of India,* 1 : 86.

Material examined : 1 ex., 500 mm SL, CANR. 05.03.02, Kalingapatnam (Vamsadhara). F-3733; 7 ex., 245-405 mm SL, CANR, 26.06.00, Nagavali estuary, F-5295.

Diagnostic features : Body depth 30-36, head 9-12 (3.5-4.0 in trunk), tail 1.6-1.8 in TL. Teeth molariform, in multiserial bands on jaws and vomer. D origin about P length behind P tip; tail tip stiff and finless. Uniform olive-brown above, lighter below. D with a narrow dark edge.

Distribution : Indo-Pacific. Inhabit mostly in estuaries, entering freshwater and paddy fields.

3. *Strophidon sathete* (Hamilton)

1822. *Muraenophis salhele* Hamilton, *Fishes of Ganges* : 17, 363 (Gangetic estuary near Calcutta).

2000. *Strophidon sathete* : Bohlke and McCosker, *Raffles Bull. Zool.,* (8) : 585.

Material examined : 1 ex., 612 mm SL, CANR, 25.06.00, Nagavali estuary, F-5302.

Diagnostic features : Tail longer than rest of body; eyes small; teeth small, biserial, inner series enlarged. Dark greenish-olive, becoming greenish-yellow below; with silvery dots along the sides, usually confused as lateral line pores.

Distribution : India : Hooghly estuary and Bay of Bengal.

Remarks : This species has been reported as *Thyrsoidea macrura* (Bleeker) in Indian literature, which is considered as a junior synonym of *Strophidon sathete* (Hamilton) by recent authors (Bohlke, 1997).

4. *Hilsa kelee* (Cuvier)

1829. *Clupea kelee* Cuvier, *Regne Animal.* (2nd ed.), **2** : 320 (Vizagapatnam).

1985. *Hilsa kelee* : Whitehead, *FAO Fish. Synop.*, (125) **7**(1) : 220.

Material examined : 4 ex., 35-42 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3718.

Diagnostic features : D iv, 13-14; A iii, 17-19; P i, 14-15; V i, 7; LS 39-44; lower GR 75-175; belly scutes (15-17) + (12-14). Depth 2.5-3.3 in SL. Distinct median notch in upper jaw. Fronto-parietal striae exposed. GR on 2nd arch curled outward. Scales perforated. A black blotch behind gill opening, usually followed by a series of oval blotches down flank.

Distribution : Indo-west Pacific. Marine, pelagic; entering estuaries and able to tolerate low salinity.

5. *Nematalosa nasus* (Bloch)

1795. *Clupea nasus* Bloch, *Naturges. ausland. Fische,* (**19**) : 116, pi. 429, fig. 1 (Malabar).

1991. *Nematalosa nasus* : Talwar and Jhingran, *Inland Fishes of India,* 1 : 111.

Material examined : 1 ex., 60 mm SL, SZS, 27.01.03, Kalingapatnam, F-3622.

Diagnostic features : D iii-v, 11-14; A ii-iii, 18-23; P i, 14; V i, 7; LS 46-49; belly scutes (17-19) + (10-13), total 28-32. Depth 2.4-2.9 in SL. Mouth inferior, lower jaw strongly flared outward. Hind edge of scales toothed. Dark bluish dorsally, silvery below, a dark spot behind gill opening.

Distribution : Indo-west Pacific. Marine, but entering estuaries.

6. *Sardinella fimbriata* (Valenciennes)

1847. *Spariella fimbriata* Valenciennes, *Hist nat. Poiss.*, **20** : 359 (Malabar).

1985. *Sardinella fimbriata* : Whitehead, *FAO Fish Synop.*, (125) **7**(1) : 98.

Material examined : 1 ex., 83 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3717; 2 ex., 120-123 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5373.

Diagnostic features : D iv, 14-16; A iii, 16-19; P i, 13-15; V i, 7; LS 40-45; lower GR 53-82 (at 50-120 mm SL); belly scutes (17-18) + (12-14). Body depth 2.9-4.0 in SL. Ventral

striae on scales not meeting at center. Hind part of scales with few perforations and fimbriated at posterior margin and somewhat produced posteriorly. Back blue-green; flanks silvery; a dark spot at D origin.

Distribution : Southern coast of India, Bay of Bengal, to the Philippines; also eastern tip of Papua New Guinea. Marine, coastal.

7. ***Opisthopterus tardoore*** (Cuvier)

1829. *Pristigaster lardoore* Cuvier, *Regne Animal* (2nd ed.), **2** : 382 (Vizagapatnam).

1991. *Opislhoplerus lardoore* : Talwar and Jhingran. *Inland Fishes of India,* **1** : 123.

Material examined : 1 ex., 140 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3783.

Diagnostic features : D ii-iii, 11-14; A iii, 48-60; P i, 11-13; V absent; lower GR 22-28; LS 46-51; belly scutes 29-35. Body depth 3.3-3.7 in SL. D in posterior half of body. Back blue-green.

Distribution : Gulf of Oman, India, Sri Lanka, Myanmar, and Indonesia.

8. ***Stolephorus andhraenais*** Rao

1965. *Stolephorus andhraensis* Rao, *Ann. Mag. nat Hist.* (13) **9** : 103 (Waltair, Kakinada, India).

Material examined : 1 ex., 43 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5329;. 5 ex., 44-51 mm SL, CANR, 23.06.00. Vamsadhara estuary, F-5348.

Diagnostic features : D iii, 12-14; A iii, 17-18; lower GR 20-21; pre-pelvic scutes 6 or 7, needle-like. Pre-operculum indented near maxilla tip. A origin below middle of D base. Milky-white; a bright silvery stripe along flanks; no double pigment line on back.

Distribution : East coast of India; Singapore and probably Papua New Guinea.

9. ***Stolephorus commersoni*** Lacepede

1803. *Stolephorus commersonii* Lacepede, *Hist. nat. Poiss,* 5 : 381, pi. 12, fig. 1 (Mauritius).

Material examined : 1 ex., 87 mm SL, SZS, 29.01.03, Nagavali estuary, F-3629.

Diagnostic features : D iii, 12-14; A iii, 18-19; lower GR 23-28; belly with 1-4 needle-like pre-pelvic scutes; no spine on pelvic scute and before D. Hind border of pre-operculum evenly rounded near maxilla tip. Maxilla tips reaching to gill opening. V tips reaching beyond D origin. Creamy white with a silvery stripe along flanks; a double pigment line on back before D.

Distribution : East coast of Africa, India, Indonesia, to Samoa.

10. ***Stolephorus indicus*** (van Hassdt)

1823. *Engraulis indica* van Hasselt, *Algemeene Konsl.-en Leiterbode.* **1**(23) : 329 (Java).

1988. *Stolephorus indicus* : Whitehead *et. al. FAO Fish. Synop.,* (125) **7**(2) : 412.

Material examined : 1 ex., 40 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3719; 2 ex., 38-50 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3768.

Diagnostic features : D iii, 12-14; A iii, 16-18; lower GR 21-28; belly with 3-5 needle-like pre-pelvic scutes; no pre-dorsal spine; no spine on pelvic scute. Hind border of pre-operculum evenly rounded near maxilla tip; maxilla tip pointed, reaching to or just beyond anterior border of pre-operculum. A silvery stripe along flarus.

Distribution : Indo-west Pacific.

11. *Thryssa dussumieri* (Valenciennes)

1848. *Engraulis dussumieri* Valenciennes, *Hist. not. Poiss.*, **21** : 69 (Arabian Sea).

1988. *Thryssa dussumieri* : Whitehead *el. al. FAO Fish. Synop.*, (125) 7(2) : 429.

Material examined : 1 ex., 80 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3786.

Diagnostic features : D iii, 9-12; A iii, 31-35; P i, 9; V i, 6; lower GR 17-19, serrae in distinct clumps; scutes (15-16) + (6-9). Maxilla very long, reaching at least halfway along P; first supra-maxilla absent. A dark blotch behind upper part of gill opening often joined to a dark saddle on nape.

Distribution : Pakistan, India, Sri Lanka, Myanmar, and western Pacific.

12. *Thryssa mystax* (Schneider)

1801. *Chtpea mystax* Schneider, *Syst. Ichthyol Bloch* : 426. pi. 83 (Malabar).

1973. *Thryssa mystax* : Whitehead, *J. mar. boil. Ass. India.* **14**(1) : 231, fig. 54.

Material examined : 1 ex., 131 mm SL, CANR, 26.06.00, Nagavali estuary, F-5294.

Diagnostic features : D iii, 10-12; A iii, 29-37; P i, 12; V i, 6; lower GR 13-16, serrae not clumped; scutes (16-20) + (8-13). Maxilla tip reaching to or beyond P base. A dark venulost-area behind upper part of gill opening.

Distribution : India, Sri Lanka, east to Indonesia.

13. *Thryssapurava* (Hamilton)

1822. *Clupea purava* Hamilton, *Fishes of Ganges* : 238, 382 (Ganges estuaries).

1988. *Thryssa purava* : Whitehead *et. at., FAO Fish Synop.*, (125) 7(2) : 440.

Material examined : 1 ex., 74 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3787.

Diagnostic features : D iii, 9-12; A iii, 38-44; P i, 14; V i, 6; lower GR 17-21; scutes (15-17) + (10-1 1). Maxilla tip projecting slightly beyond edge of gill cover or to halfway to P base. An indistinct Welch behind upper part of gill opening and a faint mid-dorsal line.

Distribution : East coast of India.

14. *Chanos chanos* (Forsskal)

1775. *Mugil chanos* Forsskai, *Descnpt. Animal.* : xiv. 74 (Djedda, Red Sea).

1991. *Chanos chanos* : Talwar and Jhingran, *Inland Fishes oj India*, **1** : 150.

Material examined : 2 ex., 84-94 rnm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5370.

Diagnostic features : D 13-17; A 9-11; P 15-17; V 11-12; LL 75-90; GR (147-160) + (107-165). Depth 3.1-4.7 in SL. Mouth terminal, small; jaws without teeth. Scales small, cycloid. P and V with large axillary scales. Brilliant silvery, darker dorsally.

Distribution : Indo-west Pacific. Inhabits coastal waters, enters estuaries, rivers and lakes.

15. ***Barilius barila*** (Hamilton)

1822. *Cyprinus (Barilius) barila* Hamilton, *Fishes of Ganges* : 267, 384 (rivers of northern Bengal).

1991. *Barilius barila* : Talwar and Jhingran, *Inland Fishes of India,* 1 : 343.

Material examined : 1 ex, 49 mm SL. CANR, 07.03.02, Pukkalapetta (Nagavali), F-3689.

Diagnostic features : D ii, 7-8; A iii, 10-11; P i, 12; V i, 8; LL 43-46; pre D 22. Depth 4.6-4,8 in SL. Maxilla extends to below anterior third of eye. Two pairs of barbels. P as long as head. Back dark olivaceous, silvery below with about 14 vertical blue bands that extend from back to LL.

Distribution : Northern India, up to Orissa in south; Nepal; Bangladesh; and Myanmar.

16. ***Chella laubuca*** (Hamilton)

1822. *Cyprinus (Chela) laubuca* Hamilton, *Fishes of Ganges* : 260, 384 (ponds in northern parts of Bengal).

1991. *Chella laubuca* : Talwar and Jhingran, *Inland Fishes of India.* 1 : 316.

Material examined : 1 ex, 49 mm SL, CANR, 04.07.0i, 4 km away from mouth (Nagavali estuary), F-3799.

Diagnostic features : D ii, &-10; A ii, 17-20; P i, 8-10;V i, 6; LL 31-37; Ltr 6-7/2-4; pre D 15-20. Depth 2, 5-4.1 in SL. LL complete. Abdomen keeled between and behind V. Translucent; a black longitudinal stripe along flank; a deep black, golden edged blotch on caudal peduncle.

Distribution : Pakistan, India, Bangladesh, Sri Lanka, Myanmar, Malay, Sumatra.

17. ***Cirrhinus reba*** (Hamilton)

1822. *Cyprinus reba* Hamilton, *Fishes of Ganges* : 280, 386 (rivers and ponds of Bengal and Bihar).

1991. *Cirrhinus reba* : Talwar and Jhingran, *Inland Fishes of India,* **1** : 173.

Material examined : 1 ex., 109 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3687.

Diagnostic features : D ii-iii, 8; A iii, 5; Pi, 15; V i, 8; LL 34-38; Ltr 7/5-6. Upper lip entire, often fringed in juveniles; lower jaw with a small symphysial knob or tubercle. One pair of short rostral barbel present. D height less than body depth. P as long as head. Dark grey dorsally, silvery below; scales with dark edges.

Distribution : India, Nepal, Bangladesh, Pakistan.

Remarks : Roberts (1997) consider this species as synonym of *Cirrhinus ariza* (Hamilton) (=*Labeo ariza*). But following Jayaram (1999), the name *C. reba* is retained here.

18. ***Labeo boga*** (Hamilton)

1822. *Cyprinus boga* Hamilton, *Fishes of Ganges* : 286, 386, pi. 12, fig. 1 (Brahmaputra river).

1991. *Labeo boga* : Talwar and Jhingran, *Inland Fishes of India,* **1** : 200.

Material examined : 1 ex., 108 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), E-3688; 1 ex., 107 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3704.

Diagnostic features : D ii-iii, 9-10; A ii, 5; P i, 15; V i, 8; LL 37-39. Depth 4.7-5.3, head 4.5-5.0 in SL; eye 3.7-4.0 in head. Snout without lateral lobe. Mouth narrow; lips thick; lower lip joined to isthmus by a bridge. Barbels-a minute maxillary pair only. D inserted above or slightly anterior to P tip. P tip not reaching V base. Five scale rows between LL and V base. Often with a dark spot above P.

Distribution : Pakistan, India, Nepal, Bangladesh and Myanmar.

19. ***Parludosorna daniconius*** (Hamilton)

1822. *Cyprinus daniconius* Hamilton, *Fishes of Ganges* : 327, 391, pi. 15, fig. 89 (Rivers of southern Bengal).

1991. *Parluciosoma, daniconius* : Talwar and Jhingran, *Inland Fishes of India,* **1** : 382.

Material examined : 2 ex., 44-50 mm SL, CANR, 04.07.0 1; Nagavali estuary, 4 km away from mouth, F-3800.

Diagnostic features : D ii, 7; A ii, 5; P i, 14; V i, 8; LL nearly; complete, 31-34; Ltr $4^1/_2/1/2^1/_2$. Mouth small; lips simple; lower jaw with a symphysial process; no barbels. D, inserted behind A origin. Back olive, flanks and belly silvery; a distinct blue-black mid-lateral stripe from eye to base of C, edged above and below by a thin, metallic golden line; a narrow dark stripe above A.

Distribution : Pakistan, India, Sri Lanka, Bangladesh, Myanjnar and Mekong.

20. ***Puntlus ticto*** (Hamilton)

1822. *Cyprinus ticto* Hamilton, *Fishes of Ganges* : 314, 398, pl. 87 (south-eastern parts of Bengal).

1991. *Puntius ticto* : Talwar and Jhingran, *Inland Fishes of India,* **1** : 291.

Material examined : 1 ex., 40 mm SL, CANR, 04.07.01, Nagavali estuary, 4 km away from mouth, F-3798.

Diagnostic features : D iii-iv, 8; A ii-iii, 5; P i, 12-14; V i, 8; LS 23-25; LL pore 6-8; Ltr 4-5/4; preD 9-1 1. Depth 2.4-2.9, head 3.5-4.0 in SL. D spine serrated on poste/ior edge; last unbranched D ray osseous, strong and often serrated. Barbels absent. A long, transverse

black blotch above P; a similar golden edged blotch over end of A on caudal peduncle. D in male with a thick red margin.

Distribution : Pakistan, India, Nepal, Sri Lanka, Bangladesh, Myanmar, Thailand.

21. ***Mystus gulio*** (Hamilton)

1822. *Pimelodus gulio* Hamilton, *Fishes of Ganges* : 201, 399, pl. 23, fig. 66 (Higher parts of Gangetic estuaries).

1991. *Mythus gulio* : Taiwar and Jhingran, *Inland Fishes of India*, **2** : 260.

Material examined : 1 ex., 95 mm SL, SZS, 29.01.03, Nagavali estuary, F-3627; 20 ex., 40-57 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3641; 2 ex., 80-88 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3655; 2 ex., 54-61 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3675; 10 ex., 58-70 mm SL, CANR. 06.03.02, Pukkalapeta (Nagavali), F-3710; 7 ex., 60-110 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3724; 1 ex., 82 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3784; 1 ex., 86 mm SL, CANR, 05.07.01, Nagavali estuary mouth, F-3790; 1 ex., 81 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5317; 1 ex., 76 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5336; 4 ex., 71-79 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5362.

Diagnostic features : D I, 7; A ii-iv, 9-11; P I, 8-9. Depth 3.8-4.1 in SL; eye 5-6 in head. Occipital process triangular, about 1.5 times longer than broad at its base, extends to basal bone of D; median longitudinal groove on head short, not reaching base of occipital process. Barbels 4 pairs. D spine strong, serrated on its inner edge; adipose fin small, inserted well behind D. Least height of C peduncle equals its length. Branchiostegal rays 9. Bluish-brown on head and back, dull white below; maxillary barbels black.

Distribution : Pakistan, India, Bangladesh, and Myanmar.

22. ***Arius arius*** (Hamilton)

1822. *Pimelodus arius* Hamilton, *Fishes of Ganges* : 170, 376 (Estuaries .of Bengal).

1991. *Arius arius* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 700.

Material examined : 3 ex., 79-95 mm SL, CANR, 26.06.00, Nagavali estuary, F-5296; 1 ex., 210 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5333; 4 ex., 45-64 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5340.

Diagnostic features : D I, 7; A v-vi, 14-16; P I, 10; V i, 5. Barbels 3 pairs. Median fontanelle groove on top of head shallow, not reaching to base of supra-occipital process. Eyes 1.6-2.5 in inter-orbital width. Teeth on palate globular, in a single ovate patch on each side with a hornlike conical anterior projection. Tip of D spine prolonged into a filament. Back dark bluish to silvery; adipose fin with black spot.

Distribution : Pakistan, India, Bangladesh, and Myanmar.

23. *Arius gagora* (Hamilton)

1822. *Pimelodus gagora* Hamilton, *Fishes of Ganges*; 167, 376, pi. 10, fig. 54 (estuaries of Bengal).

1991. *Arius gagora* : Talwar and Jhingran, *Inland Fishes*, 2 : 702.

Material examined : 18 ex., 40-73 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5316.

Diagnostic features : D I, 7; A v-vi, 12-13; P I, 10. Barbels 3 pairs. Median longitudinal groove on top of head shallow and lanceolate, reaching to median keel of supraorbital process. Teeth on palate globular, sparse, in two large semioval patches. D spine as long as P spine, equals postorbital head length. Brownish on back, dull white below; adipose D spotted black.

Distribution : India : West Bengal and Orissa; Bangladesh.

Remarks : This is the first record from Andhra Pradesh. This species is mostly confused with *Arius jella* Day which has comparatively a shorter D spine.

24. *Arius jella* Day

1877. *Arius jella* Day, *Fishes of India*, (3) : 467, pi. 106, fig. 3 (Madras).

Material examined : 8 ex., 45-75 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3758; 3 ex., 60-71 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3785.

Diagnostic features : D I, 7; A iv-v, 12-14; P I, JO; V i, 5. Eye 6-7 in head. Barbels 3 pairs. Median fontanelle on top of head broad and flat, reaching to base of supra-occipital process. Palatine teeth globular, in a single large ovate patch on each side, with loosely packed teeth; inner margins of the patches not straight. D and P spine strongly serrated. D spine shorter than P spine and as long as head excluding snout. Bluish-black above; adipose fin with a black blotch.

Distribution : India, Sri Lanka, and Myanmar.

25. *Liza macrolepis* (Smith)

1849. *Mugil macrolepis* Smith, *Illust. Zool. S. Africa*, 4 : pi. 28, fig. 2(Rivers and Lakes of S. Africa).

1991. *Liza macrolepis* : Talwar and Jhingran, *Inland Fishes of India*, 2 : 891.

Material examined : 2 ex., 38-45 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3649.

Diagnostic features : D IV + I, 8; A III, 9; P 15; LS 31-34; Ltr 12. Head 3.5-4.3 in SL. P tip not reaching vertical through D origin; 1st D inserted nearer to C base than snout tip; 2nd D origin above middle of A base. Greenish above, silvery-below.

Distribution : Indo-west Pacific.

26. *Liza melinoptera* (Valenciennes)

1836. *Mugil melinopterus* Valenciennes, *Hist. nat. Poiss.*, 11 : 146. pl. 313 (Vanicola).

1991. *Liza melinoptera* : Talwar and Jhingran, *Inland Fishes of India*, 2 : 892.

Material examined : 4 ex., 63-94 mm SL, SZS, 27.01.03, Kalingapatnam, F-3621; 1 ex., 98 mm SL, SZS, 29.01.03, Nagavali estuary, F-3630; 4 ex., 31-81 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3650; 1 ex., 98 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3662; 3 ex., 47-92 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3678; 3 ex., 28-33 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3692; 13 ex., 32-114 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3732; 24 ex., 26-82 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3759; 21 ex., 35-87 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3774; 1 ex., 51 mm SL, CANR, 07.07.01, Vamsadhara estuary mouth, F-3792; 3 ex., 1 12-116 mm SL, CANR, 26.06.00, Nagavali estuary, F-5298; 1 ex., 73 mm SL, CANR, 25.06.00, Nagavali estuary, F-5307; 13 ex., 26-94 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5326; 7 ex., 40-105 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5346; 3 ex., 74-84 mm SL, CANR, 22.06.00, Vamsadhara estuarv mouth, F-5372.

Diagnostic features : D IV + I, 8; A HI, 9; P 15; LS 26-31; Ltr 9-10. Head 3.4-3.8 in SL. Pre-orbital filling space between lip and eye. D origin nearer to C base than to snout tip; 2nd D origin above anterior half of A base. Greenish-brown dorsally.

Distribution : Indo-west Pacific.

27. *Liza parsia* (Hamilton)

1822. *Mugil parsia* Hamilton, *Fishes of Ganges* : 215, pi. 17, fig. 71 (Freshwater rivers of Bengal).

1991. *Liza parsia* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 894.

Material examined : 3 ex., 32-56 mm SL, CANR, 24.06.00, Varasaxlhara, estuary, F-5327.

Diagnostic features : *D* IV + I, 8; A III, 9; P 14; LS 37-36; Ltr 11. Head 4.0-4.3 in SL. Pre-orbital filling space between lip and eye. First D inserted nearer to snout tip than to C base; 2nd D origin over anterior half of A base. Greenish-brown above, sivery below; a golden spot on upper part of operculum.

Distribution : Pakistan, India and Sri Lanka.

28. *Liza tade* (Forsskal)

1775. *Mugil crenilabrus tade* Forsskal, *Descripl. Animal,* : 74(Arabia).

1991. *Liza tade* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 894.

Material examined : 1 ex., 115 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3684; 1 ex., 100 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3706.

Diagaastic features : D IV + I, 8; A III, 9; P 17; LS 30-35; Ltt 11. Head 4.0-5.2 in SL. Pre-orbital filling space between lip and eye. First D inserted nearer to snout tip than C base; 2nd D origin over posterior half of A base. Greenish-brown above, silvery below.

Distribution : Indo-west Pacific.

29. *Mugil cephalus* Linnaeus

1758. *Mugil cephalus* Linnaeus, *Syst. Nat.* (ed. 10), 1 : 316 (European Seas).

Material examined : 3 ex., 44-64 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3686; 2 ex., 69-76 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3705; 10 ex., 42-75 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3731 and 3739; 1 ex., 63 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3760; 1 ex., 73 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3772.

Diagnostic features : D IV + I, 8; A III, 8; P 15; LS 38-42; Ltr 14-15. Head 3.4-3.7 in SL. P axillary scale long. First D inserted nearer to snout tip than C base. Pre-orbital slenderf filling only half space between lip and eye. Olive-green above, silvery below.

Distribution : Circum-global-temperate and tropical waters.

30. *Valamugil cunnesius* (Valenciennes)

1836. *Mugil cunnesius* Valenciennes, *Hist. nai. Poiss.*, **11** : 114 (Malabar).

1991. *Valamugil cunnesius* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 901.

Material examined : 1 ex., 66 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3663; 1 ex., 47 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3761; 8 ex., 36-59 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3773; 1 ex., 61 mm S-L, CANR, 26.06.00, Nagavali estuary, F-52^9;. 3 ex., 52-58 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5347.

Diagnostic features : D IV + I, 8; A III, 9; P 15-16; LS 30-35; Ltr 11-12. Head 3.4-4.2 in SL. Adipose eyelid well developed, covering half or more of iris. First D inserted nearer to snout tip than to C base; 2nd D origin on vertical through anterior third of A base. P axillary scale long. Scales with membranous digitated hind margin. Yellow-brown to dark grey on back, silvery below; a dark axillary spot on P base.

Distribution : Indo-west Pacific.

31. *Valamugil speigleri* (Bleeker)

1858. *Mugil speigleri* Bleeker, *Nat. Tijdschr. Ned.-Indie.*, **16** : 279 (Java).

1991. *Valamugil speigleri* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 903.

Material examined : 1 ex., 68 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3685.

Diagnostic features : D IV + I, 8; A III, 9; P 16; LS 37-40. Head 4.2-4.4 in SL. Adipose eyelid well developed, covering half or more of iris. Second D origin behind A origin. Axillary scale of P long, 32-34% of P length. P with a black axillary spot; D margin black.

Distribution : Pakistan, India, Sri Lanka, Indonesia and Australia.

32. *Hyporhamphus limbatus* (Valenciennes)

1846. *Hemiramphus limbatus* Valenciennes, *Hist. not. Poiss.*, **19** : 44 (Malabar, Bombay and Pondicherry).

1991. *Hyporhamphus limbatus* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 734.

Material examined : 1 ex., 142 mm SL, SZS, 29.01.03, Nagavali estuary, F-3624;

Diagnostic features : D 12-16; A 13-16; P i, 10-11; GR 23-37, Head 3.5-3.7 in trunk. Upper jaw triangular, short and scaly; its width 0.6-0.8 in length. Lower jaw longer than head length. Teeth minute, tricuspid. Preorbital canal simple, without posterior branch. C emarginate. Greenish above, flank with silvery stripe; fleshy tip of beak reddish; fins hyaline.

Distribution : Persian Gulf, through India, to Thailand and China.

33. *Microphis hrachyrus* (Sleeker)

1853. *Syngnathus brachyrus* Bleeker, *Verh. batav. Genoot. Kunst. Wet.*, **25**(6) : 16 (Indonesia).

1991. *Microphis brachyrus* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 770.

Material examined : 1 ex., 125 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3479.

Diagnostic features : D 37-54; A 4; P 17-23; C 9. Rings (17-22) + (20-26); subdorsal ring (2.0-0.25) + (6.5-8.75), total 7.0-10.75. Head 4.2-5.3, snout 1.6-1.7 in SL. Depth of snout 7.2-11.3 in its length. Tail without caudal, shorter than trunk. Longitudinal opercular ridge distinct, with one to several supplemental ridges. Operculum and anterior part of trunk with black spots; a dark diffuse lateral band present.

Distribution : Central and eastern Indian Ocean.

34. *Oryzias dancena* (Hamilton)

1822. *Cyprinus dancena* Hamilton, *Fishes of Ganges* : 342, 393 (Estuary below Calcutta, India).

1998. *Oryzias dancena* : Roberts, *Ichthydt. Res.*, **45**(3) : 214, fig. 1,2A.

Material examined : 1 ex., 28 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3690.

Diagnostic features : D 6; A 20; P 10; V 6; C 16; LS 27. Body compressed; head flat above. Mouth upturned, oblique; upper jaw prominent; lips fleshy. Scales large, thin. D inserted above posfcrior !/rfd of A; P high on sides; V small; C rounded. Green above, silvery below.

Distribution : India, Bangladesh.

Remarks : Roberts (1998) consider *Oryzias melastigma* (McClelland) as a junior synonym of *Aplocheilus panchax* (Hamilton) and only two species under genus *Oryzias* Jordan and Snyder, *viz.*, *O. dancena* (Hamilton) and *O. carnaticus* (Jerdon), are recognized from India (Jayaram, 1999).

35. *Platycephalic indicus* (Linnaeus)

1758. *Callionymus indicus* Linnaeus, *Systema Naturae* (ed. 10), **1** : 250 (Asia).

1991. *Plaiycephalus indicus* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 782.

Material examined : 3 ex., 37-56 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3643; 1 ex., 142 mm SL, CANR, 26.06.00, Nagavali estuary, F-5291.

Diagnostic features : D I/VIII + 13; A 13; P 18; V I, 5; GR (2-3)+(7-8); LL 68-82. Head bearing smooth bony ridges; a small pre-ocular spine and two pre-opercular spines. Teeth on vomer in one transverse patch. Brownish above, whitish below; C with 2-3 horizontal black stripes.

Distribution : Indo-west Pacific.

36. *Tetraroge niger* (Cuvier)

1829. *Apistus niger* Cuvier, *Hist. not. Poiss.*, 4 : 415 (Arian Coupan R. mouth, Pondicherry, India).

1962. *Tetraroge niger* : de Beaufort and Briggs, *Fish. Indo-Aust. Archep.*, 11 : 70.

Material examined : 1 ex., 65 mm SL, SZS, 29.01.03, Nagavali estuary, F-3634; 1 ex., 56 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3669; 1 ex., 31 mm SL, CANR, 23.06,00, Vamsadhara estuary, F-5394; 1 ex., 34 mm SL, CANR, 25.06.00, Nagavali estuary, F-5395.

Diagnostic features : D XIII, 8; A III, 5. Depth 2.4-2.9, head 2.3-2.6 in SL. D origin above posterior part of eye. Preorbital with a short spine extending to middle of eye. Brownish black dorsally, pink or white ventrally with reddish-brown mottling. C yellowish or reddish with broad black submarginal band.

Distribution : India, eastward to the Philippines.

37. *Ambassis ambassis* (Lacepede)

1802. *Ceniropomus ambassis* Lacepede, *Hist. nat. Poiss.*, **4** : 252, 273 (Reunion Is.).

2003. *Ambassis ambassis* : Anderson and Heemstra, *Cybium*, **27**(3) : 201, fig.2.

Material examined : 1 ex., 74 mm SL, SZS, 27.01.03, Kalingapatnam, F-3619; 2 ex., 62-76 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3656; 2 ex., 50-60 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3673; 4 ex., 60-74 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3700; 6 ex., 45-65 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3725; 1 ex., 55 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3752; 1 ex., 51 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3769; 3 ex., 60-69 mm SL, CANR, 26.06.00, Nagavali estuary, F-5290; 1 ex., 60 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5321.

Diagnostic features : D VIJ +1, 8-9; A III, 8-9; P i, 12-14; V I, 5; LL 27-30, complete; preD 16-21; cheek with 2 scale rows. Supra-orbital ridge smooth, ending posteriorly in a spine; preorbital ridge entire. Bright silvery with mid-latera stripe.

Distribution : Indo-west Pacific.

Remarks : Earlier reports of this species are referreji as *Ambassis commersoni* Cuvier, which is considered as a junior synonym of *A. ambassis* by Anderson and Heemstra (2003).

38. ***Ambassis gymnocephalus*** (Lacepede)

1802. *Lutjanus gymnpcephalus* Lacepede, *Hist. nat. Poiss.*, **3** : 181, 216, pl. 23. fig. 3 (Indo-Pacific).

1991. *Ambassis gymnocephalus* : Talwar and Jhingran, *Inaland Fishes of India*, **2** : 796.

Material examined : 3 ex., 23-33 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3645; 1 ex., 38 mm SL, SZS, 28.ftl.03, near Light House, Kalingapatnam (Vamsadhara), F-3660; 8 ex., 31-43 mm SL, CANR, Q3.03.02, Kalingapatnam (Vamsadhara), F-3674; 3 ex., 36-38 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3701; 6 ex., 35-37 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3726; 10 ex., 36-42 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3753; 12 ex., 37-40 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3770; 2 ex., 40-45 mm SL, CANR, 05.07.01, Nagavali estuary mouth, F-3789; 6 ex., 37-44 mm SL, CANR, 25.06.00, Nagavali estuary, F-5308; 16 ex., 34-46 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5322; 9 ex.. 35-48 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5342.

Diagnostic features : D VIII + I, 8-10; A III, 9-10; P ii, 12-14; V I, 5; LL interrupted; LS 24-28; preD 12-15; cheek with 2 scale rows. Supra-orbital ridge dentate, with 2-4 spines posteriorly; pre-orbital ridge dentate; pre-opercular ridge serrated. Silvery with mid-lateral stripe.

Distribution : Indo-west Pacific.

39. ***Epinephelus coioides*** (Hamilton)

1822. *Bola coioides* Hamilton, *Fishes of Ganges* : 82 (Ganges estuaries).

1993. *Epinephelus coioides* : Heemstra and Randal, *FAO Fish. Synop.*, (125) **16** : 130.

Material examined : 2 ex., 29-32 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3680; 5 ex., 33-71 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3745.

Diagnostic features : D XI, 14-16; A III, 8; P 18-20, GR (8-10) + (14-17), total 23-26; LL pored 58-65; LS 100-118. Depth 2.9-3.7, head 2.3-2.6 in SL; inter-orbital width 5.0-6.2 in head; snout 1.8-1.9 in upper jaw. Body platelets on lateral side of 1st gill arch presert. Preopercle angular. Mid-lateral body scales ctenoid. Orange or reddish-brown dorsally, fading to white ventrally; numerous small dark spots on head, body and median fins, largest spots about 4 or 5 times that of rear nostrils. Five faint. Irregular, oblique, dark bars which bifurcate ventrally.

Distribution : Indo-west Pacific.

Remarks : This species is often confused with and misidentified as *E. tauvina* along our coast.

40. *Terapon jarbua* (Forsskal)

1775. *Sciaena jarbua* Forsskal, *Descript. Animal* : 50 (Djedda, Red Sea).

1991. *Terapon jarbua* : Talwar and Jhingran, *Inland Fishes of India,* 2 : 811.

Material examined : 1 ex., 45 mm SL, SZS, 30.01.03, Pukkalapeta (Nagavali), F-3635; 4 ex., 22-29 mm SL,.SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3640; 1 ex., 63 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3653; 5 ex., 33-46 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3665; 2 ex., 27-32 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3682; 11 ex., 29-88 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3696; 13 ex., 35-68 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3720; 4 ex., 40-64 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3750; 8 ex., 27-60 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3762; 1 ex., 106 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3781; 2 ex., 50-60 mm SL, CANR, 05.07.01, Nagavali estuary mouth, F-3788; 1 ex., 46 mm SL, CANR, 07.07.01, Vamsadhara estuary mouth, F-3793; 4 ex, 33-55 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5315; 2 ex, 24-57 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5335; 2 ex, 64-67 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5363.

Diagnostic features : D XI-Xii, 9-11; A III, 7-10; P 13-14; GR (6-8) + (12-15); LL pored 75-100, Ltr 13-17/19-24. Back with 3-4 longitudinal downwardly curved black stripes; D with a large black spot; C with 3 horizontal oblique stripes.

Distribution : Indo-west Pacific.

41. *Terapon theraps* Cuvier

1829. *Therapon theraps* Cuvier, *Hist. nat. Poiss.,* 3 : 129, pl. 43 (Java; Mahe).

1991. *Terapon theraps* : Talwar and Jhingran, *Inland Fishes of India.* 2 : 812.

Material examined : 1 ex., 55 mm SL, SZS, 29.01:03, Nagavali estuary, F-3626.

Diagnostic features : D XI-XII, 9-11; A III, 7-9; P 14-15; GR (6-8) + (14-17); LL pored, 46-56; Ltr 6-8/14-16. Body with 2-4 horizontal stripes; spiny D with a black blotch between 3rd and 7th spine; C striped.

Distribution : Indo-west Pacific.

42. *Sillago intermedius* Wongratana

1977. *Sillago intermedius* Wongratana, *Nat. Bull. Siam. Soc.,* 26 : 257-262 (East Coast, Gulf of Thailand).

Material examined : 1 ex., 71 mm SL, SZS, 27.01.03, Kalingapatnam, F-3623; 1 ex., 73 mm SL, SZS, 30.01.03, Pukkalapeta (Nagavali), F-3636; 1 ex., 40 mm SL, CANR, 07-03-02, Pukkalapeta (Nagavali), F-3695; 6 ex., 44-77 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3715.

Diagnostic features : D XI + I, 21-22; A II, 21-22; LL 67-70. Airbladder with two posterior extensions; anterior margin with two divergent blind tubes; an anterolateral extension on each side, each sending a blind tubule anteriorly and then curving posteriorly along abdominal wall. Sides of body just-below LL with a longitudinal row of dusky black spots, and a series of saddle-like dusky black blotches.

Distribution : India and Thailand.

43. *Sillago lutea* McKay

1985. *Sillago (Parasillago) lutea* McKay, *Mem. Queensland Mus.*, **23**(1) : 40-42, figs. 10D, 13H-I, 18 (Australia, India and Sri Lanka).

1992. *Sillago lutea* : McKay, *FAO Fish. Synop.*, (125) 14 : 50.

Material examined : 1 ex., 172 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3657.

Diagnostic features : D XI + I, 20-22; A II, 21-23; LL 67-72. Airbladder with a median anterior extension and with or without rudimentary anteriorly directed antero-lateral projections; posterior extension single. Body light sandy-brown above, pale below.

Distribution : India, Sri Lanka, northern Australia.

44. *Sillago sihama* (Forsskal)

1775. *Atherina sihama* Forsskal, *Descript. Animal* : 70.

1991. *Sillago sihama* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 818.

Material examined : 2 ex., 87-89 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3716.

Diagnostic features : D XI + I, 20-23; A II, 21-24; P 17; lower GR 7-9; LL 67-72. Airbladder with two post-coelomic extensions. Light brown, fading to white below.

Distribution : Indo-west Pacific.

45. *Sillago vincenti* McKay

1980. *Sillago vincenti* McKay, *J. mar. biol. Ass. India*, **18**(2) : 378, fig.1 (Kavanad near Neendakara, Kerala).

Material examined : 1 ex., 142 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3658; 4 ex., 111-160 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3757; 2 ex., 136-137 mm SL, CANR, 26.06.00, Nagavali estuary, F-5288; 1 ex., 165 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5318.

Diagnostic features : D XI + I, 21-23; A II, 22-24; P 17; LL 70-74. Airbladder with a single post-coelomic extension, with a bulbous anterior projection and without antero-lateral extensions. Light brown, fading to white; soft D with 5-7 rows of brown or black spots.

Distribution : Southern coast of India.

46. *Leiognathus equulus* (Forsskal)

1775. *Scomber equula* Forsskal, *Descript. Animal,* : 75 (Red Sea).

1991. *Leiognathus equulus* : Taiwan and Jhingran, *Inland Fishes of India,* 2 : 831.

Material examined : 1 ex., 67 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3778.

Diagnostic features : D VIII, 16; A III, 14; P i, 19. Depth 1.7-1.9 in SL. Dorsal profile strongly arched; cleft of mouth opposite lower edge of eye. Breast naked. Silvery, with faint narrow vertical lines on back; P axil dusky; a small brown saddle-shaped blotch on C peduncle.

Distribution : Indo-west Pacific.

47. *Leiognathus splendens* (Cuvier)

1829. *Equuta splendens* Cuvier, *Regne Animal.* (2nd ed.), 2 : 212 (Coromandel coast).

1991. *Leiognathus splendens* : Talwar and Jhingran, *Inland Fishes of India,* 2 : 832.

Materials examined : 4 ex., 28-37 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3712; 1 ex., 61 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3779.

Diagnostic features : D VIII, 16; A III, 14; P i, 19. Depth 1.7-2.0 in SL. Breast pealed. Ridge on lower arm of preopercle denticulated. D spines strong. Silvery, with wavy, close-set vertical lines on back. Spiny D with a jet-black blotch.

Distribution : Indo-west Pacific.

48. *Alepes kleinii* (Bloch)

1793. *Scomber kleinii* Bloch, *Naturges. ausland. Fische,* 7 : 86, pl. 347, fig. 2 (Malabar coast, India).

1999. *Alepes kleinii* : Smith-Vaniz, *Living marine resources of the Western Central Pacific,* 4 : 2688.

Material examined : 1 ex., 61 mm SL, SZS, 29.01.03, Nagavali estuary, F-3631.

Diagnostic features : D I/VIII + I, 23-24; A II + I, 18-22; GR (10-12) + (27-32), total 38-44; LL scutes 40-46. Ventral profile distinctly more convex than dorsal; adipose eyelid well developed on posterior part of eye. Upper jaw anteriorly with 2 irregular rows of conical teeth, inner surface with blunt teeth posteriorly. A large black spot on upper margin of opercle and adjacent areas of shoulder.

Distribution : Indo-west Pacific (except African coast).

Remarks : This species was earlier known as *Caranx para* Cuvier (Smith-Vaniz, 1984). The present nomenclature is based on Randall (1995) and Smith-Vaniz (1999).

49. *Atropus atropos* (Bloch)

1801. *Brama atropos* Bloch, *Syst. Ichthyol* : 98 (Tranquebar).

1984. *Atropus atropos* : Smith-Vaniz, *in,* Fischer and Bianchi, *FAO species identification sheets. W. Indian Ocean (Fishinf Area 51),* 1 : no pagination.

Material examined : 1 ex., 38 mm SL, SZS, 29.01.03, Nagavali estuary, F-3632;

Diagnostic features : D I/VIII + I, 22-23; A II + I, 18; LL scutes 30-35. Abdomen with a deep longitudinal groove between A and V, accommodating V. Body deeply ovate; strongly compressed. V length equal to head. Bluish-green above, silvery below; V deep black; juveniles with vertical bands.

Distribution : Indo-Pacific.

50. *Caranx carangus* (Bloch)

1793. *Scomber carangus* Bloch, *Naturges. ausland Fische,* (7) : 69 (Antiles, Atlantic Ocean).

1991. *Caranx carangus* : Talwar and Jhingran, *Inland Fishes of India,* **2** *:* 823.

Material examined : 2 ex., each 42 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3763.

Diagnostic features : D I/VIII + I, 20-22; A II + I, 15-18; LL- scutes 33-37. Breast naked ventrally, often with a small patch of pre-pelvic scales. Eye 3.5-4.0 in head; cleft of mouth opposite lower $^1/_3$rd of eye. Silvery, darker above with golden hue; young with 4-5 dark crossbars; a small opercular spot.

Distribution : India, through Indonesia, the Philippines, to Japan and tropical Atlantic.

Remarks : *C. carangus* is considered to be a junior synonym of *Caranx hippos* (Linnaeus) (Smith-Vaniz *et al.,* 1990) which is an Atlantic species and unlikely to occur in our area. The present name is considered here in concurrence with Indian literature.

51. *Caranx ignobilis* (Forsskal)

1775. *Scomber ignobilis* Forsskal, *Descript Animal* : 55 (Red Sea).

1991. *Caranx ignobilis* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 823.

Material examined : 8 ex., 49-64 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5324; 8 ex., 48-58. mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5344; 2 ex., 53-56 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5365.

Diagnostic features : D I/VIII + I, 19-20; A II + I, 15-17; lower GR 16-17; LL scutes 28-30. Breast naked ventrally, typically with a small patch of pre-pelvic scales. Silvery-grey.

Distribution : Indo-west Pacific.

52. *Caranx sexfasciatus* Quoy & Gaimard

1825. *Caranx sexfasciatus* Quoy and Gaimard, *Voy. 'Uranie' et. Physic. Zool.*, : 358, pl. 65, fig. 4 (Waigeo, Indonesia).

Material examined : 1 ex., 75 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3664; 1 ex., 51 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3711; 12 ex., 43-63 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3751; 2 ex., 56-68 mm

SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3764; 1 ex., 58 mm SL, CANR, 05.07.01, Nagavali estuary mouth, F-3791; 6 ex., 55-85 mm SL, CANR, 26.06.00, Nagavali estuary, F-5297; 1 ex., 103 mm SL, CANR, 25.06.00, Nagavali estuary, F-5309; 3 ex., 55-65 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5323; 2 ex., 65-73 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5334; 1 ex., 64 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5364.

Diagnostic features : D I/VIII + I, 18-22; A II + I, 14-17; GR (6-8) + (15-19); LL scutes 24-36. Breast fully scaled. Dark grey above, silvery below; a small black spot on upper edge of operculum. Soft D lobe with white tip. Juveniles with crossbars.

Distribution : Indo-west Pacific.

53. *Megalaspis cordyla* (Linnaeus)

1758. *Scomber cordyla* Linnaeus, *Syst. Nat.* (ed. 10), **1** : 298 (no locality).

1986. *Megalaspis cordyla* : Smith-Vaniz, *in* Smith and Heemstra, *Smith's Sea Fishes* : 653, fig. 210.34.

Material examined : 2 ex., 100-104 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3780; 1 ex., 140 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5367.

Diagnostic features : D VIII + 1, 10 + 8-9 finlets; A II +1,10 + 6-8 finlets; GR (8-11) + (18-22); LL scutes 51-59, well developed, broad. Breast naked. Bluish-green above, silvery below; prominent black spot on posterior edge of operculum.

Distribution : Indo-west Pacific.

54. *Scomberoides lysan* (Forsskal)

1775. *Scomber lysan* Forsskal, *Descript. Anim.*, : 54 (Red Sea).

1991. *Scomberoides lysan* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 825.

Material examined : 1 ex., 29 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3713.

Diagnostic features : D I/V1-VII + 1, 19-21; A II + I, 17-19; GR 21-27. Upper jaw extends to posterior margin of eye in adults. Scales on mid-body below LL lanceolate. Double series of 6-8 dusky round or oval blotches above and below LL; distal half of D black.

Distribution : Indo-west Pacific.

55. *Gerres filamentosus* Cuvier

1829. *Gerres filamentosus* Covicr, *Regne Animal*, (ed. 2), **2** : 188 (Vizagapatnam).

Material examined : 1 ex., 86 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3654; 1 ex., 83 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3727; 1 ex., 70 mm SL, CANR, 26.06.00, Nagavali estuary, F-5292; 1 ex., 75 mm SL, CANR, 25.06.00, Nagavali estuary, F-5306.

Diagnostic features : *D* IX, 10-11; A III, 7; P i, 14; LL 44-47; $4^1/_2$-5 scale rows between LL and bas&pf 5th D spine. Depth 2.0-2.5 in SL. Pre-dorsal distance equal to or less than body depth. Second spine of D filamentous. Silvery, with 7-10 vertical series of ovoid spots on upper sides.

Distribution : Indo-west Pacific.

56. *Gerres limbatus* Cuvier

1810. *Ggrres limbatus* Cuvier, in Cuvier and Valenciennes, *Hist., nat. Poiss.*, 6 : 476 (Malabar, India).

Material examined : 1 ex., 71 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3659; 2 ex., 36-86 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3728.

Diagnostic features : D IX, 10; A III, 7; LL 33-35; 3 scale rows between base of 5th D spine and LL. Depth 2.3-2.7 in SL. P tips reaching to level of anus, but not to A origin. Silvery, with 4 diffuse, dark saddles along back, extending down sides to mid-line; upper part of spiny D dark above a line between middle of 2nd spine and tip of 6th spine.

Distribution : West coast of India, eastward to South China Sea.

57. *Gerres longirostris* (Lacepede)

1801. *Labrus longirostris* Lacepede, *Hist. nat. Poiss.*, 3 : 427, 468, pi. 19, fig. 1 (Madagascar).

2001. *Gerres longirostris* : Iwatsuki, Kimura and Yoshino, Copeia, (4) : 955.

Material examined : 3 ex., 25-35 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3647; 2 ex., 22-29 mm SL, CANR, 07-03-02, Pukkalapetta (Nagavali), F-3681; 15 ex., 30-45 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3707; 1 ex., 45 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3729;. 1 ex., 48 mm SL, CANR, 07.07.01, Vamsadhara estuary mouth, F-3794; 7 ex., 38-51 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5320; 7 ex., 39-62 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5343.

Diagnostic features : D IX, 9-11; A III, 7; LL 42-44; $4^1/_2$-$5^1/_2$ scale-rows between LL and base of 5th D spine. Depth 2.5-2.9 in SL. Tip of P reaching to or beyond A origin. Olive above, silvery below; in young, 7-8 dusky bars on sides of body; in older specimens, several vertical series of ovoid spots below LL and rows of dark spots on following spate rows above LL; trailing edge of C black.

Distribution : Tropical Indo-west Pacific.

Remarks : This has been recorded as *G. acinaces* Bleeker in Indian literature, which is considered as a junior synonym (Iwatsuki *et al.*, 2001).

58. *Plectorhynchus gibbosus* (Hombron & Jaquinot)

1802. *Holocaruhus gibbosus* Hombron and Jaquinot, *Hist. not.* Poiss., 4 : 344, 389 (no locality).

1986. *Plectorhinchus gibbosus* : Smith and McKay, *Smith's Sea Fishes* : 566, fig. 179.5.

Material examined : 1 ex., 40 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5351.

Diagnostic features : D XIV, 15-16; A III, 7; P 17; GR (9-10) + (19-20); LL 50-55. Upper lip swollen in adults. D spines strong, 4th and 5th longest, fin deeply notched; base of spiny D 2.0 times in base of soft D; 2nd. A spine longer and stouter than 3rd; P slightly longer than V. Scales not reaching nostrils. Uniform dark, with reddish tinge. Distal soft D, A and C yellowish or pink in juveniles.

Distribution : Indo-west Pacific.

Remarks : Author for this species as found in earlier literature (*i.e.* Lacepede, 1802) is erroneous (Eschmeyer, 2005). This species is similar to *Plectorhinchus nigrus* (Cuvier) and need to be distinguished properly.

59. ***Pomadasys kaakan*** (Cuvier)

1830. *Pristipoma kaakan* Cuvier, *Hist. not. Poiss.*, **5** : 244 (India).

1984. *Pomadasys kaakan* : McKay, in Fischer and Bianchi, *FAO species identification sheets. W. Indian* Ocean. 2 : HAEM Pound 13.

Material examined : 3 ex., 40-50 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3730.

Diagnostic features : D XII-XIII, 13-15; A III, 7-8; P 17-18; GR (5-6) + (13-14); LL 43-52. Depth 2.5-2.8 in SL. Upper jaw extending to the level of anterior margin of eye. Second A spine longer and stronger than 3rd spine. Silvery grey; with 7-11 interrupted double brown spots forming transverse bars in juveniles; D with 2 rows of brown spots.

Distribution : Indo-west Pacific.

60. ***Lutjanus argentimaculatus*** (Forsskal)

1775. *Stiaena argentimaculata* Forsskal, *Descript Animal,* : 47 (Arabia).

1991. *Lutjanus argentimaculatus* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 835.

Material examined : 1 ex., 68 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3714; 2 ex., 48-50 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5328; 5 ex., 35-58 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5341; 2 ex., 60-95 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5371.

Diagnostic features : D X, 13-14; A III, 8-9; P i, 15-16; GR (6-7) + (10-ll); LL 44-48. Depth 2.5-2.9, head 2.3-2.7 in SL. Preopercle notch shallow. Longitudinal scale rows above LL parallel to dorsal profile anteriorly, but appearing to rise obliquely under soft part of D; scale rows below LL horizontal; scale on head beginning behind eyes; temporal region mostly naked with a few scales; 7-8 scale rows on pre-operculum. Red-brown, pale on belly; often with silvery spots in center of each scale.

Distribution : Indo-west Pacific.

61. *Lutjanus fulviflamma* (Forsskal)

1775. *Sciaena fulviflamma* Forsskal, *Descript. Animal* : 45 (Arabia).

1985. *Lutjanus fulviflamma* : Alien, *FAO Fish. Synop.*, (125)6 : 80-81.

Material examined : 1 ex., 40 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3735.

Diagnostic features : D X-X1, 12-14; A III, 7-8; P i, 15-16; GR (6-7) + (7-1 1); LL 46-50. Depth 2.6-2.9, head 2.4-2.7 in SL. Pre-opercle notch shallow, inter-operole knob indistinct. Vomerine teeth in arrdwhead shape. Scale rows above LL rising obliquely to dorsal profile; below LL, parallel to axis; scales on head beginning behind eyes. Silvery, with yellow lines along scale rows; a black blotch below anterior part of soft D on LL, major portion of which below LL.

Distribution : Tropical Indo-west Pacific.

62. *Lutjanus johni* (Bloch)

1792. *Anthias johni* Bloch, *Naturges. ausland. Fische,* (6) : 113, 318 (Surat, India).

1991. *Lutjanus johni* : Talwar and Jhingran, *Inland Fishes of India,* 2 : 835.

Material examined : 2 ex., 41-42 mm SL, SZS, 27.01.03, Kalingapatnam, F-3620; 1 ex., 47 mm .SL, CANR, 03,03.02, Kalingapatnam (Vamsadhara), F-3666; 3 ex., 57-80 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3697.

Diagnostic features : D X, 13-14; A III, 8, P i, 16; LL 48-50. Preopercular notch shallow; no inter-opercular knob. Teeth on vomer inverted 'V' or triangular shaped. Scale rows above LL parallel to dorsal profile; scales on head beginning above, middle of eyes. Yellowish; each scale spotted, in center, a large black blotch below soft D, major part of which above LL.

Distribution : Indo-west Pacific.

63. *Lutjanus russelli* (Bleeker)

1849. *Mesoprion ruselli* Bleckcr, *Verh. batav. Genoot. Kunst. Wet.,* **22** : 41 (India).

1986. *Lutjanus russelli* : Alien, in Smith and Heemstra, *Smith's Sea Fishes* : 577, pl. 56, fig. 181.17.

Material examined : 2 ex., 34-42 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3734.

Diagnostic features : D X, 14-15; A III, 8-9; P i, 15; GR (5-6) + (10-13); LL 48-52. Pre-opercular notch shallow. Teeth on vomer in a triangular patch. Scale rows above LL rising obliquely to dorsal profile. Reddish-brown; a dark brown blotch above LL below spiny and soft D; about 8 brown lines, lower ones horizontal, upper ones rising obliquely to dorsal profile.

Distribution : Indo-west Pacific.

64. *Acanthopagrus berda* (Forsskal)

1775. *Sparus berda* Forsskal, *Descript. Anim.*, : 32 (Arabia).

1991. *Acanthopagrus berda* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 847.

Material examined : 2 ex., 31-34 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3709; 1 ex., 35 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3736.

Diagnostic features : D XI, 11-12; A 111, 8-9; P i, 13; LL 44-47. Depth 2.0-2.4 in SL. Four to 6 incisors at front of upper jaw; 6-8 on lower jaw, followed by 3-5 rows of molars. Preoperculum with 6 scale rows. Greyish-silvery to black; A and C greyish-black.

Distribution : Indo-west Pacific. Inhabits seas and estuaries, entering fresh waters.

65. *Rhabdosargus sarba* (Forsskal)

1775. *Sparus sarba* Forsskal, *Descript. Animal* : xi, 31 (Djedda, Red Sea).

1991. *Rhabdosargus sarba* : Talwar and Jhingran, *Inland Fishes*, **2** : 849.

Material examined : 1 ex., 46 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3737; 2 ex., 47-52 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3748.

Diagnostic features : D XI, 12-13; A III, 11; P i, 13-14; lower GR 7-9; LL 55-60. Depth 2.0, head 4.0 in SL. Jaws with 4-6 enlarged incisiform teeth at front, followed by 3 or more rows of molars. Silvery-grey, each scale with a golden centre.

Distribution : Indo-west Pacific.

66. *Johnieops dussumieri* (Cuvier)

1830. *Corvina dussumieri* Cuvier, *Hist. not. Poiss.*, 5 : 119 (Malabar, India).

1996. *Johnius dussumieri* : Sasaki, *Mem. Fac. Sci. Kochi Univ. Ser. D* (*Biol.*),16/17. : 91-92.

Material examined : 1 ex., 121 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3782.

Diagnostic features : D 1X-X + 1, 26-31; A 11, 7; P i, 16-17; GR (6-9) + (13-15), long and slender; LL 48-50. Depth and head 3.0-3.4 in SL; 2nd A spine 3.0-3.3 in head. Snout evenly decurved, not inflated. Preopercular margin finely serrated. Teeth well differentiated in size in jaws, outer teeth of upper jaw enlarged and widely spaced; inner teeth of lower jaw enlarged. Gas bladder Hammer-shaped with 12-17 pairs of arborescent appendages. Dusky-brown on back, silvery below; a steel-blue blotch on opercle; upper two-third of spiny D black.

Distribution : Pakistan, Sri Lanka, India, pastward to Andamans.

Remarks : This species, commonly called as sin croaker, was previously recorded as *Johnieops sina* (Cuvier) from Indian waters, is now known as *J. dussumieri* (Cuvier) (Heemstra, 1986; Sasaki, 1996).

67. *Johnius macropterus* (Bleeker)

1853. *Umbrina macropterus* Bleeker, *Natuurk. Tijdchr. Ned—Indie,* **4** : 254 (Priaman, Sumatra).

1995. *Johnius macropterus* : Talwar, *Fauna of India-Sciaenidae* : 91.

Material examined : 2 ex., 61-62 mm SL, SZS, 29.01.03, Nagavali estuary, F-3633;

Diagnostic features : D X + I, 30-34; A II, 7; P i, 14-16; GR (5-6) + (8-ll); LL 44-50. Depth 3.2-3.8, head 3.4-4.0 in SL; 2nd A spine 2.9-3.4 in head. A blunt barbel on chin. Snout rounded, slightly projecting. Teeth in upper jaw differentiated in size, outer row enlarged and close-set. Scales cycloid on snout and breast, ctenoid on body. Gas bladder hammer-shaped with 13-16 pairs of arborescent appendages. Back dark grey, flanks and belly whitish silvery reflections; barbel and chin whitish; spiny D darkish.

Distribution : Indo-west Pacific.

68. *Scatophagus argus* (Linnaeus)

1766. *Choetodon argus* Linnaeus. *Syst Nat.* (ed. 12), **1** : 464 (India).

1991. *Scatophagus argus* : Talwar and Jhingran, *Inland* Fishes of India, 2 : 875.

Material examined : I ex., 18 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3642 2 ex., 30-32 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3668; 1 ex., 64 mm SL, CANR, 06.03.02 Pukkalapeta (Nagavali), F-3698.

Diagnostic features : D XI, 16-18; A VI, 14-15; P 16-17. Body quadrangular. Scales very small. Body with numerous dark round spots.

Distribution : India, Sri Lanka, through Indonesia, to Australia, New Hebrides and Solomon Island.

69. *Upeneus sulphureus* Cuvier

1829. *Upeneus sulphureus* Cuvier, *Hist. nat. Poiss.,* **3** : 450 (Anjer Straits of Sunda).

Material examined : 1 ex., 53 mm SL, SZS, 28.01.03, near Light House, Kalingapatnam (Vamsadhara), F-3661; 2 ex., 58-59 mm SL, CANR, 25.06.00, Nagavali estuary, F-5304; 5 ex., 58-62 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5314; 7 ex., 52-60 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5338.

Diagnostic features : D VIII + I, 8; A I, 7; P 16; GR 8 + (20-21); LL 34-37. Depth 3.2-3.6, head 3.1-3.3 in SL; 5-7 scale rows between both D; 12 scale rows along upper part of C peduncle. D with 3 horizontal stripes; no crossbars on C.

Distribution : Indo-west Pacific.

70. *Eleutheronema tetradactylum* (Shaw)

1804. *Polynemus tetradactylum* Shaw, *General* Zool., **5** : 155 (Vizagapatnam).

1991. *Eleutheronema tetradactylum* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 907.

Material examined : 1 ex., 103 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3765.

Diagnostic features : D VIII + 1, 13-15; A II, 15-17; P 17 + iv. Lower lip absent except towards rictus; teeth extending on posterior part of jaws. Silvery-green above, yellowish-white below.

Distribution : Persian Gulf, to India, Indonesia, to China, the Philippines, north and west Australia.

71. ***Filimanus xanthonema*** (Valenciennes)

1831. *Polynemus xanthonemus* Valenciennes, *Hist. not. Poiss.*, **7** : 517 (Pondicherry, India).

1991. *Filimanus xanthonema* : Feltes, *Copeia,* 1991(2) : 318-319.

Material examined : 2 ex., 6.9-109 mm SL, CANR; 26.06.00, Nagavali estuary, F-5450.

Diagnostic features : D VIII + 1, 11-13; A III, 10-12; P vi, 13-15; LL 43-51; Ltr. 6-8/ 9-12; GR 36-45. Depth 2.9-3.7, head 2.9-3.6 in SL. Space separating premaxillary teeth bands 2 or more times width of each band. Upper P with all unbranched rays; free filaments of P usually 6 on each side, but sometimes 5 on each side or asymmetrically 5 and 6, or 6 and 7; the longest filament not reaching to A origin. Brownish above, yellowish on sides. Median fins blackish posterioly; P black, filaments white.

Distribution : East coast of India to Indonesia.

Remarks : The specimens examined here were having pectoral fins with 5 free filamentous rays on each side. Most commonly the free pectoral filaments are 6 in other specimens.

72. ***Sphyraenajello*** Cuvier

1829. *Sphyraena jello* Cuvier, *Hisi nal. Poiss.*, **3** : 258 (Vizagapatnarn).

Material examined :1 ex., 74 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5349.

Diagnostic features : D V +1, i, 8; A II, i, 7; P ii, 12-13; LL 130-140; no GR on 1st arch. Depth 7.9-8.9, head 3.2-3.6 in SL. Preopercle smoothly rounded. Teeth erect. Last rays of D and A not longer than anterior rays. Bluish or brown above, sides silvery; a series of dark serpentine bars on flank reaching a little below LL.

Distribution : Indo-west Pacific.

73. ***Butis melanostigma*** (Bleeker)

1849. *Eleotris melanostigma* Bleckcr, *Verh. batav, Genoot. Kuiat. Wet.*, **22** : 23 (Indonesia).

1991. *Butis melanostigme* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 973.

Material examined : 1 ex., 100 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3743.

Diagnostic features : D VI + I, 8; A1, 8; P 18-19; LS 29-30; Ltr 9-10; preD ± 25. Depth 4.5-5.0, head 2.7-3.0 in SL. Three crests on snout; maxilla extends to below front to middle of eye; outer row teeth in jaws enlarged. Ctenoid scales between eye and the orbital crest; inter-opercle scaled. C little shorter than head. Body dark with several thin longitudinal dark lines and often with irregular black spots; P base with large black spot; C black.

Distribution : Indo-west Pacific.

74. *Eleotris fusca* (Schneider)

1801. *Poecilia fusca* Schneider, *Syst. Ichthyol.* : 453 ("Oriadeae insulae rivulis"-Pacific Islands).

1991. *Eleotris fusca* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 975.

Material examined : 1 ex., 44 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3676; 4 ex., 35-45 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3743.

Diagnostic features : D VI + I, 8-9; A I, 8; P ISIS; LS 60-68; Ltr 16-19; preD ± 50. Depth 4.2-4.8, head 3.0-3.5 in SL; eyes 5-6 in head. Maxilla extends to below middle of eye. Anterior most and third papillae row under eye extend below longitudinal row. Head scaled above, between and behind eyes, on cheeks and opercle. Middle of C peduncle with 12-14 transverse scale rows. Head, body and fins dark brown to black; numerous horizontal lines on body; fins spotted.

Distribution : Indo-west Pacific.

75. *Eleotris melanosoma* Bleeker

1852. *Eleotris melanosoma* Bleeker, *Natnurk. Tijdschr. Ned-Indie*, **3** : 705 (Wahai, Celebes and West Sumatra).

Material examined : 3 ex., 32-38 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3691; 2 ex., 41-57 mm SL, CANR, 25.06.00, Nagavali estuary, F-5310.

Diagnostic features : D VI + I, 8; A I, 8; P 15-16; LS 45-55; Ltr 14-15; preD ± 40-45. Depth 4.5-5.5, head 2.7-3.5 in SL; eyes 4.5-5.5 in head. Maxilla reaches to below rear half of eye. Anterior 3 vertical papillae rows below eye extend below longitudinal row on mid-cheek. Pre-opercle scaled dorsally, scales not reaching to below eyes. Middle of C peduncle with 11 or 12 transverse scale rows. Dark brown to black, often with pale longitudinal lines; fins spotted in young.

Distribution : Tropical Indo-west Pacific.

76. *Acentrogobius viridipunctatus* (Valenciennes)

1837. *Gobivs viridipunctatus* Valenciennes, *Hist. nat. Poiss.*, **12** : 62. (Bombay).

1991. *Acentrogobius viridipunctatus* : Talwar and Jhingran, *Inland Fishes of India*, 2 : 926.

Material examined : 1 ex., 107 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3775; 1 ex., 107 mm SL, CANR, 26.06.00, Nagavali estuary, F-5293; 1 ex., 28 mm SL, CANR, 26.06.00, Nagavali estuary, F-5451.

Diagnostic features : D VI + I, 10; A I, 9; P 18-20; LS 35-36; Ltr 10; preD ±30. Depth 4.0-5.5, head 3.3-4.0 dn; SL; eye 4.0-5.0 in head. Longitudinal rows of papillae on cheek. Head scaled above behind eyes; upper part of pre-operculum andvoperculum scaled. Blackish-green, laterally with dark spots, half way the flank a longitudinal row of larger spots. A blackish longitudinal stripe at base of D; 2nd D with 2 dark longitudinal bands; C membrane spotted black, upper part of C base without spots.

Distribution : Indo-west Pacific,

77. *Chiramenu fluviatilis* Rao

1970. *Chiramenu fluviatilis* Rao, *J. mar. boil. Assoc. India,* **12**(1/2) : 184, fig. 1 & 2 (Godavari estuary, Andhra Pradesh).

Material examined : 7 ex., 49-84 mm SL, CANR, 04.07.01, Nagavali estuary, 4 km away from mouth, F-3796.

Diagnostic features : D VI + I, 10; A I, 10; P i, 15; LS 54-58. Depth 5.7 to 6.2 in SL. Mouth inferior, lips thick, Teeth on upper jaw in a single row. Tongue bilobate. Two minute flaps on shoulder girdle. C shorter than head. Black spots on head and body. Five narrow vertical bands on flank.

Distribution : Estuaries of Orissa and Andhra Pradesh, India.

78. *Favonigobius reichei* (Bleeker)

1853. *Gobius reichei* Bleeker, *Natuurk. Tijdschr. Ned-Indie,* **5** : 509 (Padong, Indonesia).

1991. *Favonigobita reichei* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 934.

Material examined : 1 ex., 40 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5332; 2 ex., 33-43 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5337.

Diagnostic features : D VI +1, 8-9; A 1, 8; P 16; LS 26-28; Ltr 7-8; preD 12, foremost 9-10 scales fallout readily. Depth 5.0, head 3.8 in SL; eyes 3.0-420 in head. Teeth in several rows. An oblique narrow band of mucous canals below eye running to maxillary, a broad band bordered by 2 strongly developed canals, that runs longitudinally over cheek; cheek and opercle naked. Greenish above, pale below; with numerous small spots; mid-side with 4-5 slightly enlarged groups of black spots; a bar from eye to upper jaw; median fins spotted.

Distribution : Indo-west Pacific.

79. *Glossogobius giuris* (Hamilton)

1822. *Gobius giuris* Hamilton, *Fishes of Ganges* : 51, pi. 33, fig. 15 (Gangetic Provinces).

1991. *Glossogobius giuris* : Talwar and Jhingran, *Inland Fishes of India,* **2** : 936.

Material examined : 1 ex., 100 mm SL, SZS, 29.01.03, Nagavali estuary, F-3628; 2 ex., 46-51 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3652; 1 ex., 59 mm SL,

CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3671; 3 ex., 48-56 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3683; 3 ex., 72-108 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3702; 11 ex., 50-85 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3723 and 3740; 1 ex., 45 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3754; 6 ex., 61-115 mm SL, CANR. 06.07.01, Vamsadhara estuary mouth, F-3766, 3 ex., 68-132 mm SL, CANR, 26.06.00, Nagavali estuary, F-5289; 2 ex., 72-76 mm SL, CANR, 25 06.00, Nagavali estuary, F-5305; 2 ex., 115-116 mm SL, CANR, 32.06.00, Vamsadhara estuary mouth, F-5366.

Diagnostic features : D VI + I, 8-9, A 1, 7-8; P 17-22; LS 28-36; Ltr 8-14. Depth 5.0-6.2, head 3.7-4.3 in SL. Branchiostegal membrane attached to sides of isthmus. Yellowish-brown with 5 dark blotches on flank; idea of head with irregular violet spots; D, P and C. mottled with dark spots.

Distribution : Indo-west Pacific.

80. ***Oligolepis acutipennis*** (Valenciennes)

1837. *Gobius acutipennis* Valenciennes, *Hist. nat. Poiss.*, **12** : 80 (Malabar).

1991. *Oligolepis acutipennis.* Talwar and Jhingran, *Inland Fishes of India,* 2 : 939.

Material examined : 4 ex., 35-51 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3694; 9 ex., 29-53 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3741; 2 ex., 31-50 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5331.

Diagnostic features : D VI + I, 8-9; A I, 7-8; P 17-22; LS 28-36; Ltr 8-14. Depth 5.0-6.2, head 3.7-4.3 in SL. Branchiostegal membrane attached to sides of isthmus. Yellowish-brown with 5 dark blotches on flank; sides of head with irregular violet spots; D, P and C mottled with dark spots.

Distribution : Indo-west Pacific,

81. ***Oxyurichthys formosanus*** Nichols

1959. *Oxyurichthys, formosanus* Nichols, *Amer. Mus. Novit.,* (1876) : 2 (Taiwan).

Material examined : 1 ex., 45 mm SL, SZS, 30.01.03, Pukkalapeta (Nagavali), F-3638; 2 ex., 37-44 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3651; 1 ex., 41 mm SL, CANR, 07.03.02, Pukkalapeta (Nagavali), F-3693; 1 ex., 46 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3776; 1 ex., 37 mm SL, CANR, 07.07.01, Vamsadhara estuary mouth, F-3795; 5 ex., 31-43 mm SL, CANR, 26.06.00, Nagavali estuary, F-5300; 7 ex., 36-56 nam SL, CANR, 23.06.00, Vamsadhara estuary, F-5350.

Diagnostic features : D VI + 1, 10; A I, 11-12; P 18-20; LS 26-28. Eye without a bump dorsally. Head, nape and breast naked. Tongue rounded; teeth in upper jaw uniserial. Brownish, with a conspicuous dark vertical band below eye; a dark blotch at C base; first elongated spine of D with 5 black patches.

Distribution : India-Ennore Godavari and Mahanadi estuaries; Taiwan.

82. ***Oxyurichthys microlepis*** (Sleeker)

1849. *Gobius microlepis* Bleeker, *Verh. batav. Genoot. Kunst. Wet.*, **22** : 35 (Madura Straits).

1991. *Oxyurichthys microlepis* : Talwar and Jhingran, *Inland Fishes of India*, 2 : 941.

Material examined : 2 ex., each 51 mm SL, SZS, 30.01.03, Pukkalapeta (Nagavali), F-3639;

Diagnostic features : D VI + I, 12; A I, 13; P 20-22; LS ± 55; Ltr ± 14. Depth 5.2-6.0, head 4.0-4.5 in SL. Eye without a bump dorsally. Head scaled above behind eyes; scales on body cycloid anteriorly; weekly ctenoid posteriorly. Tongue rounded; teeth uniserial in upper jaw. Violet; vertical fins pink; 1st D with 2 blue lines, 2nd D with bjue spots; P orange with violet spots below; A pink with yellow and violet margin; C bordered below with violet, upper part with black spots.

Distribution : Indo-west Pacific.

83. ***Parapocryptes rictuosus*** (Valenciennes)

1837. *Apocryptes rictuosus* Valenciennes, *Hist. not. Poiss.*, **12** : 151 (India).

1991. *Parapocryptes rictuosus* : Talwar and Jhingran, *Inland Fishes of India*, 2 : 957.

Material examined : 1 ex., 48 mm SL, CANR, 25.06,00, Nagavali estuary, F-5312; 1 ex., 46 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5355.

Diagnostic features : D VI + I, 23-26; A I, 24-28; P 20; LS ±75. Depth 10-12 in SL; eyes 6-7 in head. Maxilla extends well beyond eye. Both D continuous at bases. Greyish, lighter below; dark ill-defined oblique bands from back to half way the flanks; inner side of mouth with dark spots.

Distribution : India-east coast.

84. ***Psammogobius biocellatus*** (Valenciennes)

1837. *Gobius biocellatus* Valenciennes, *Hist. not. Poiss.*, **12** : 73 (Pondicherry).

2001. *Psammogobius biocellatus* : Larson and Murdy, *in* Carpenter and Niem, *Living marine resources of the Western Central Pacific* : 3599.

Material examined : 2 ex., 63-67 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3646; 1 ex., 55 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3672; 3 ex., 42-65 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3703 and 3708; 1 ex, 55 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3767; 8 ex., 48-81 mm, SL, CANR, 24.06.00, Vamsadhara estuary, F-5313; 1 ex., 29 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5330; 7 ex., 43-77 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5339.

Diagnostic features : D VI + I, 9; A I, 8; P 17-19; LS 28-32; Ltr 7-8. Depth 5.0-6.5, head 3.0-3.3 in SL. Branchiostegal membrane form a free fold across isthmus. Body dark

with small black spots in longitudinal rows; 2-3 broad saddles on back and flanks. First D black; V with dark cross bands.

Distribution : Indo-west Pacific.

Remarks : Earlier reports of this species were under genus *Glossogobius* Gill (Talwar and Jhingran, 1991).

85. ***Taenioides anguillaris*** (Linnaeus)

1758. *Gobius anguillaris* Linnaeus, *Syst. Nat.*, (ed. 10) **1** : 264 (China).

1991. *Taenioides anguillaris* : Talwar and Jhingran, *Inland Fishes of India*, 2 : 984.

Material examined : I ex., 164 mm SL, CANR, 26.06.00, Nagavali estuary, F-5301.

Diagnostic features : D VI, 41-46; A I, 39-44; P 15-16. Depth 13-15, head 6.5-7.5 in SL; pre-anal distance less than 40% of SL. Barbels 3 pairs; upper jaw with 6 or 7 canines and lower jaw with 4 or 5 canines on each side. D, A and C confluent Body scaleless. Yellow; D and A yellow, C pink.

Distribution : India, through Indonesia, to China.

86. ***Caragobius urolepis*** (Bleeker)

1852. *Amblyopus urolepis* Bleeker, *Nat. Tijdschr. Ned.-Indie*, **3** : 581 (Palembang, Sumatra).

2003. *Caragobius urolepis* : Murdy and Shibukawa, Zootaxa, 301 : 5.

Material examined : 2 ex., 54-57 mm SL, CANR, 25.06.00, Nagavali estuary, F-5311; 1 ex., 37 mm SL, CANR, 03.03.02, Vamsadhara estuary, F-5393.

Diagnostic features : D VI, 32-33; A I, 33; P 17-18. Teeth on upper jaw biserial, in lower jaw multiserial. Chin with pores. Cycloid scales present on posterior part of body. Yellowish-green; flanks and belly speckled with brown spots.

Distribution : India, and Indonesia.

Remarks : This species has been reported under genus *Brachyamblyopus* Bleeker in Talwar and Jhingran (1991). The present generic allocation is following Murdy and Shibukawa (2003).

87. ***Trypauchen vagina*** (Bloch & Schneider)

1801. *Gobius vagina* Bloch and Schneider, *Syst. Ichthyol.*, : 73 (Tranquebar).

1991. *Trypauchen* vagina : Talwar and Jhingran, *Inland Fishes of India*, **2** : 988.

Material examined : 1 ex., 36 mm SL, CANR. 05.03.02, Kalingapatnam (Vamsadhara), F-3742; 1 ex., 43 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3755.

Diagnostic features : D VI, 39-47; A I, 40-46; P 15-19; LS 80-100. Head naked; eyes minute; teeth in jaws pointed, outer row enlarged and caninoid. D and A confluent with C. V completely united forming a funnel-shaped disc. Pinkish-white.

Distribution : Indo-west Pacific.

88. *Siganusjavus* (Linnaeus)

1766. *Teuthisjavus* Linnaeus, *Syst. Nat.*, (ed. 12) **1** : 507 (Java).

1984. *Siganus javus* : Talwar and Kacker *Comm, Sea Fish. India* : 776.

Material examined : 7 ex., 28-51 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3677; 37 ex., 25-57 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3721; 1 ex., 119 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5368.

Diagnostic features : D XIII, 10; A VII, 9. Depth 2.0-2.3 in SL. A sharp, forward projecting spine before D; last spine of D much longer than 1st spine; soft D and A high angular. Head profile slightly concave above eye; anterior nostril with a small triangular flap, reaching half way to posterior nostril. Scale rows between LL and middle of D base 30-35. C truncate in young, emarginate in adults. Back greenish brown, silvery below; numerous small grey spots on head and upper flanks, becoming pale elongate undulating lines on flanks and belly; D and A orange-yellow.

Distribution : Arabian Gulf, Pakistan, India, through Indonesia, to the Philippines and to New Hebrides.

89. *Scomberomorus guttatus* (Bloch & Schneider)

1801. *Scomber guttatus* Bloch and Schneider, *Syst. Ichthyoi* : 23, pl. 5 (Tranquebar).

1984. *Scomberomorus guttatus* : Talwar and Kacker, *Comm. Sea Fish, India* : 813.

Material examined : 2 ex., 188-190 mm SL, CANR, 22.06.00, Vamsadhara estuary mouth, F-5369.

Diagnostic features : D XV-XV111 + 18-24 + 7-10 finlets; A 19-23 + 7-10 finlets; GR (1-2) + (7-12); LL with; many fine branches anteriorly, almost straight to below middle of C peduncle. Blue on back, silvery on sides; about 3 irregular rows of dark 'round spots, smaller than eye, along flanks; spinous D dark up to 8th spine.

Distribution : Persian Gulf, through India, Indonesia, to Japan.

90. *Acanthurus mala* (Cuvier)

1829. *Chaetidon meta* Cuvier, *Regne Anim.*, : 224 (Vizagapatnam, After Russell, error for *mata*).

1986. *Acanthurus mata* : Randall, *in* Smith and Heemstra, *Smith's Sea Fishes* : 814, pi. 127 & 130.

Material examined : 1 ex, 46 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3667.

Diagnostic features : D IX, 24; A III, 23; P 16. Depth 22, snout 6.7 in SL. Least depth of caudal peduncle 2.8 in head. Teeth in adults, 24 in. upper jaw and 26 in lower jaw. Dark brown with longitudinal blue lines on head and body; a yellow area behind eye and 2 yellow bands from eye to snout.

Distribution : Indo-Pacific.

91. *Channa orientalis* Bloch & Schneider

1801. *Channa orientalis* Bloch and Schneider, *Syst. Ichthyol.* : 496, pi. 90, fig. 2 (India).

Material examined : 1 ex., 102 mm SL, CANR, 04.07.01, Nagavali estuary, 4 km away from mouth, F-3797.

Diagnostic features : D 32-37; A 20-23; P 14-15; V 6; preD 12; LS 40-50; 4-5 scale-rows between pre-opercular angle and hind border sbf orbit. Green dorsally; pale ventrally with faint bluish or reddish tinge. A row of dark oblique bands along sides. P with distinct alternating blue and orange bands. Young with a large ocellus on last 5 rays of D.

Distribution : Afghanistan, Iran, Pakistan, India, Sri Lanka, Nepal, Bangladesh, Myanmar, and Indonesia.

92. *Cynoglossus punticeps* (Richardson)

1846. *Plagussia punticeps* Richardson, *Rep. Br. Ass. Advmt. Sci.*, **15** : 280 (China).

1991. *Cynoglossus punticeps* : Talwar and Jhingran, *Inland Fishes of India*, **2** : 1043.

Material examined : 1 ex., 43 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3644; 2 ex., 68-70 mm SL, CANR, 04.07.01, Nagavali estuary mouth, F-3756; 2 ex., 56-78 mm SL, CANR, 25.06,00, Nagavali estuary, F-5303; 8 ex., 47-62 mm SL, CANR, 24.06.00, Vamsadhara estuary, F-5319; 1 ex., 52 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5345.

Diagnostic features : D 90-100; A 72-78; C 10. Two LL on ocular side, 16-19 scale-rows in between; median LL 78-99; no LL on blind side. Snout rounded or obtusely pointed; angle of mouth not reaching beyond lower eye, slightly nearer to tip of snout than to gill opening; eyes not contiguous. Scales ctenoid on both sides. Ocular side yellow-brown with very distinct irregular dark brown patches, often forming irregular cross bars; some rays of D and A dashed with dark brown.

Distribution : Pakistan, India, through Indonesia, the Philippines, Taiwan and Australia.

93. *Paraplagusia bilineata* (Bloch)

1784. *Pleuronectes bilineata* Bloch, *Naturges. ausland. Fische*, (3) : 29, pL 188 (China)

1984. *Paraplagusia bilineata:* Talwar and Kacker, *Commercial Sea Fishes of India* : 885.

Material examined : 1 ex., 128 mm SL, CANR, 03.07.01, Nagavali estuary mouth, F-3777.

Diagnostic features : D 100-114; A 72-89; C 10; two LL on ocular side, interlinear scale rows 16-19. Rostral hook long, reaching beyond lower eye; lips with a row of fringed tentacles. Ocular side brownish, often spotted or marbled with darker patches.

Distribution : Tropical Indo-west Pacific.

94. ***Arothron hispidus*** (Linnaeus)

17S8. *Tetraodon hispidus* Linnaeus, *Syst, Nat.* (ed. 10), **1** : 333 (India).

1986. *Arothron hispidus* : Smith and Heemstra, *Smith's Sea Fishes* : 896, pl. 142.

Material examined : 1 ex., 30 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5353.

Diagnostic features : D 10; A 10; P 17-19. Nasal organ a bifid tentacle. Caudal peduncle depth less than its length. White spots on head, back and sides; dark bars below P and on sides of head below eye.

Distribution : Indo-west Pacific.

95. ***Arothron immaculatus*** (Bloch & Schneider)

1801. *Tetrodon immaculatus* Bloch and Schneider, *Syst. Ichth.*, **18** : 507 (no locality).

1986. *Arothron imtnacvlahir.* Smith and Heemstra, *Smith 's*

Material examined : 2 ex., 31-45 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3738; 3 ex., 28-41 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3747; 1 ex., 33 mm SL, SZS, 29.01.03, Kalingapatnam (Vtonsadhara), F-3749; 3 ex., 17-23 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5352.

Diagnostic features : D 9-10; A 9-10; P 16-17. Nasal organ a bifid tentacle. Whole body spiny except lips and caudal peduncle. Yellow-olive above, lighter below. C with black edges; P base with a characteristic blotch.

Distribution : Indo-west Pacific.

96. ***Arothron reticularis*** (Bloch & Schneider)

1801. *Tetrodon reticularis* Bloch and Schneider, *Syst.-Ichth* : 506 (Malabar, India).

1991. *Arothron reticularis* : Talwar and Jhingran, *Inland Fishes of India.* 2 : 1054.

Material examined : 1 ex., 20 mm SL, CANR, 23.06.00, Vamsadhara estuary, F-5354. (Labeled as *Arothron leopardus* (Day)).

Diagnostic features : D 11; A 10; P 19. Nasal organ a bifid tentacle. Caudal peduncle depth more than its length. Small spinules on head and body, except caudal peduncle and anterior part of snout. Small white spots on back; belly with longitudinal brown stripes, curving upward on sides of head; fins yellowish hyaline.

Distribution : Indo-west Pacific.

97. ***Chelonodon patoca*** (Hamilton)

1822. *Tetrodon patoca* Hamilton, *Fishes of Ganges* : 7, 362, pi. 18, fig. 2 (Estuaries of Ganges).

1991. *Chelonodon patoca:* Talwar and Jhingran, *Inland Fishes of India,* **2** : 1057.

Material examined : 1 ex., 20 mm SL, SZS, 29.01.03, Kalingapatnam (Vamsadhara), F-3648; 4 ex., 23-29 mm SL, CANR, 03.03.02, Kalingapatnam (Vamsadhara), F-3670; 4 ex.,

20-28 mm SL, CANR, 06.03.02, Pukkalapeta (Nagavali), F-3699; 26 ex., 21-30 mm SL, CANR, 05.03.02, Kalingapatnam (Vamsadhara), F-3722; 2 ex., 30-38 mm SL, CANR, 06.07.01, Vamsadhara estuary mouth, F-3771; 10 ex., 25-50 mm SL, CANR, 24.06,00, Vamsadhara estuary, F-5325.

Diagnostic features : D 9-10; A 8-10; P 15-16. Inter-orbital space flat and broad. Nostril a round depression, surrounded by a low rim produced in to a posterior and anterior flap. Body with a spiny patch on back, throat and belly; sides naked. Blackish above with numerous small round yellowish spots; flanks and belly silvery; juveniles often with 3-4 dark cross bands on back.

Distribution : Tropical Indo-west Pacific.

98. ***Lagocephalus spadiceus*** (Richardson)

1845. *Tetrodon spadiceus* Richardson, *Voy, Sulphur. Ichth.*, : 123, pL 58. figs. 4.5 (Canton, China).

1991. *Lagocephalus spadiceus* : Talwar and Jhingran, *Inland Fishu of India*, **2** : 1059.

Material examined : 2 ex., 55-75 mm SL, SZS, 29.01.03, Nagavali estuary, F-3625;

Diagnostic features : D 11-12; A 11-12; P 17. Spinules on dorsal surface of body extend only about half way from inter-orbital region to D. Greenish-olive above, flanks and belly whitish; posterior margin of C entirely white.

Distribution : Indo-west Pacific.

DISCUSSION

This paper forms the first study of the ichthyofaunal diversity of the Vamsadhara and Nagavali estuary of Srikakulam district in Andhra Pradesh. A total of about 900 fish samples were studied from the locality and were determined under 98 species belonging to 70 genera, 40 families and 13 orders.

Only one species, *Arius gagora,* is reported here for extension of distributional range as it was earlier reported only from Orissa and West Bengal, in India. Of the 98 species, 63 were recorded from Vamsadhara estuary and 70, from Nagavali estuary. All the cyprinid fishes, *Channa orientalis* aild *Chiramenu fluviatilis* were obtained from Nagavali estuary at an upstream region where freshwater condition prevails.

About 71 percent of the fishes recorded here are having commercial value. The fishes belonging to the family Ophichthidae, Syngnathidae, Adrianichyidae, Tetrarogidae, Eleotridae, Gobioididae, Trypauchenidae, Tetraodontidae and many fishes of the family Gobiidae are not of fishery interest. Juveniles of *Siganus javus* are found in plenty in Vamsadhara estuary while the adults are known to inhabit marine environment.

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REFERENCES

Anderson, M.E. and Heemstra, P.C., 2003. Review of the glassfishes (Perciformes : Ambassidae) of the Western Indian Ocean. *Cybium,* **27**(3) : 199-209.

Barman, R.P., 1993. Pisces : Freshwater Fishes. *Fauna of Andhra Pradesh, State Fauna Series,* **5**(1) : 89-334.

Rarman R.P., Kar, S. and Mukhcijee, P., 2004. Marine and estuarine Fishes. *Fauna of Andhra Pradesh, State Fauna Series,* **5**(2) : 97-311.

Bohlke, E.B., 1997. Notes on the identity of elongate-unpatterned Indo-Pacific morays with descripdoo of new species (Muraenidae, subfamily Muraeninae). *Proc. Acad. Nat. Sci., Philad,* **147** : 89-109.

Day, R., 1875-78 (1888). *The fishes of India, being a Natural History of the fishes known to inhabit ^he seas and freshwater of India, Burma and Ceylon.* London. Part 1, 1875 : 1-168, 1-40 pis.; Part 2,1876 : 169-368,41-78 pis. (+ 51 A-C); Part 3, 1877 : 369-552, 70-138 pis.; Part 4, 1878 : i-xx + 553-778,139-195 pis.; Suppl., 1888 : 779-816, 7 figs.

Eschmeyer, W.N. (Ed.), 2005. *Catalogue of Fishes.* Updated database version of May 2005. Catalog database as made available to FishBase in May 2005.

Fischer, W. and Bianchi, G. (eds), 1984. *FAO species identification sheets for fishery purposes. Western Indian Ocean (Fishing Area 51).* FAO, Rome, 1-5 : page var.

Fischer, W. and Whitehead, P.J.P., 1974. *FAO species identification sheets for fishery purposes. Eastern Indian Ocean (Fishing Area 57) and Western Central Pacific (Fishing Area 71).* FAO, Rome, 1-4; page var.

Heemstra. P.C., 1986. Sciaenidae. *In* : M.M. Smith and P.C. Heemstra (eds.). *Smith's Sea Fishes,* Springer-Verlag, Berlin : 616-619.

Iwatsuki, Y., Kimura, S. and Yoshino, T., 2001. Redescription of *Gerres longirostris* (Lacepede, 1801) and *Gerres oblongus* Cuvier *in* Cuvier and Valenciennes, 1830, included in the *Gerres longirostris* complex (Perciformes : Gerreidae). *Copeia,* **2001**(4) : 954-965.

Krishnan, S. and Mishra, S.S., 2001. Fishes. *Fauna of Godavari Estuary, Estuarine Ecosystem Series,* **4** : 85-166.

Mishra, S.S., 2009. Fishes. *Fauna of Krishna Estuary : Estuarine Ecosystem Series,* **5** : 1-298.

Munro, I.S.R., 1955. *The Marine and Freshwater Fishes of Ceylon.* Dept. of External Affairs, Canberra, 349 pp.

Murdy, E.O. and Shibukawa, K., 2003. A revision of the Indo-Pacific genus *Caragobius* (Gobiidae : Amblyopinae). Zoofoxa, 301 : 1-12.

Randall, J.E., 1995. *Coastal fishes of Oman.* University of Hawaii Press, Honolulu, Hawaii : 439 pp.

Roberts, T.R., 1997. Systematic revision of the tropical Asian Labeoin cyprinid fish genus *Cirrhinus,* with descriptions of new species and biological observations on *C. lobatus. Nat. Hist. Bull Siam Soc.,* **45** : 171-203.

Roberts, T.R., 1998. Systematic observations on tropical Asian medekas or ricefjshes of the genus *Oryzias,* with description of four new species. *Ichthyol. Res.,* **45**(3) : 213-224.

Sasaki, K., 1996. Sciaenid fishes of the Indian Ocean (Teleostei, Perciformes). *Mem. Fac. Sci. Kochi Univ., Ser. D (BioL),* 16/17 : 83-95.

Smith, M.M. and Heemstra, P.C. (Eds.), 1986. *Smith's Sea Fishes.* Springer-Verlag, Berlin : 1047 p., 144 pis.

Smith-Vaniz, W.F., 1984. Carangidae. *In* Fischer, W. and Bianchi, G. (eds). *FAO species identification sheets for fishery purposes. Western Indian Ocean. (Fishing Area 51).* FAO, Rome, 1 : page var.

Smith-Vaniz, W.F., 1999. Carangidae. Jacks and scads (also trevallies, queenfishes, runners, amberjacks, pilotfishes, pompanos, etc.). *In.* Carpenter, K.E. and Niem, V.H. (eds). *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific* VoL 4. *Bony fishes Part-2 (Mugilidae to Carangidae).* FAO, Rome : 2659-2756.

Smith-Vaniz, W.F., Quero, J.C. and Desoutter, M., 1990. Carangidae. *In* : J.C. Quero, J.C. Hureau, C- Karrer, A. Post and L. Saldanha (eds.). *Check-list of the eastern tropical Atlantic.* (CLOFETA). JN1CT, Lisbon; SEI, Paris; and UNESCO, Paris, Vol. **4** : 729-755.

Talwar, P.K. and Jhingran, A.G, 1991. *Inland Fishes of India and adjacent countries.* Oxford & IBH, New Delhi, 1 & 2 : 1158 pp.

Talwar, P.K. and Kacker, R.K., 1984. *Commercial Sea Fishes of India.* Hand Book (4), Z.S.I., Kolkata : 997 pp.