OCCASIONAL PAPER NO. 188

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Fish and Fisheries of Digha Coast of West Bengal

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Records of the Zoological Survey of India

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INTRODUCTION

Digha is the largest fishlanding centre of West Bengal. The marine fish catches from this point meet the demand of different markets of the state especially of Calcutta and Howrah. Fishes inhabiting the coastal waters of Digha are a treasured resource both in terms of their utility as food and as materials for scientific study. Digha has a potential coastline of about 10 km which offers scope for more effective exploitation of marine fishery resources.

A list of marine and estuarine fishes of Digha was first published by Manna & Goswami (1985) who listed 168 species. Later, Goswami (1992) in an elaborated faunal list from this coast, listed 239 species of fishes from Digha including freshwater species. Some of the marine species from this list are of doubtful status and some are synonimysed by subsequent workers. Therefore, the list in fact embodies about 170 currently recognised species of marine fishes. Talwar *et al.* (1994) in a fairly comprehensive report on marine and estuarine fishes of West Bengal recorded 402 species of fishes inhabiting marine and esturaine zone of West Bengal. This account includes the species from the Hugli estuary and the Sandheads also without specifying place of occurrence of most of the species. Hence, it is difficult for an average reader or the student to understand the state of the art of ichthyofauna of Digha coast. Moreover, for preparing any programme of proper utilisation of fishery resources without detriment to their ecosystem, an understanding of the ichthyofaunal diversity and seasons of occurrence of important commercial fish species / groups is of prime importance.

The present study was, therefore, undertaken with a view to document in a single cover, the species available from Digha coast and the seasons of occurrence of commercially important fishes.

MATERIAL & METHODS

Topography of the study area

Digha is situated close to the Gangetic mouth on the east of India at lat. 21°36' N. and long. 87°30' E. Coastline is straight and the beach is flat and compact. The slope is very gentle and varies between 1 in 76 and 1 in 150 (Neogi, 1970). The beach is made up of sand grains mixed with variable proportions of silt and which makes it very compact (Barua, Bhattacharjee and Bagchi, 1980). Sea is quite shallow with little wave action on the beach and an extensive area of about 250 m of the intertidal zone is exposed during low water spring tides.

Climatology and Hydrography

Digha has a tropical humid climate. Annual rainfall varies from 1000 mm to 1300 mm, temperature ranges from 16^0 to 35.5^0C; relative humidity varies between 50% (in December) and 78% (in July), average wind speed in the period from May to June exceeds 30km / hour; velocity is lowest in the months of January, February, October to December, which ranges from 3.5 to 4.5 km/hour. (Goswami 1992).

Tidal variation

Tidal amplitude is about 2 m on an average in a total lunar cycle (Goswami, 1992)

Area of collection

The specimens were collected during the period from 1989 to 1994 from the following places (Fig. 1)

1. *Paschim Gadadharpur :* Situated about 6 km west from Digha, a landing center for drag net hauls.
2. *Udaypur :* A place on the western side about 5 km from Digha, a landing center for drag net hauls.
3. *Ongaria ghat :* Situated about 4km on the western side from Digha; it is also a landing center for drag net hauls.
4. *Jatranala ghat :* About 6 km west from Digha ; a landing center for drag net hauls.
5. *New Digha :* Situated about 2km west from Digha; landing center for drag net hauls.
6. *Hospital ghat :* Situated about 1km west from Digha; a landing center for drag net hauls.
7. *Sea Hawk ghat or Digha 'Ghole' :* A place on the eastern side about 1km from Digha; a landing center for drag net hauls.
8. *Digha Mohna :* More or less estuarine zone, about 4km on the east from Digha, where two irrigation canals *viz.* Khadalgobra canal and Ramnagar canal fall into the sea. It is landing center for both fishing vassels and drag net hauls.
9. *Sankarpur Harbour :* A minor fishing harbour, about 6 km away from Choudamile (near Ramnagar) in the Champa canal which falls into the sea across Digha Mohna. The harbour has landing platform, auction centers, boat building yard, ice plant, etc. About 600 fisihing vessels operate from this harbour. The harbour is under the administrative control of the West Bengal Fisheries Corpn. Ltd.

The present paper deals with 212 marine fish species belonging to 145 genera

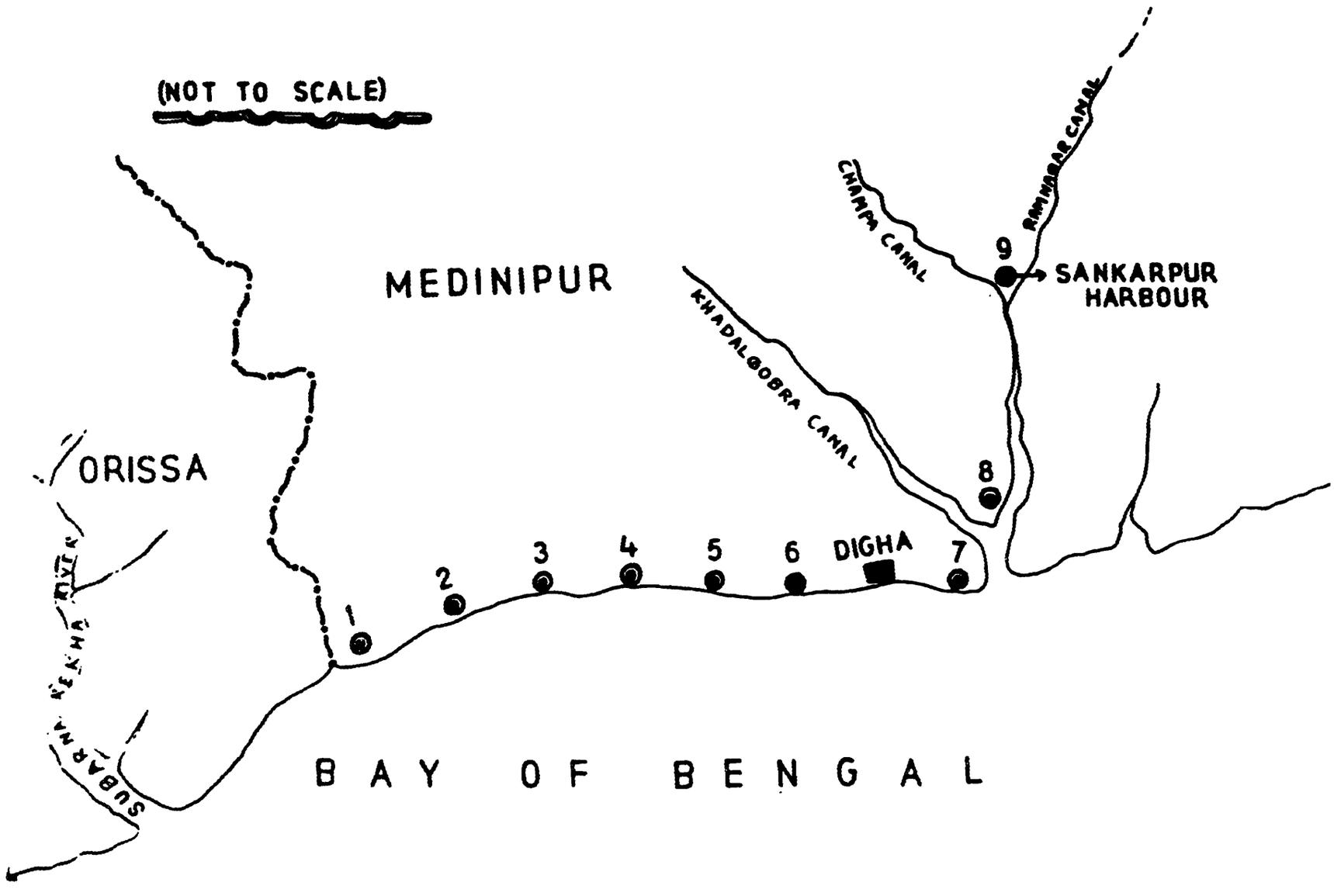

Fig. 1 Diagramatic view of Digha coast showing areas of collection (1–9)

covering 88 families. The species dealt with in the earlier works whose status are doubtful have not been incorporated in this work. The sequence of families is phylogenetic following Talwar (1984) and Talwar *et al.* (1994). Family characters and the keys have also been compiled from these works. The classification adopted here is after Nelson (1994).

The drawings / line drawings have been adopted from F.A.O. publications (Species Identification Sheets) or Talwar & Jhingran (1991) without individually crediting them.

Fish landing data recorded weekly from motorised fisihing vessels and drag net hauls from 1989 to 1994 from Digha Mohna and Sankarpur, and from the rest seven of the areas of collection respectively. Data from fishing vessels were collected during the operation period in a year i.e. from mid June to middle of February; those from drag nets hauls were collected throughout the year except in May when there is no netting.

Key to families

1. (a) Five separate gill-openings on each side (lateral or vertical) of head (Class Chondrichthyes) 2
   (b) Single gill-opening on each side of head (Class osteichthyes) 12
2. (a) Gill-openings on lateral sides of head (Sharks) 3
   (b) Gill-openings on underside of head (Skates & Rays) 8
3. (a) Head with oculonarial expansions ..... CARCHARHINIDAE
   (b) Head without aculonarial expansions 4
4. (a) Eyes behind mouth; deep nasoral grooves connecting nostrils and mouth 5
   (b) Eyes partly or entirely over mouth; nasoral grooves absent 7
5. (a) Caudal fin less than half the length of rest of shark .... STEGOSTOMATIDAE
   (b) Caudal fin more than half the length of rest of shark 6
6. (a) Mouth huge and terminal; head strongly depressed .... RHINCODONTIDAE
   (b) Mouth small and subterminal ; head cylindrical or moderately depressed .... HEMISCYLLIIDAE
7. (a) No precaudal pits ; dorsal caudal fin margin smooth .... PROSCYLLIIDAE
   (b) Precaudal pits and rippled dorsal caudal margin present .... CARCHARHINIDAE
8. (a) Body moderately depressed; tail not distinctly marked off from the body (Skates) 9

(b) Body distinctly depressed; tail more or less sharply marked off from the body (Rays) 10

9. (a) Snout extremely prolonged as a flat, narrow and firm blade, the edges of which are armed with a single series each of tooth-like. structures ..... PRISTIDAE

(b) Snout wedge-shaped and fairly prolonged, but not as a blade nor with teeth ..... RHINOBATIDAE

10. (a) Caudal fin well developed ; skin soft and flabby ; powerful electric organs in head region ..... NARCINIDAE

(b) No caudal fin; skin firm ; no electric organs in head region 11

11. (a) Eyes and spiracles lateral on head; small dorsal fin ..... MYLIOBATIDAE

(b) Eyes and spiracles on top of head; no distinct dorsal fin ..... DASYATIDAE, GYMNURIDAE

12. (a) Body bilaterally symmetrical 13

(b) Body not bilaterally symmetrical, highly compressed ; dorsal and anal fins long 76

13. (a) Gill openings reduced to a small opening on upper side of body; body scaleless ..... CALLIONYMIDAE

(b) Not as above 14

14. (a) Body eel-like, elongate, round in cross section; gill-opening narrow, on sides of head, no spinous rays in fins 15

(b) Body not eel-like but if it does have an eel-like form then pelvic fins present 19

15. (a) Body with minute embedded scales ; dorsal, anal and caudal fins well developed; pectoral fins present ..... ANGUILLIDAE

(b) Body naked 16

16. (a) Large canine teeth on vomer 17

(b) No large canine teeth on vomer 18

17. (a) Pectoral fins well developed ..... MURAENESOCIDAE

(b) Pectroal fins absent ..... MURAENIDAE

18. (a) Body extremely elongate, thread-like; Posterior nostril lateral or superior (not labial); branchiostegal rays not overlapping midventrally ..... MORINGUIDAE

(b) Body elongate, but not thread-like ; posterior nostril usually within or piercing the upper lip; branchiostegal rays overlapping along the midventral line ..... OPHICHTHIDAE

19. (a) From of body eel-like ..... PSEUDOCHROMIDAE
subfamily .....
..... CONGROGADINAE
(b) From of body not eel-like 20
20. (a) Sucking disc on head ..... ECHENEIDAE
(b) No Sucking disc on head 21
21. (a) Snout markedly elongate, tube-shaped, with a small mouth at end of tube ...
..... SYNGNATHIDAE
(b) Snout not tubular 22
22. (a) Pectoral fin with two distinct bases, the upper with rays attached and lower with several free filamentous rays ..... POLYNEMIDAE
(b) Pectoral fin with one base 23
23. (a) Weberian apparatus present; head and body scaleless; barbels around mouth
..... 24
(b) Weberian apparatus absent; body usually with scales 25
24. (a) Caudal fin rouned ..... PLOTOSIDAE
(b) Caudal fin forked ..... ARIIDAE
25. (a) Mesocoracoid present 26
(b) Mesocoracoid absent 30
26. (a) Dorsal fin inserted in poserior half of body ..... CHIROCENTRIDAE
(b) Dorsal fin median, not far posterior on body 27
27. (a) Lateral line Present ..... MEGALOPIDAE
(b) Lateral line absent 28
28. (a) Articulation of lower jaw well behind eye, lower jaw usually slender, snout piglike and projecting, lower jaw 'underslung' ..... ENGRAULIDAE
(b) Articulation of lower jaw under or only just behind eye, jaw deep 29
29. (a) Anal fin moderate, with less than 30 finrays ..... CLUPEIDAE
(b) Anal fin long, with at least 30 finrays ..... PRISTIGASTERIDAE
30. (a) Adipose dorsal fin present 31
(b) Adipose dorsal fin absent 32
31 (a) Caudal fin trilobed; body semitransparent ..... SYNODONTIDAE
..... Sub-family HARPADONTINAE
(b) Caudal fin forked ..... Sub-family SYNODONTIDAE

32. (a) Pelvic fins absent, but if present then inserted below base of pectoral fins or in front of them on throat 33
    (b) Pelvic fins present and inserted normally on belly or not far behind pectoral fins, or, finally, under pectoral fins but more less markedly behind vertical from posterior edge of pectoral fin base 36
33. (a) Mouth very small; gill openings restricted; scales usually modified as spines, shields or plates 34
    (b) Mouth moderate; gill openings normal 35
34. (a) Teeth united into a solid beak ..... TETRAODONTIDAE
    (b) Jaw with distinct teeth (i.e. teeth not fused) ..... TRIACANTHIDAE
35. (a) Head large with eyes placed dorsally, body naked..... BATRACHOIDIDAE
    (b) Not as above ..... BREGMACEROTIDAE
36. (a) No spines in fins; opercular and preopercular margins without spines or serrations 37
    (b) Spinous rays present if only in one fin 38
37. (a) Mouth openiong large, both jaws extended into long beaks with numerous needle-sharp teeth; scales small ..... BELONIDAE
    (b) Mouth small, only lower jaw prolonged into a beak; scales large .... HEMIRAMPHIDAE
38. (a) Suborbital stay (a posterior extension of the third suborbital bone) present (it can be probed with a needle under skin of cheek); head bony, tend to be spiny 39
    (b) Suborbital stay absent 41
39. (a) Pelvic fins widely separated; head greatly depressed, much broader than deep ..... *PLATYCEPHALIDAE*
    (b) Pelvic-fin bases adjacent; head not depressed, usually deeper than its breadth 40
40. (a) Gill membranes free from isthmus; wholly or partly scaled .... SCORPAENIDAE
    (b) Gill membranes united with isthmus; no distinct scales .... SYNANCEIIDAE
    ..... Sub-family SYNANCEINAE
41. (a) The short dorsal fins, widely separted from each other; pelvic fins sub-abdominal and markedly behind pectoral-fin base, about equidistant between pectoral-fin base and origin of first dorsal fin 42

(b) Dorsal fins with continguous bases, but if (rather rarely) the fins are separate, that the seperation is negligible and pelvic fins are situated not on belly but near base of pectoral fins 43

42. (a) First dorsal fin with four spines; teeth in jaws small, feeble hidden or absent; lateral line absent ..... MUGILIDAE

(b) First dorsal fin with five spines; jaws with strong canine teeth; lateral line well developed ..... SPHYRAENIDAE

43. (a) Head large and cuboid, eyes dorsal or nearly so ; lateral line on upper part of side ..... URANOSCOPIDAE

(b) Not as above 44

44. (a) A peculiar occipital hook in males ; lateral line short and rudimentary ..... KURTIDAE

(b) Not as above 45

45. (a) Pelvic fins placed below pectoral fins, with one spine and 4 or 5 soft rays, often united 46

(b) Pelvic fins not inserted below pectoral fins, and not united 48

46. (a) Pelvic fins separate (no sucking disc), bases close together but not united ..... ELEOTRIDAE

(b) Pelvic fins united 47

47. (a) Two dorsal fins, separate or connected at their bases ..... GOBIIDAE ..... Sub-family GOBIINAE

(b) One very elongated dorsal fin, body eellike .....Sub-family AMBLYOPINAE

48. (a) Toothed saccular outgrowths in gullet behind last gill arch ..... STROMATEIDAE

(b) No toothed pharyngeal sacs 49

49. (a) Premaxilla fixed (nonprotrusible) 50

(b) Maxillary bone not very firmly attached to premaxillae which are hence free to move forward 51

50. (a) Body spindle-shaped; caudal fin well developed .....SCOMBRIDAE

(b) Body very elongate and strongly compressed; caudal fin absent ..... TRICHIURIDAE

51 (a) Pelvic fin with two strong spines, separated by three soft rays; anal fin with seven spines ..... SIGANIDAE

(b) Pelvic fin with at most one spine 52

52. (a) One or more spines on caudal peduncle ..... ACANTHURIDAE
    (b) Caudal peduncle unarmed 53
53. (a) Two long barbels behind chin which can be folded into a median grove on throat; two widely separated dorsal fins ..... MULLIDAE
    (b) No barbels on chin or, if present (Sciaenidae), then dorsal fins not widely separated 54
54. (a) Dorsal fin with 6 to 9 isolated spines, each depressible in a grove; two silvery stripes on sides of body ..... RACHYCENTRIDAE
    (b) Dorsal fin with no free spines 55
55. (a) First two anal-fin spines detached from rest of fin (these spines partially or completely embedded in large specimens); scutes on straight part of lateral line usually present ..... CARANGIDAE
    (b) First two anal fin spines not detached from rest of fin, no scutes on caudal peduncle 56
56. (a) Anterior rays of soft dorsal and anal fins markedly elongated, giving both fins a sickle shape; pelvic fins usually small or vestigial; body deep ..... MONODACTYLIDAE
    (b) Anterior rays of soft dorsal and anal fins elongated, but when elongated they do not give either fin a sickle shape 57
57. (a) Body very deep, its maximum depth more than half the total length; single dorsal fin, the spinous rays clearly distinguishable 58
    (b) Body oblong or moderately deep, its maximum depth less than half the total length; when deep-bodied and with single dorsal fin, there are either no spinous rays or are difficult to distinguish 59
58. (a) Anal fin with three spines; gill membranes broadly united to isthmus ..... EPHIPPIDAE
    (b) Anal fin with four spines; gill membranes broadly united to isthmus ..... SCATOPHAGIDAE
59. (a) Single dorsal fin with no spinous rays, or else difficult to distinguish from soft rays 60
    (b) Single or two dorsal fins, with well developed spinous rays 61
60. (a) Dorsal fin originating on head; forehead prominent (steep and high) in adult males; pelvic fins present ..... CORYPHAENIDAE
    (b) Dorsal fin originating behind head; forehead not prominent; pelvic fins absent in adults ..... PARASTROMATEIDAE

61. (a) Two dorsal fins, well separated, but if close together then not joined by membrane 62

(b) Single dorsal fin, sometimes deeply notched between spinous and soft parts of fin, but in such cases the membrane joining the two parts is intact..... 66

62. (a) Anal-fin base considerably longer than second dorsal-fin base; mouth large, oblique, with two small caninestat front ..... LACTARIIDAE

(b) Anal-fin base as long as or shorter than second dorsal-fin base 63

63. (a) Mouth small, maximum ending far short of eye or even before nostrils, body elongate ..... SILLAGINIDAE

(b) Mouth moderate-sized or large; maxilla reaching nostrils, but often extending beyond anterior margin of eye 64

64. (a) Pelvic fin without an axillary scaly process ..... APOGONIDAE

(b) Pelvic fin with an axillary scaly process 65

65. (a) Caudal fin forked; scales ctenoid ..... CHANDIDAE

(b) Caudal fin rounded; scales ctenoid ..... CENTROPOMIDAE

66. (a) Pelvic fins without an axillary scaly process; anal-fin spines three 67

(b) Pelvic fins with an axillary scaly process 69

67. (a) Inner ray of pelvic fin attached to abdomen by membrane ..... PRIACANTHIDAE

(b) Inner ray of pelvic fin not attached to abdomen by membrane..... 68

68. (a) Mouth large, the maxilla extending to below hind margin of eye; dorsal fin with 11 spines ..... SERRANIDAE

(b) Mouth small, the maxilla not extending beyond eye centre; dorsal fin with 12 to 14 spines ..... TERAPONIDAE

69. (a) Anal fin with two spines; lateral line scales extending to hind margin of caudal fin ..... SCIAENIDAE

(b) Anal fin with three spines; lateral scales ending at caudal-fin base 70

70. (a) Dorsal and anal fins rounded and symmerical so that with the tail they appear as a single three lobed fin ..... LOBOTIDAE

(b) Not as above 71

71. (a) Mouth strongly protrusible 72

(b) Mouth moderately protrusible 73

72. (a) Head naked, upper surface with bony ridges and a nuchal spine on nape..... LEIOGNATHIDAE

(b) Head entirely covered with clearly visible scales, upper surface smooth ..... GERREIDAE

73. (a) Distal and of premaxillae overlapping maxillae externally; molarlike teeth present at sides of jaws ..... SPARIDAE

(b) Maxillae not overlapping hind tip of premaxillae 74

74. (a) Suborbital process either absent or weakly developed ..... HAEMULIDAE

(b) Suborbital process well developed, sometimes forming a spine posteriorly 75

75. (a) Spinous rays in dorsal and anal fins moderately strong; teeth present on roof of mouth ..... LUTJANIDAE

(b) Spinous rays in dorsal and anal fins week; no teeth on roof of mouth .... NEMIPTERIDAE

76. (a) Preopercular margin free and visible, not covered by skin; lower jaw generally prominent ..... BOTHIDAE

(b) Preopercular margin not entirely free, hidden beneath skin; lower jaw not prominent 77

77. (a) Eyes on right side of body ..... SOLEIDAE

(b) Eyes on left side of body ..... CYNOGLOSSIDAE

Class : CHONDRICHTHYES
(Cartilaginous fishes)

The chondrichthyes (comprising the sharks and rays) are characterised by a cartilaginous skeleton more or less hardened by calcification. This group is primarily marine although a few elasmobranchs have adopted to life in freshwater.

Subclass : ELASMOBRANCHI
Order : ORECTOLOBIFORMES
Family : HEMISCYLLIIDAE
(Bamboo sharks)

Small and slender with nasoral grooves, perinassal grooves, short barbels, small transverse mouth in front of eyes, dorsolateral eyes, large spiracles below eyes. Two dorsal fins without spine; low keellike rounded anal fin, separated from the lower caudal origin by a narrow notch; and a long precauadal tail.

Species occurring in the region

Chiloscyllium griseum Muller & Henle (fig. 2B)
Chiloscyllium indicum (Gmelin) (fig. 2 A)

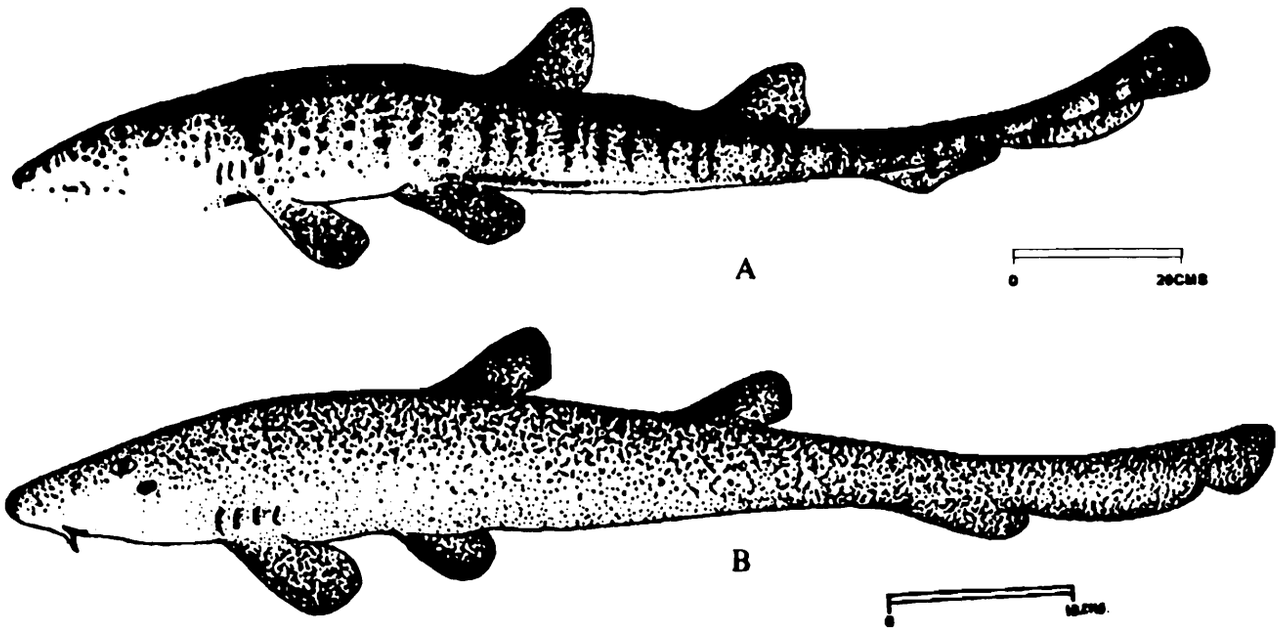

Fig 2 a) Family : Hemiscyllidae, *Chyloscyllium indicum* (Gmelin);
b) Family : Hemiscyllidae, *Chiloscyllium griseum Muller & Henle.*

Key to species

1. (a) Body and tail very slender : lateral ridges and numerous small dark spots and bars on body ..... *Chiloscyllium indicum*

   (b) Body and tail moderarely slender; without lateral ridges and numerous small dark spots and bars ..... *Chiloscyllium griseum.*

Family : STEGOSTOMATIDAE
(Zebra sharks)

Body cylindrical, with prominent ridges on sides. Eyes laterally situated on head, behind mouth : deep nasoral grooves connecting nostrils and ventral mouth. Gill slits small, the fifth overlapping fourth. First dorsal fin slightly larger than second fin; anal fin larger than second darsal fin; caudal fin about half of total length.

Species occurring in the region

Stegostoma fasciatum (Hermann)

Familly : RHINCODONTIDAE
(Whale sharks)

Body large and robust, with a broad and blunt snout. Eyes very small. Mouth wide and terminal. Gill openings exceptionally large, the last two slits behind origin pectoral fin, over fin base.

Species occurring in the region

Rhincodon typus Smith

Order : CARCHARHINIFORMES
Family : PROSCYLLIIDATE
(Finback catsharks)

Trunk and precaudal cylindrical. Caudal fin narrow and tapelike, relatively long.

Remaks : This is a small family of deep water sharks. Compagno (1984) reported *Eridancis radcliffei* Smith belonging to this family from northern Bay of Bengal.

Family : CARCHARHINIDAE
(Requiem Sharks)
(Fig. 3 A-D)

The Requiem sharks form the largest family among the elasmobranch fishes. All the members of the family have the appearance of 'typical sharks" These sharks have round eyes, no nasoral grooves or barbels, usually no spiracles, a long arched mouth that reaches post anterior ends of eyes, moderately long labial furrows, more or less blade like teeth in jaws, two dorsal fins and an anal fin, the first dorsal fin placed well ahead of pelvic bases, the second fin usually much smaller than the first, precaudal pits present, and the caudal fin with a strong ventral lobe, Further, the fifth gill-opening over or behind origin of pectoral fin.

Most species inhabit tropical continental coastal and offishore waters.

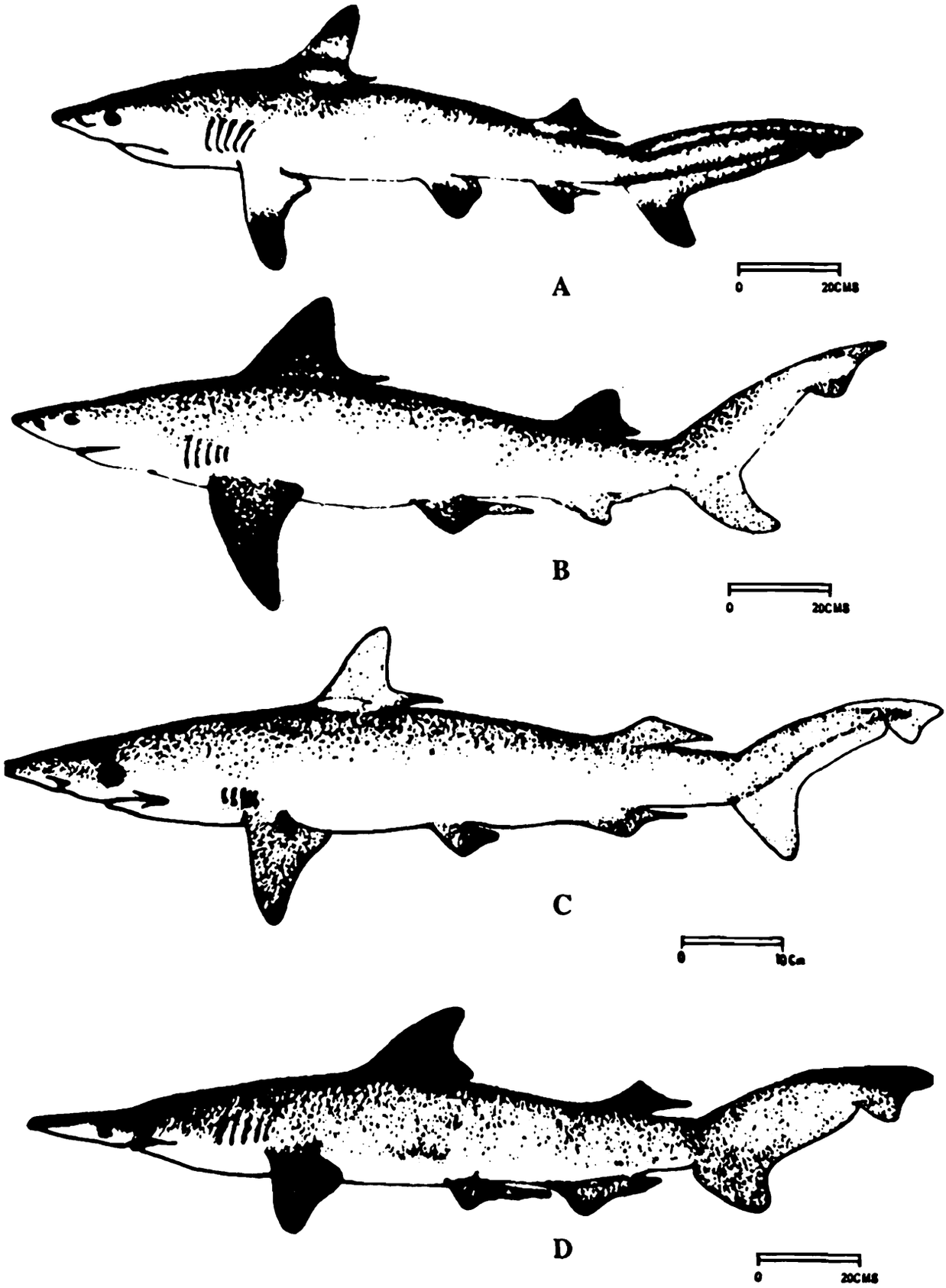

Fig. 3. a) Family : Carcharinidae, *Carcharhinus limbatus* (Valenciennes), b) *Glyphis gangeticus* (Muller & Henle), c) *Rhizoprionodon acutus* (Ruppel), d) *Scoliodon laticaudus* (Muller & Henle)

Species occurring in the region

Carcharhinus dussumieri (Valenciences)
Carcharhinus limbatus (Valenciences)
Glyphis gangeticus (Muller and Henle)
Rhizoprionodon acutus (Ruppell)
Scoliodon laticaudus (Muller and Henle)

Key to species

1. (a) Head greatly depressed; post-ventral margin of caudal fin concave ..... *Scoliodon laticaudus.*
   (b) Head varying from conical to slightly depressed; post ventral margin of caudal fin deeply incised 2
2. (a) Second dorsal fin well behind anal origin ..... *Rhizoprionodon acutus.*
   (b) Second dorsal fin usually above vertical form anal fin origin 3
3. (a) Cusps of lower teeth prominently protruding when mouth is closed; precaudal pits longitudinal (and not crescentric) ..... *Glyphis gangeticus.*
   (b) Cusps of lower teeth not prominently protruding when mouth is closed ; precaudal pits transverse and crescentic 4
4. (a) Second dorsal fin with a conspicuous black tip, other fins without marking ..... *Carcharhinus dussumieri.*
   (b) Second dorsal fin with a black tip ; other fins with conspicuous black marking ..... *Carcharhinus limbatus.*

Family : CARCHRINIDAE
(Hammerhead sharks)

Hammerhead sharks are clearly distinguished from all other sharks by their flattened heads, extended into hammerlike lobes on each side. At its tip, each lobe bears an eye. In other features, the hammerheads resemble Requiem sharks (Gilbert, 1967) to which they are closely related.

Hammerhead sharks inhabit suface waters in tropical and warm - temperate seas. The adults of most species are semi-oceanic while the young are found close shore. Reported to be dangerous to man.

Species occurring in the region

Eusphryna blochii (Cuvier) (Fig. 4)

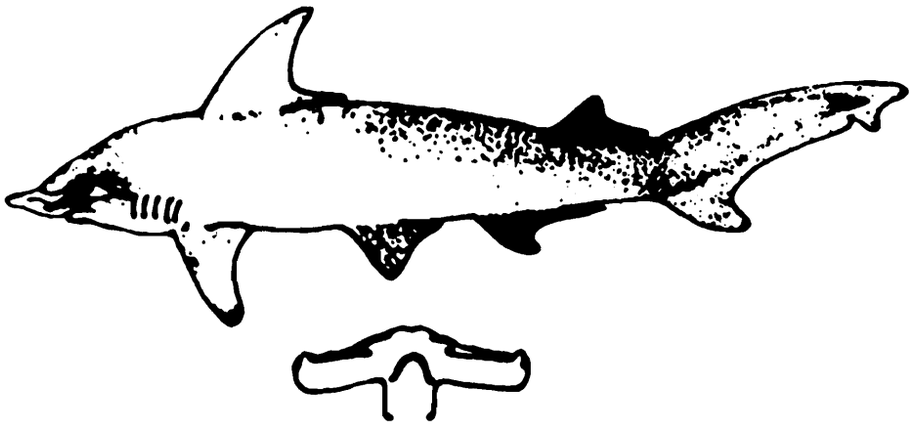

Fig. 4. Family : Syhyrnidae, *Eusphyrna blochii* (Cuvier)

Order : RAJIFORMES
Suborder : PRISOIDEI
Family : PRISTIDAE
(Sawfishes)

These sharklike rays have a long snout that is formidably armoured with sharp teeth along each side. Like rays, the sawfishes have gill slits on the underside of the body of each side just behind the mouth, and the large pectoral fins are joined broadly to the head. The body is long and slim, more like that of a shark. Two distinct dorsal fins and a caudal fin, sawfishes are cosmopolitan in distribution in warm to tropical seas, inhabiting shallow waters and straying into brackish or even fresh water.

Species occurring in the region

Anoxypristis cuspidatus (Latham) (Fig.5)
Pristis microdon Latham

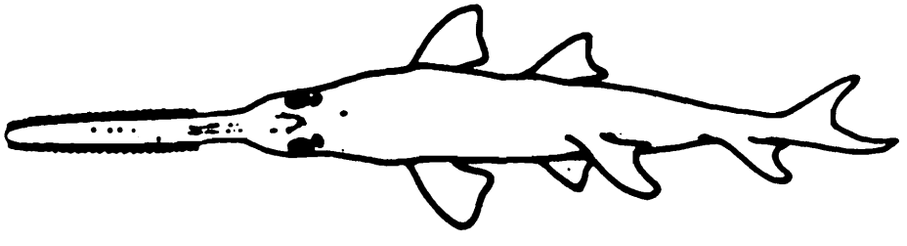

Fig. 5. Family : Pristidae, *Anoxypristis cuspidatus* (Latham)

Key to species

1. (a) Caudal fin with a prominent subterminal notch and a long ventral lobe .... *Anxyprisitis cuspidatus.*

   (b) Caudal fin without a subterminal notch, with a short ventral lobe or none ... . *Pristis microdon.*

Suborder : TORPENDINIOIDEI
Family : NARCINIDAE
(Electric Rays)

Electric ralys inhabit seas throughout the world. They have powerful electric organs, derived from branchial muscles, in the head region. Eyes are small and functional in most species, but rudimentary or obsolete in a few deep water forms. Their bodies are soft and flabby compared to skates and other rays. The cadual fin is well developed. The disc is rounded anteriorly.

Species occurring in the region

Subfamily : NARCININAE
Narcine brunnea Annandale
Subfamily : NARKINAE
Narke dipterygia **(Schneider)**

Key to species

1. (a) Two dorsal fins present; deep groove around mouth, posterior pectoral margins overlapping the anterior part of pelvic fins; plain coloured upper side of disc ..... *Narcine burnnea.*

   (b) One dorsal fin present; shallow groove aroud mouth and lips. Eyes well developed; pectoral and pelvic fins well developed ..... *Narke dipterygia.*

Suborder : RAJODEI
Family : RHINOBATIDAE
(Guitar fishes)

Guitar fishes have a distinct raylike body with the forward part rounded or heart-shaped. The snout is wedgeshaped, and the tail sector is not definitely marked off from the body. The caudal fin is relatevely short and thick, but the two dorsal and anal fins are well developed. The gills are on the underside of the body. Denticles over body form a row on midline on back, tail without spine.

The guitarfishes are shallow water bottom feeders, often being found in bays and estuaries. They are ovoviviparus.

Species occurring in the region

Rhina ancylostoma Schneider
Rhinobatos annandalei Norman
Rhina grannulatus Cauvier
Rhina lionotus Norman
Rhina obtusus Muller & Henle
Rhynchobatus djeddensis (Forsskal)

Key to species

1. (a) Caudal fin bilobed; origin of first dorsal fin above pelvic fins 2
   (b) Caudal fin not bilobed; origin of first dorsal fin behind pelvic fins..... 3
2. (a) Snout long and pointed; posterior margin of spiracles with two cutaneous folds ..... *Rhynchobatus djeddensis*
   (b) Snout broad and rounded; no spiracular folds .....*Rhina ancylostoma*
3. (a) Anterior nasal valve extending only as far as levels of anterior margin of nostril 4
   (b) Anterior nasal valve extending across inner margin of nostril, often meeting that of opposite side 5
4. (a) A single row of tubercles in median line of back .....*Rhinbatos annandalei*
   (b) Rows of minute tubercles in medium line of back ..... *Rhinobatos lionotus*
5. (a) Snout very long and narrow, the rostral ridges close together or joined throughout their length ..... *Rhinobatos grannulatus*
   (b) Snout short and narrow, the rostral ridges separated throughout their length .....*Rhinobatos obtusus*

Suborder : MYLIOBATIDEI
Super family : DASYATOIDEA
Family : DASYATOIDEA
(Sting Rays)
(Fig. 6A-B)

Stingrays are best knwon for their long, slim, whiplike tails that armed with usually one or more long poisonous spines near the base; many sharp, small teeth along the sides of the spine. These rays have the outer anterior margin of pectorals continuous along side of head, no distinct dorsal fin and no caudal fin.

Stingrays are marine and esturine, but a few species penetrate fresh waters. Stingrays generally lie on the bottom, almost completely buried in the sand or soft sediment.

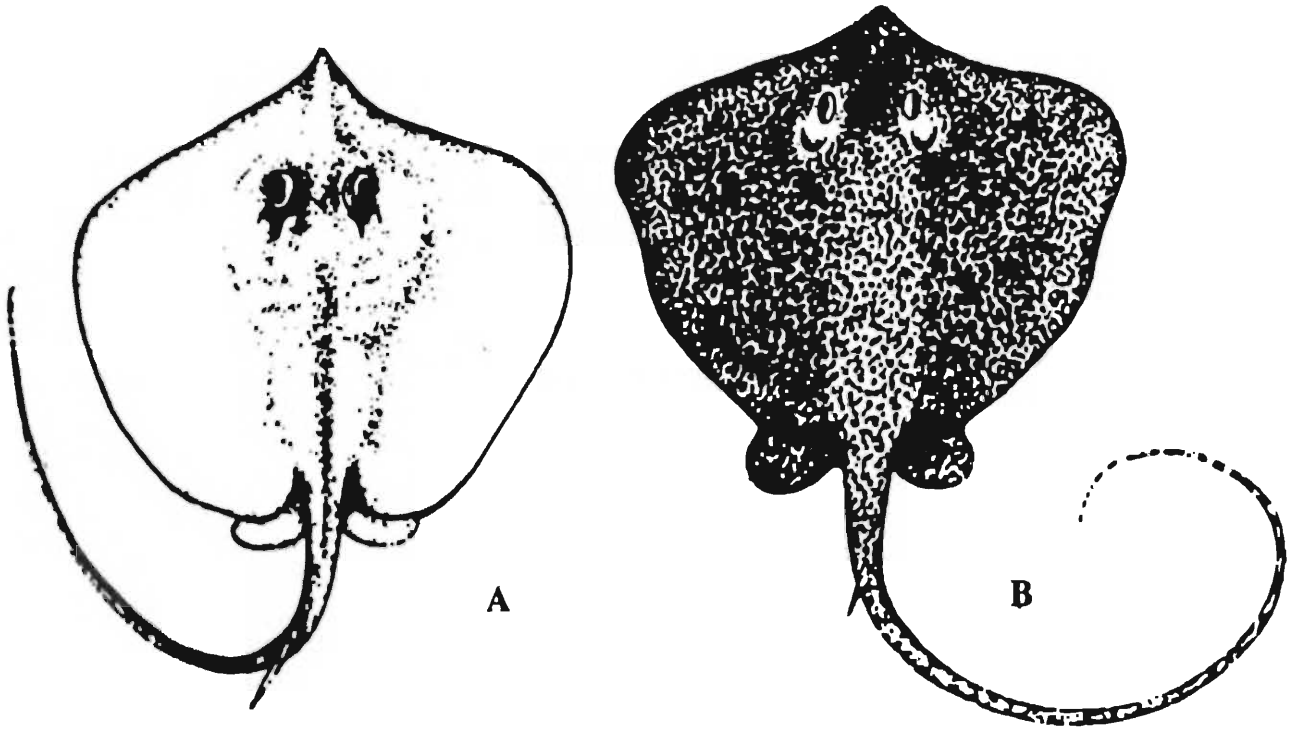

Fig. 6. a) Family : Dasyatidae, *Himantura imbricata* (Schneider), b) *Himantura uarnak* (Forskal)

Species occurring in the region

Dasyatis zugei (Muller and Henle)
Himantura imbricata (Schneider)
Himantura uarnak (Forsskal)

Superfamily : YLIOBATOIDEA
Family : GYMNURIDAE
(Butterfly rays)

Disc extremely board, more than 1.5 times as broad as long ; tail distinctly shorter than disc width. No papillae on floor of mouth.

Species occurring in the region

Aetoplatea tentaculata (Valenciennes)
Gymnura (Gymnura) japonica (Schlegel)
Gymnura (Gymnura) poecilura (Shaw)

Key to species (Dasyatidae & Gymnuridae)

1. (a) Disc extremely broad, more than 1.5 times as broad as long; tail distinctly shorter than disc width; no papillae on floor of mouth (family : Gymnuridae) 2
   (b) Disc at most 1.3 times as broad as long tail much longer than disc width ; floor of mouth with several fleshy papillae (family : Dasyatidae)..... .4
2. (a) A small distinct dorsal fin near middle length of tail; a small cutaneous fold on tail ..... *Aetoplatea tentaculata*
   (b) No dorsal fin : no cutaneous fold on tail 3
3. (a) Tail armed with a small, weak serrate spine at its anterior third .... *Gymnura japonica*
   (b) Tail without spine.....*Gymnura poecilura*
4. (a) Tail with cutaneous fold ..... *Dasyatis zugei*
   (b) Tail without fold..... 5
5. (a) Disc oval, with usually two stings..... 6
   (b) Disc more or less diamond shaped, usually with a single functional sting .... *Dasyatis uarnak*
6. (a) Ventral surface of disc entirely white ..... *Himantura imbricata*
   (b) Ventral surface of disc with broad dark margin .....*Himantura bleekeri*

Family : MYLIOBATIDAE
Subfamily : MYLIOBATINAE
(Eagle Rays)

The members of this group have a distinct head region, with the eyes and spiracles located on each side. Head is marked off from the trunk. Tail much longer than the disc. Small dorsal fin; no caudal fin.

Species occurring in the region

Aetobatus narinari (Blainville)
Aetomylaeus nichofii (Schneider) (fig. 7)

Key to species

1. (a) Single series of teeth in jaws; Caudal spine present.....*Aetobatus narinari*
   (b) Teeth in 3 series; no spine on tail .....*Aetomylaeus nichofii*

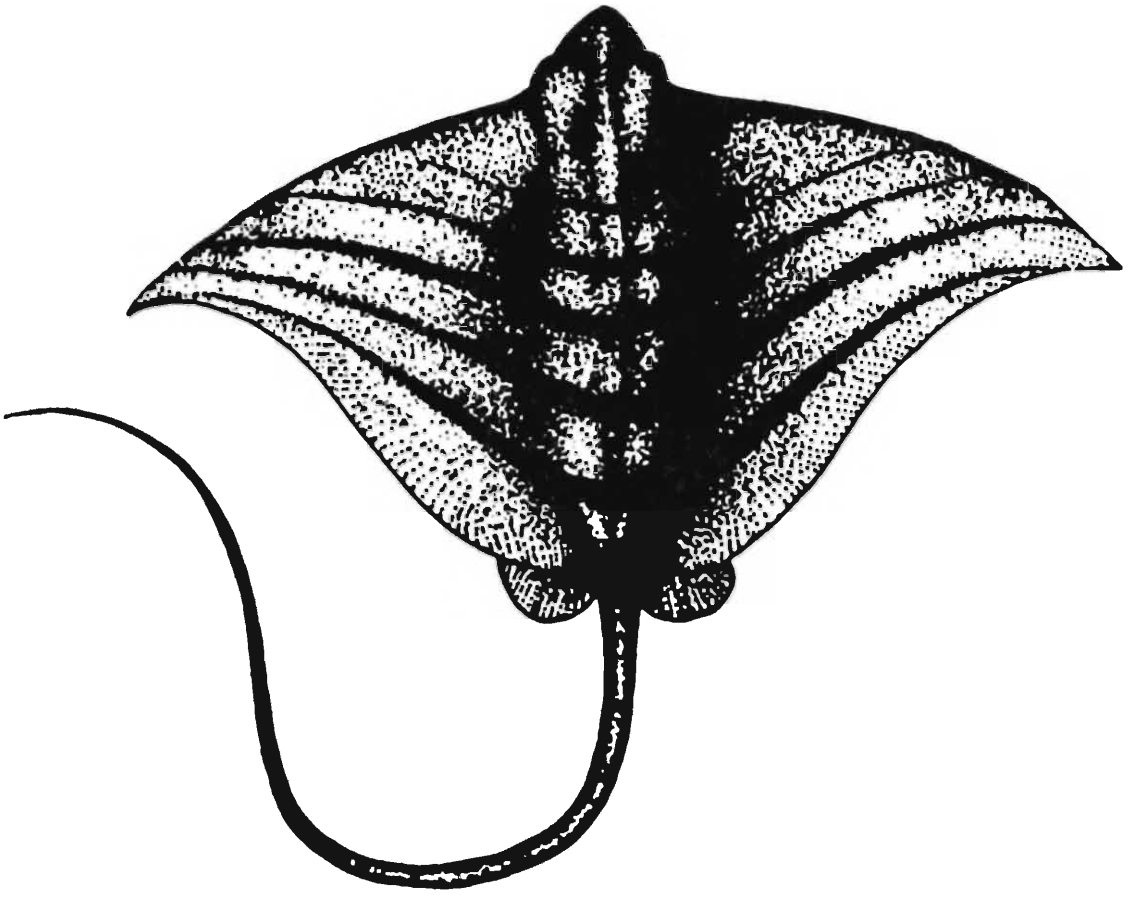

Fig. 7. Family : Myliobatidae, *Aetomylaeus nichofii* (Schneider)

Class : ACTINOTERYGII
Division : TELEOSTEL
Sub-Division : ELOPOMORPHA
Order : ELOPIFORMES
Sub-order : ELOPOIDEI
Family : MEGALOPIDAE

(Tarpons)

(Fig.8)

Although primarily marine, these fishes are also known from brackish and even fresh waters. The body is compressed, the mouth is terminal or superior. Caudal fin deeply forked; a single dorsal fin of soft rays, placed at the center of body and inserted above the origin of pelvic fins, last ray of dorsal fin extended as a long filament. Many sharp, small teeth in the mouth.

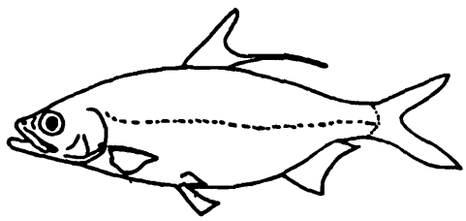

Fig. 8. Family : Megalopidae

Species occurring in the region

Magalops cyprincides (Broussonet)

Order : ANGUILLIFORMES
Sub-order : ANGUILLIDAE
(Freshwater eels)

The anguillids differ from most of the other eel families in the possession of scales, which are embedded in the skin. These eels breed in the open ocean and ocean currents move the young larvae (leptocephali) coastward where the juveniles invade fresh water. Most of the life is subsquently spent in streams and rivers but as maturity approaches the adult migrate seaward to spawn.

Species occurring in the region

Anguilla bengalensis bengalensis (Gray)
Anguilla bicolor bicolor Mc Clelland

Key to species

1. (a) Dorsal fin origin nearly above anus; no edentulous grooves in tooth bands.. ..... *Anguilla bicolor*

   (b) Dorsal fin origin about midway between gill opening and anal fin; edentulous grooves in tooth bands ..... *Anguilla bengalensis*

Family : MORINGUIDAE
(Worm Eels)
(Fig. 9)

The worm eels have an extremely elongate, thread like body; gill-openings low on body; dorsal and anal fins reduced to low folds, posteriorly, and confluent with caudal fin; eyes small and covered with skin; no scales. All have feeble pectoral fins and are thought to be head burrowers rather than tail burrowers like some of the eels of other families.

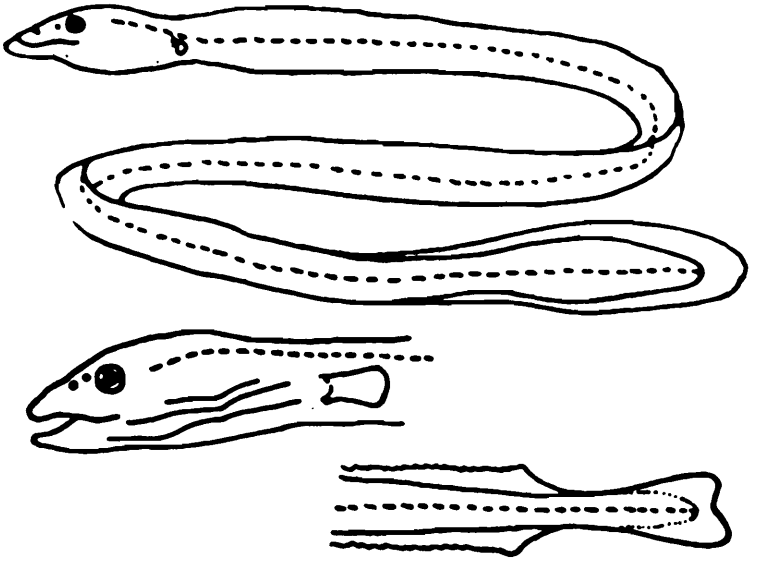

Fig. 9. Family : Moringuidae

Species occurring in the region

Moringua raitaborua (Hamilton-Buchanan)

Sub-order : MURAENOIDEI
Family : MURAENIDAE
(Moray Eels)
(Fig. 10)

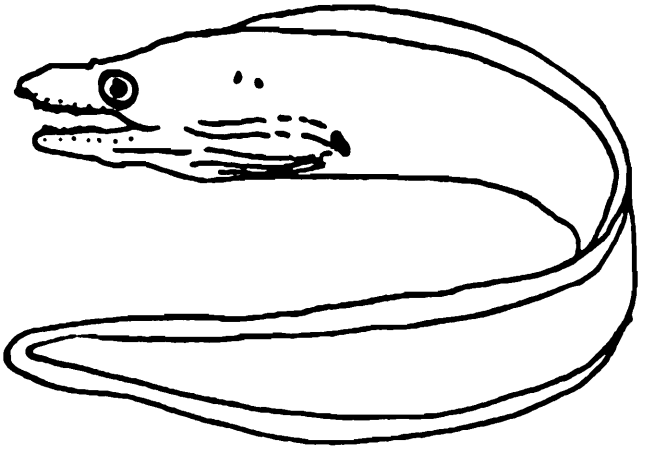

Fig. 10. Family : Muraenidae

The muraenids are identified by a combination of characteristics, important ones being the absence of pectoral fins, the dentetion, the colour pattern, and the deep dorsal

profile of the head. Body is flattened from side to side, scaleless skin is thick and leathery. The dorsal and anal fins are low, sometimes almost hidden by the wrinkled skin around them. The gill openings are restricted to small roundish lateral opening; lateral line pores on head but not on body; posterior nostril high on head; most with long fanglike teeth. Many morays are attractively coloured.

Species occurring in the region

Echidna nebulosa (Ahl)
Echidna zebra (Shaw)
Gymnothorax meleagris (Shaw and Nodder)
Gymnothorax sathete (Harmilton-Buchannan)
Gymnothorax tile (Harmilton-Buchanan)
Sideria picta (Ahl)
Thyrsoidea macrura (Bleeker)

Key to species

1. (a) Teeth mostly blunt, molarlike 2
   (b) Teeth sharp, some of them fang like 3
2. (a) Tail about half as along as rest of body ..... *Echidna zebra*
   (b) Tail about as long as rest of body ..... *Echidna nebulosa*
3. (a) Tail about twice rest of body ..... *Thyrsoidea macrura*
   (b) Tail less than 1.5 times rest of body 4
4. (a) No long median depressible fang in upper jaw ..... *Siderea picta*
   (b) One or more long median depressible fangs in upper jaw 5
5. (a) Teeth in upper jaw in a single row ..... *Gymnothorax sathete*
   (b) Teeth in upper jaw in two rows 6
6. (a) Body covered with numerous very small yellow spots ..... *Gymnothorax meleagris*
   (b) Body with white specks (often) absent in adults ..... *Gymnothorax tile*

Family : OPHICHTHIDAE
(Snake Eels)
(Fig. 11)

Snake eels are tail burrowers and accordingly have very sharp, strong, spikelike tails. The nostrils are located in two short tubes, stout barbels on tip of the snout, the

posterior nostril usually within or piercing the upper lip. In most snake eels the dorsal fin extends almost the full length of the body, originating just behind the head but stoopping short of the tip of the tail; the anal fin is much shorter. Pectoral fins are lacking or very small. Branchiostegal rays numerous and overlapping along the midventral line, forming a basketlike structure.

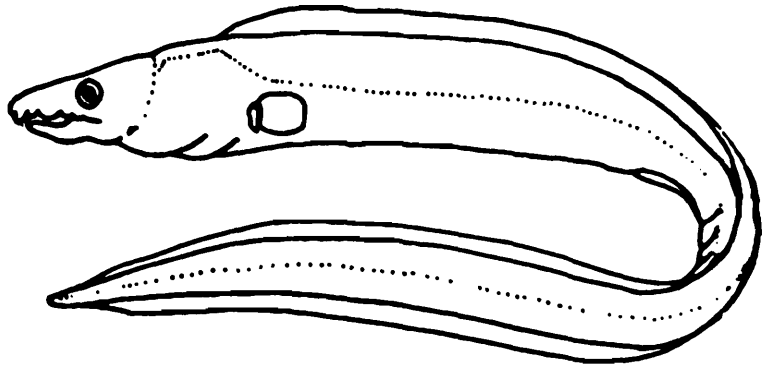

Fig. 11. Ophichthidae

Species occurring in the region

Lamnostoma orientalis (Ms Clelland)
Psiodonophis boro (Hamilton-Buchanan)

Key to species

1. (a) Pactoral fins present ..... *Lamnostoma orientalis*
   (b) Pectoral fins absent ..... *Pisodonophis boro*

Family : MURAENESOCIDAE
(Pike Congers)
(Fig. 12)

Pikecongers are small to large-sized fishes occurring in tropical waters, found on the continental shelf and slope. The eyes are large and coverd with skin. The pectoral fin base are well developed, dorsol fin origin over pectoral-fin base. The mouth is large, extending well beyond eyes; teeth large and prominent, especially in front, sharp, multiserial on jaws and typically in three rows on vomer; a median row of canines flanked on each side by a row of much smaller teeth, lateral line conspicuous. Gill openings large, almost meeting at midline.

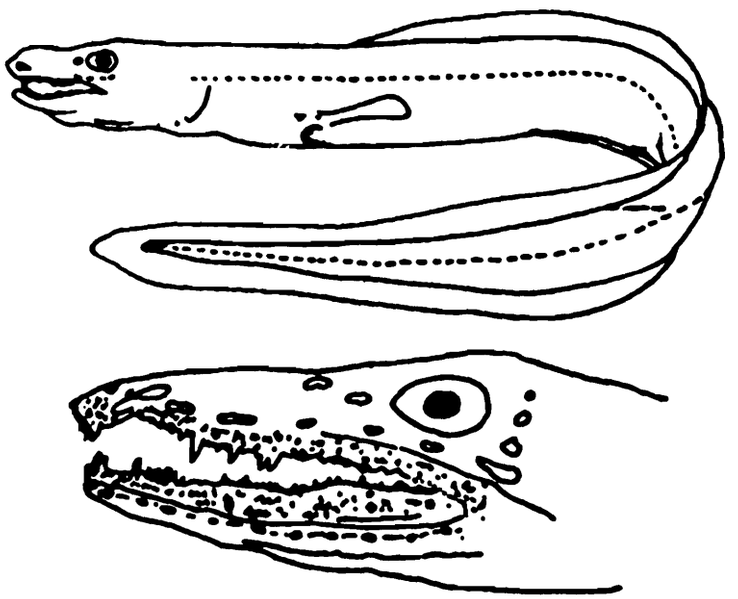

Fig. 12. Family : Muraenesocidae

Species occurring in the region

Corgresox talabon (Cuvier)
Corgresox talabonoides (Bleeker)
Muraenesox bagio (Hamilton-Buchanan)
Muraenesox cinereus (Forsskal)

Key to species

1. (a) Principal vomerine teeth blade like 2
   (b) Principal vomerine teeth large and needle like 3
2. (a) Posterior nostrils slightly closer to eyes than to antertior nostrils .... *Muraenesox bagio*
   (b) Posterior nostrils much nearer to eyes than to anterior nostrils .... *Muraenesox cinereus*
3. (a) Pectoral fins length about 4 times in head length .... *Congresox talabonoides*
   (b) Pectoral fins longer, its length about 3.2 times in head length .... *Congresox talabon*

Sub-division : CLUPEOMORPHA
Order : CLUPEIFORMES
Family : CLUPEIDAE
(Shads, Herings, etc)

The shads, herrings, sardines, and their relatives form one of the world's most important gorup of food fishes. All the clupeoids are noted for their oily Flesh. The body is deeply compressed laterally and coverd with deciduous scales, which form a knife like ridge along the centre line of the undersurface of the body. The dorsal fin is placed near the centre of the body, and the caudal fin is deeply forked. Mouth inferior, superior, or terminal; teeth usually absent. Head scaleless. Lateral line existing on a few scales behind the head in some species, absent in others.

Most clupeids are marine, but some can tolerate low salinities and some shads (Alosinae) and gizzard shads (Dorosomatinae) live temporarily or permanently in freshwater.

Species occurring in the region

Subfamily : ALOSINAE
(Fig. 13A)

Hilsa (Tenualosa) ilisha (Hamilton-Buchanan)
Hilsa (Hilsa) kelee (Cuvier)
Hilsa (Tenualosa) toli (Valenciennes)

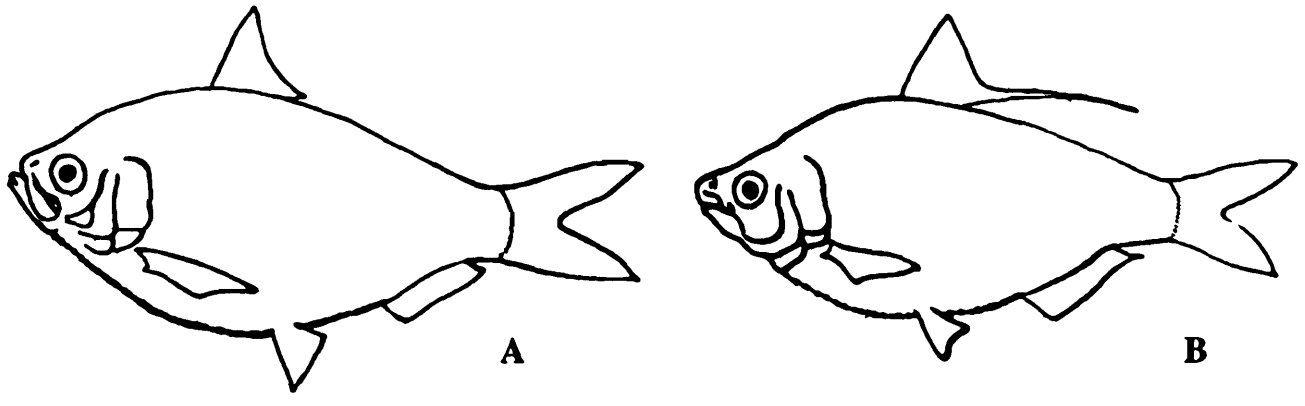

Fig. 13. Family : Clupeidae; Subfamily : a) Alosiinae, b) Dorosomatinae

Subfamily : CLUPEINAE

Herklotsichtys quadrimaculatus (Ruppell)
Sardinella brachysoma Bleeker
Sardinella fimbriata (Valenciennes)
Sardinella gibbosa (Bleeker)

Subfamily : DOROSOMATINAE
(Fig.13B)

Anodontostoma chacunda (Hamilton - Buchanan)
Namatalosa nasus (Bloch)

Key to subfamilies

1. (a) Mouth inferior, lower jaw flared at corners; last dorsal finray often filamentous ..... DOROSOMATINAE
   (b) Mouth terminal, lower jaw not flared out ward at corners; last dorsal finray not filamentous 2
2. (a) Upper jaw with a distinct notch at centre ..... ALOSINAE
   (b) Upper jaw without a median notch ..... CLUPEINAE

Subfamily : ALOSINAE
(Shads)

Key to species

1. (a) Fronto-parietal striae (on top of head) 8 to 14; gill rakers on inner arches distinctly curved outward ..... *Hilsa kelee*
   (b) Fronto-paretal striae weakly developed, usually hidden by skin; gill rakers on inner arches straight, scales not perforated 2
2. (a) Series of small spots on flanks; head length 28 to 32% of standard length; gill rakers 100 to 250 on lower arm of arch ..... *Hilsa ilisha*
   (b) No spots on flank; head length 25 to 27 % of standard length; gill rakers 60 to '00 on lower arm of arch ..... *Hilsa toli*

Subfamily : CLUPEINAE
(Sardines, Herrings, Sprats)

Key to species

1. (a) Last two anal fin rays enlarged 2
   (b) Last two anal fin rays not enlarged ..... *Herklotsichthya guadrimaculatus*
2. (a) Post pelvic scutes 15 ..... *Sardinella gibbosa*
   (b) Post pelive scutes 12 - 14 3
3. (a) Posterior scales with numerous vertical striae ..... *Sardinella brachysoma*
   (b) Posterior scales with 4-5 vertical striae ..... *Sardinella fimbriata*

Subfamily : DOROSOMATINAE
(Gizzard Shads)

Key to species

1. (a) Last dorsal finray produced, filamentous ..... *Namatolosa nusus*
   (b) Last dorsal finray normal, not filamentous ..... *Anodontostoma chacunda*

Family : PRISTIGASTERIDAE
(Ilishas, Pellonas)
(Fig. 14A-14B)

Body compressed, fully scuted along belly. Mouth directed more or less upward, lower jaw projecting. Dorsal fin short (absent in *Raconda*); anal fin long with atleast 30 finrays. Pelvic fins small (absent in *Opisthopterus*), with 6-7 finrays.

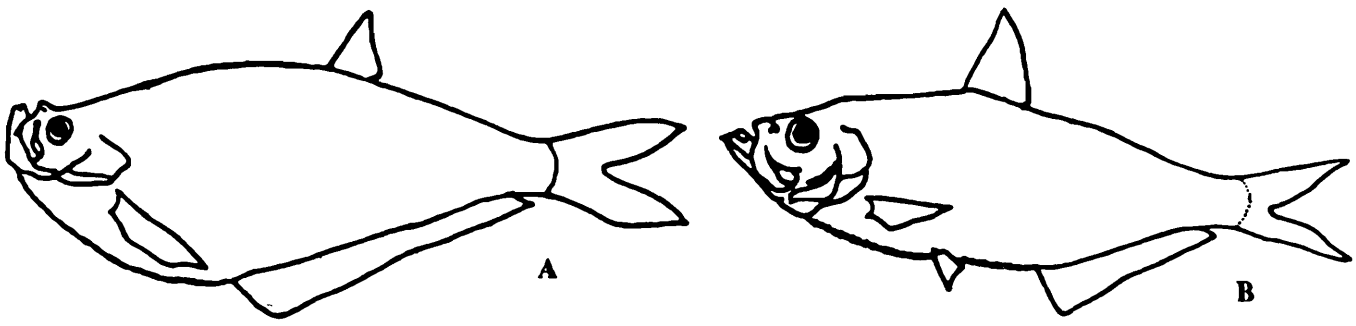

Fig. 14. Family : Pristigasteridae A) *Ophisthopterus tardoore* (Cuvier) B) *Ilisha* sp.

Species occurring in the region

Subfamily : PELLONINAE

Ilisha kampeni (Weber & de Beaufort)
Ilisha megaloptera (Swainson)
Ilisha melastoma (Schneider)
Pellona ditchela Valenciennes

sub-family : PRISTIGASTERINAE

Opisthopterus tardoore (Cuvier)
Raconda russeliana Gray

Key to species

1. (a) Toothed hypo-maxilla present ..... ***Pellona ditchela***
   (b) No toothed hypo-maxilla 2
2. (a) No dorsal fin; no pelivc fins; anal fin very long ..... ***Raconda russeliana***
   (b) Dorsal fin present 3
3. (a) No pelvic fins ..... ***Opisthopterus tardoore***
   (b) Pelvic fin present 4
4. (a) Swim bladder with a single long tube passing back down right side of body above anal fin base 5
   (b) Swim bladder with paired post-coelomic extension ..... ***Ilisha kampeni***
5. (a) Depth of body 2.4 to 2.7 (in standard length) ..... ***Ilisha megaloptera***
   (b) Depth of body 2.8 to 3.3. in standard length ..... ***Ilisha melastoma***

Family : ENGRAULIDAE
(Anchovies)
(Fig. 15A-15B)

Small translucent silvery fishes, occurring often in immense shoals in coastal waters. They have a prominent snout that projects beyond the lower jaw which is small and inconspicuous. The mouth is very large and the maxillary extremely long, extending well beyond eye. The single dorsal fin is almost at the centre of the body; the pelvic fins are abdominal in position, often opposite the dorsal fin; and the caudal fin is deeply notched. The adipose fin and lareral line are absent. Body translucent with a silvery stripe down the side.

The anchovies are small fishes that are always found in schools, never singly. They inhabit coastal waters, including creek and estuaries.

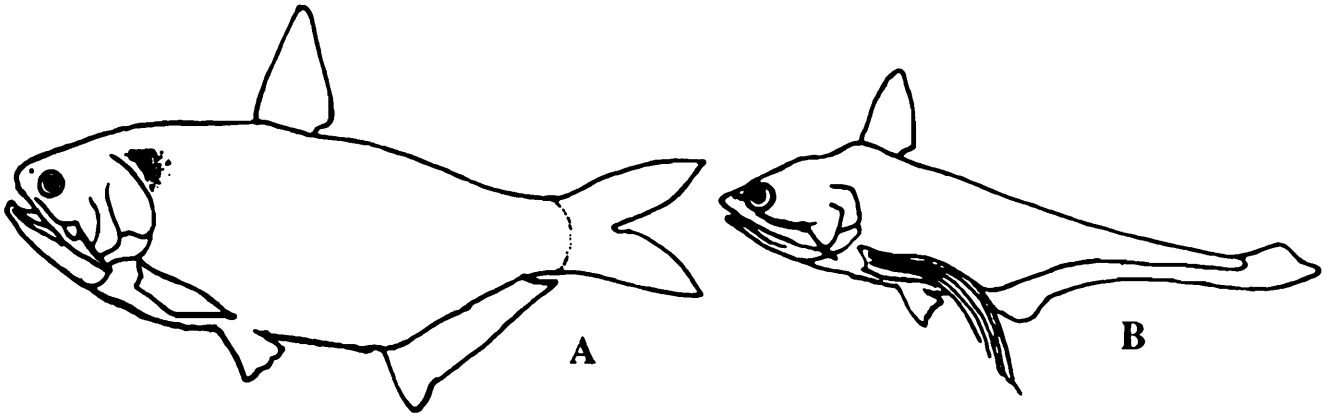

Fig. 15. Family : Engraulidae : A) *Thryssa* sp. B) *Colisa* sp.

Species occurring in the region

Subfamily : COILIINAE

Coilia dussumieri Valenciennes
Coilia ramcarati (Hamilton-Buchanan)
Coilia reynaldi Valenciennes
Setipinna phasa (Hamilton-Buchanan)
Setipinna taty (Valenciennes)
Thryssa malabarica (Bloch)
Thryssa purava (Hamilton-Buchanan)
Thryssa hamiltonii (Gray)

Subfamily : ENGRAULINAE

Stolephorus commersonii Lacepede
Stolephorus heterolobus (Ruppell)
Stolephorus indicus (Van Hasselt)

Key to species

1. (a) Body tapering, 'rat-tailed'; caudal fin and anal fins confluent 2
   (b) Body normal; caudal fin bilobed 4
2. (a) Longitudinal three rows of orange/ gold spots (light organs) on flanks of body; free pectoral filaments ..... *Coilia dussumieri*

(b) No pearly sports on flanks of body 3

3. (a) Pelvic finrays 9 or 10 ..... *Coilia ramcarati*

(b) Pelvic fin rays 7 ..... *Coilia reynaldi*

4. (a) Abdominal scutes present only before pelvic fin bases 5

(b) Abdominal scutes present before and behind pelvic fin bases 8

5. (a) Muscular portion of isthmus not reaching to hind border of gill-membrane.. ..... *Stolephorus heterolobus*

(b) Muscular portion of isthmus extending forward to or beyond gill-membrane 6

6. (a) Maxilla tip reaching to anterior border of preopercle ..... *Stolephorus indicus*

(b) Maxilla tip reaching to gill-opening ..... *Stolephorus commersonii*

7. (a) First pectoral finray filamentous 5

(b) First pectoral finray normal, not filamentous 6

8. (a) Anal fin with 48 to 58 rays; pre-pelvic scutes 20 to 29 ..... *Setipinna taty*

(b) Anal fin with 69 to 81 rays; pre-pelvic scutes about 15 ..... *Setipinna phasa*

9. (a) Maxilla long, extending to or beyond pectoral-fin base ..... *Thyrssa purava*

(b) Maxilla short, reaching only to gill-opening or just beyond 11

10. (a) Lower gill rakers on first arch 1 to 15 ..... *Thryssa hamiltony*

(b) Lower gill rakers on first arch 17 to 19 ..... *Thryssa malabarica*

Family : CHIROCENTRIDAE
(Wolf-Herrings)
(Fig. 16)

Chirocentrids are marine costal fishes, widely distributed in the warmer parts of the Indo-pacfic region.They are pelagic inshore predators on small fishes. Anatomically,

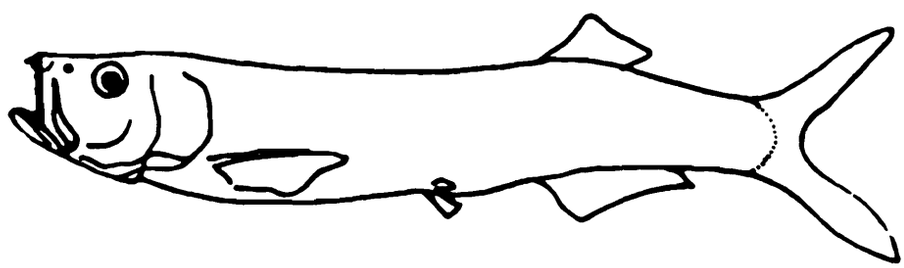

Fig. 16. Family : Chirocentridae

these fishes have one major feature as an adult that sets it apart from all other herrings. This is the presence of spiral valve in the intestine, a development found elsewhere only in the sharks and rays and a few of the primitive bony fishes. They have distinct gill-rakers and also have strong canine teeth for holding their prey. The wolf-herrings look like a herring and the rows of scales down the midline of the belly form a knife like ridge, but no scutes. The dorsal fin is set far back, and the caudal fin is deeply forked. The body elongated and compressed.

Species occurring in the region

Chironcentrus nudus Swainson

Sub-division : EUTELEOSTEI
Superorder : OSTARIOPHYSI
Order : SILURIFORMES
Family : ARIIDAE
(Sea Catfishes)
(Fig.17)

Marine catfishes having a sharp spine at the front of the dorsal fin and another in each of the pectoral fins; usually three pairs of barbles around the mouth; They also have an adipose fin; caudal fin forked. Nostrils close together; some bony plates (granulated bony shield) on head and near dorsal-fin origin.

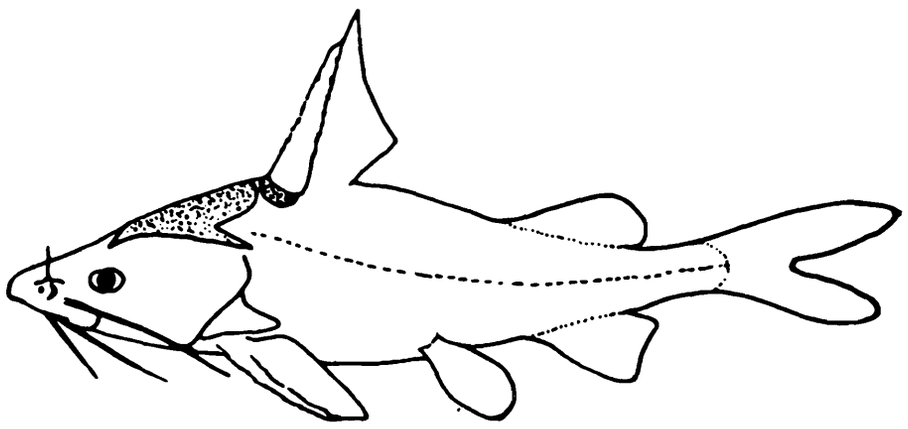

Fig. 17. Family Ariidae

The sea catfishes occur in large quantities in West Bengal. They are mostly marine but occur also in brackish water. The sharp pectoral and dorsal fin spines can inflict painful wounds.

Species occurring in the region

Arius jella Day
Arius sagor (Hamilton-Buchanan)
Arius tenuispinis Day
Arius sona (Hamilton-Buchanan)
Arius thalassinus (Ruppell)

Key to species

1 (a) Teeth on palate in three patches on either side, arranged in a large triangular group ..... *Arius thalassinus*

(b) Teeth on palate in one or two patches on each side 2

2. (a) Teeth on palate in one patch on each side 3

(b) Teeth on palate in two distinct patch on each side 4

3. (a) Premaxillary tooth-band distinctly divided in middle ..... *Arius tenuispinis*

(b) Premaxillary tooth-band continuous ..... *Arius jella*

4. (a) Basal palate before dorsal fin distinctly large, butterfly-shaped ..... *Arius sagor*

(b) Predorsal palate narrow, S,-shaped; outer palatine triangular-shaped ..... *Arius sona*

Family : PLOTOSIDAE
(Eeltail catfish)

Body eell-like, and the anal fin is long confluent with caudal fin which is pointed or bluntly rounded and extends on dorsal surface of body. The spines in the dorsal and pectoral fins are connected to venom glands that release poison into the stab wounds. Four pairs of barbels are present. Compared to other marine cat fishes, these are colourful which is not unusual for venomous animals.

Species occurring in the region

Plotosus canius Hamilton-Buchanan
Plotosus lineatus lineatus (Thunberg)

Key to species

1 (a) Body with 2 or 3 yellow-white stripes; maxillary barbels extending some what behind eyes ..... *Plotosus lineatus*

(b) Body without any stripes; maxillary barbels extending to or beyond opercular margin ..... *Plotosus canius*

SUPERORDER : CYLOSQUAMATA
Order : AULOPIFORMES
Family : SYNODONTIDAE
Subfamilly : HARPADONTINAE
(Bombay Duck)
(Fig. 18)

Head compressed; eyes anteriorly placed and directed forward ; head and body noted except for scales along with the lateral line and part of the posterior half; caudal fin trilobed. Mouth very large. Lateral line extending as a median lobe of caudal fin. Nine pelvic fin rays. Inhabits coastal water and estuaries.

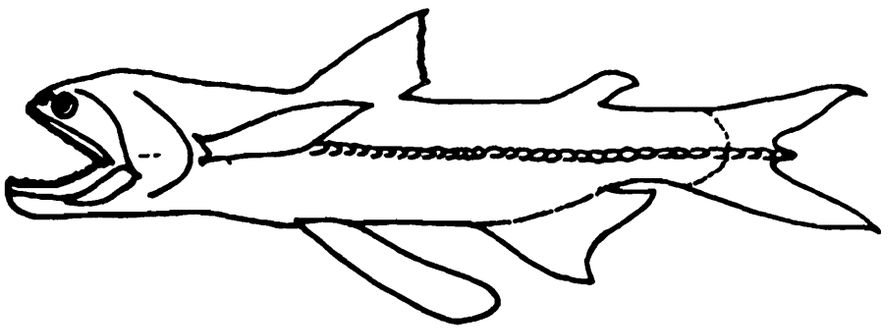

Fig. 18. Family : Harpadontinae

Species occurring in the region

Harpadon nehereus (Hamilton-Buchanan)

Subfamily : SYNODONTINAE
(Lizardfishes)

Body elongate, usally cylindrical and with an adipose fin. Mouth very large and terminal, with rows of numerous small, slender and pointed teeth which are visible even when mouth is closed; teeth also on palate and tongue, those on palate in 1 or 2 bads. Head and body with scales along lateral line not enlarged.

Species occurring in the region

Saurida tumbil (Bloch)

Order : GADIFORMES
Family : BREGMACEROTIDAE
(Codlets)

Body moderatery elongated and with a relatively short head. Two dorsal fins, the

first a single long ray on nape, the second with a long base, niddle rays much shorter; one long anal fin with niddle rays much shorter; pelivc fins inserted under rear part of head, with long, thick rays that extend under far beyond the origin of anal fin, with five rays. Scales relatively large; lateral line adjacent to second dorsal fin.

Species occurring in the region

Bregmaceros macclellandi Thompson

Order : BATRACHOIDIFORMES
Family : BATRACHOIDIDAE
(Toadfishes)

Bottom dwellers, having broad toad like heads and very large mouths equipped with numerous sharp teeth. Lower jaw projecting. Slime covered body taperes to a slim tail.

Species occurring in the region

Batrichthys grunniens (Linnaeus)

Order : CYPRINODONTIFORMES
Suborder : EXOCOETOIDEI
Superfamily : EXOCOETOIDEA
Family : EXCOETIDAE
(Flyingfishes)
(Fig. 19)

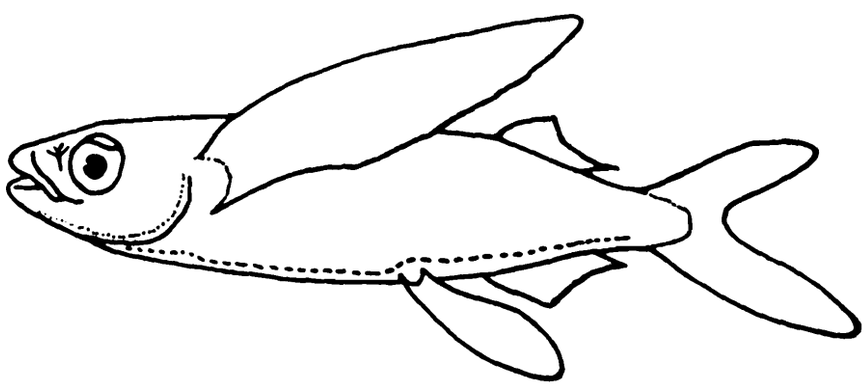

Fig. 19. Family : Excoètidae

Elongate fishes with pectoral fins strikingly long to form wings used for gliding over the surface of the sea. Scales large, cycloid.

Species occurring in the region

Exocoetus volitans Linnaeus

Family : HEMIRAMPHIDAE
(Halfbeaks)
(Fig. 20)

The half beaks are mainly marine, but some inhabit brackish as well as freshwater. They live on the surface and are protectively coloured for this mode of life by being green or blue on the back, and silvery white on the flanks and ventrally. The body is elongated, rounded, and flattened laterally only in the tail region. The single dorsal and anal fins are located to the rear and directly opposite each other. They have a small mouth-opening with an elongate lower jaw; the upper jaws is short and triangular. The lateral line is low on body.

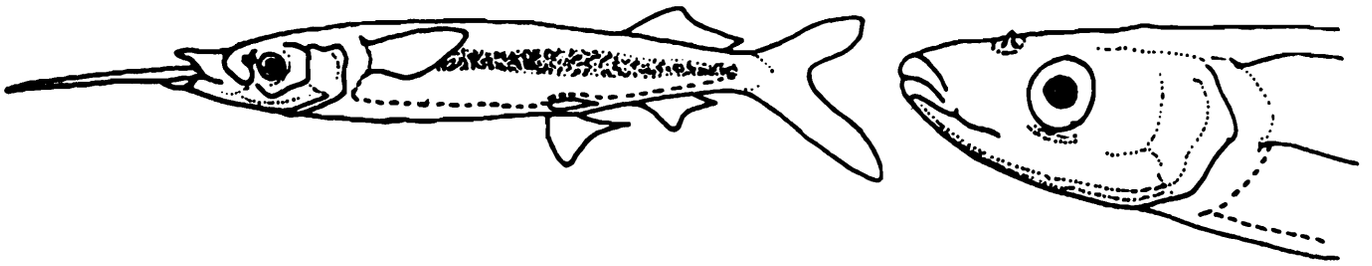

Fig. 20. Family : Hemiramphidae

Species occurring in the region

Hemiramphus far (Forsakal)
Hyporhamphus limbatus (Valenciennes)
Rhynchorhamphus georgii (Valenciennes)

Key to species

1. (a) Four to 6 elongated blotches on sides of body, upper jaw scaleless ..... *Hemiramphus far.*
   (b) No blotches on sides of body; upper jaw scaly 2
2. (a) Upper jaw flat or slightly arched ..... *Rhynchorhamphus georgii*
   (b) Upper Jaw arched, dome-shaped ..... *Hyporhamphus limbatus.*

Family : BELONIDAE
(Needlefishes)
(Fig. 21)

Elongate fishes. Mouth opening large; both upper and lower jaws elongate with numerous needlelike teeth, Scales small. They occur in marine as well as brackish and fresh waters. These fishes live at the surface and are protectively coloured for this mode of life by being green or blue on the back and silvery white on the lower sides and belly.

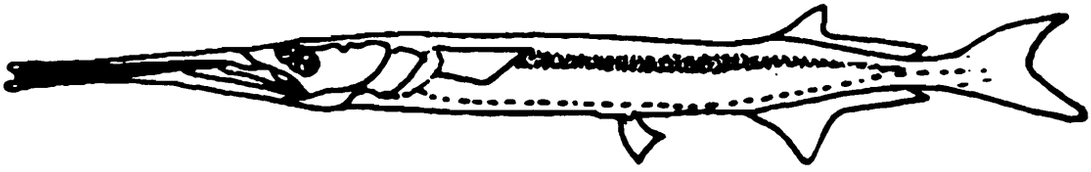

Fig. 21. Family : Belonidae

Species occurring in the region

Strongylura leiura (Bleeker)
Strongylura strongylura (Van Hasselt)
Tylosurus crocodilus crocodilus (Peron & Le Sueur)

Key to species

1. (a) Caudal peduncle with small black keel; caudal fin forked ..... *Tylosurus crocodilus*
   (b) Caudal peduncle without lateral keel; caudal fin rounded or emarginate 2
2. (a) Caudal fin rounded, a prominent round black spot near base of caudal fin.... *Strongylura strongylura.*
   (b) Caudal fin emarginate; no black spot near base of caudal fin ..... *Strongylura leiura.*

Order : SYNGNATHIFORMES
Family : SYNGNATHIDAE
(Pipefishes, Seahorses)

Body elongate and encased in series of body rings. They have long, tubular snouts. Single dorsal fin present, anal fin very small and usually with 2 to 6 rays. No pelvic fins; caudal fin absent in some (in seahorses) or greatly reduced; tail (caudal peduncle)

may be prehensile and employed for holding on to objects when caudal fin is absent. The gill openings are very small; gills tufted and lobe-like.

Syngnathids are usually confined to shallow water. Seahorses and pipefishes are identical in anatomical features except for body shape. In seahorses the head is bent down, joining the body almost at right angles, whereas pipefishes are straight. No species of seahorse has been reported from West Bengal (Talwar 1994 : 280).

Species occurring in the region

Hippichthys specifer (Ruppell)
Ichthyocampus carce (Hamilton-Buchanan)

Key to species

1. (a) Lateral tail ridge absent ..... *Ichthyocampus carce.*
   (b) Lateral tail ridge present ..... *Hippichthys specifer.*

Order : SCORPAENIFORMES
Suborder : SCORPAENOIDEA
Family : SCORPAENIDAE
(Scorpionfishes)
(Fig. 22)

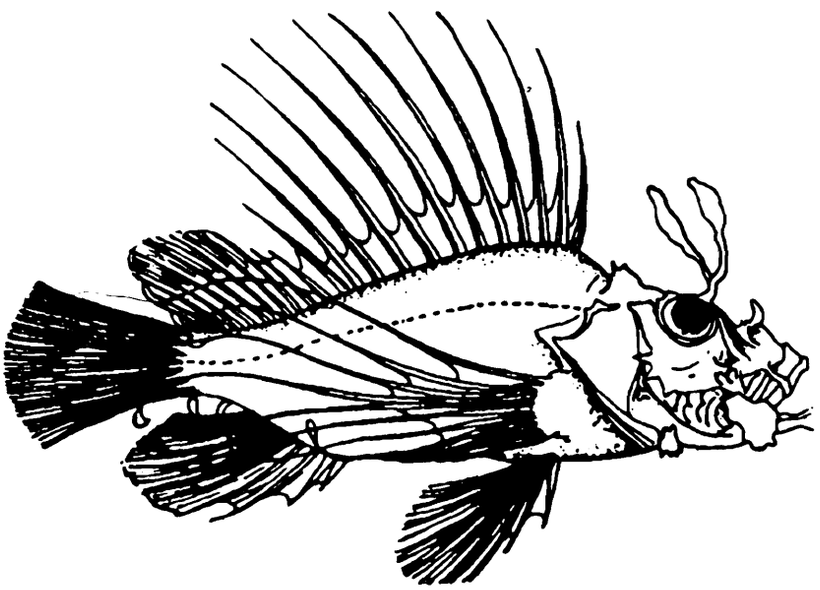

Fig. 22. Family : Scorpaenidae

Body compressed, head usually with ridges and spines. Dorsal fin usually single, pectroal fin well developed. Scales usually ectenoid.

Species occurring in the region

Pterois russellii Bennett
Pterois volitans (Linnaeus)

Key to species

1 (a) Pectoral fin with 13 rays ..... *Pterois russellii*

(b) Pectoral fin with 14 rays ..... *Pterois volitans*

Remarks : Talukdar et al. (1996 : 37) reported *Pterois volitans* from Digha coast.

Family : SYNANCEIIDAE
Subfamily : SYNANCENAE

Body scaleless (except for burried scales along lateral line and other parts of the body), usually covered with skin glands; head large, venom glands present, near base of dorsal fin spines.

Species occurring in the region

Trachicephalus uranoscopus (Bloch & Schneider)

Suborder : PLATYCEPHALOIDEI
Family : PLATYCEPHALIDAE
(Spiny flatheads)
(Fig. 23)

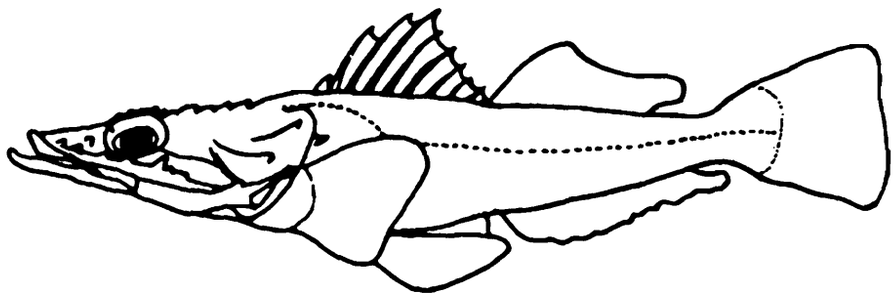

Fig. 23. Family : Platycephalidae

Benthic fishes found in mud or sand bottoms of shelf areas at depths of about 75m. or less. The head is extremely depressed, usually with ridges and spines; mouth large the lower jaw projects forward. There are two dorsal fins; spinous dorsal is preceded by a single isolated spine, usually with nine spines. Body elongate and cylindrical. Ctenoid scales cover body.

Species occurring in the region

Platycephalus indicus (Linnaeus)

Order : PERCIFORMES
Suborder : PERCOIDEI
Family : AMBASSIDAE
(Perchlets)

Body strongly compressed, oblong or oblong avate Mouth slightly protractile; teeth small, in bands on jaws and on palate. Scales moderate to large, cycloid rather deciduous.

Species occurring in the region

Ambassis nalua (Hamilton-Buchanan)

Family : CENTROPOMIDAE
(Sea Perches)
(Fig. 24)

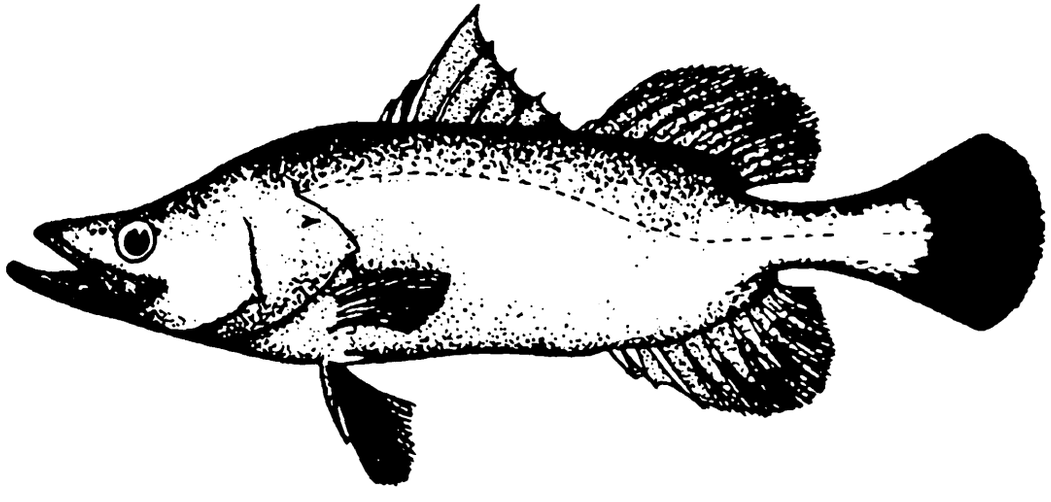

Fig. 24. Family : centropomidae, *Lates calcarifer* (Bloch)

Body elongated, or oblong, compressed, the dorsal profile concave at nape. Mouth large, with the lower jaw longer than upper; teeth small, and in villi-form bands on jaws, and on vomer and palatines. Opercle with a spine. Dorsal fin with a very deep notch almost dividing spinous from soft part of fin; anal fin with 3 spines and 7 or 8 soft rays; caudal fin rounded. Scales large, ctenoid; lateral line extending on to tail.

Species occurring in the region

Lates calcarifer (Bloch)

Family : SERRANIDAE
(Groupers)
(Fig. 25)

Body basslike with a strongly spined dorsal fin and a soft-rayed second dorsal fin. Opercle with three spines. Scales usually ctenoid. Maxilla exposed.

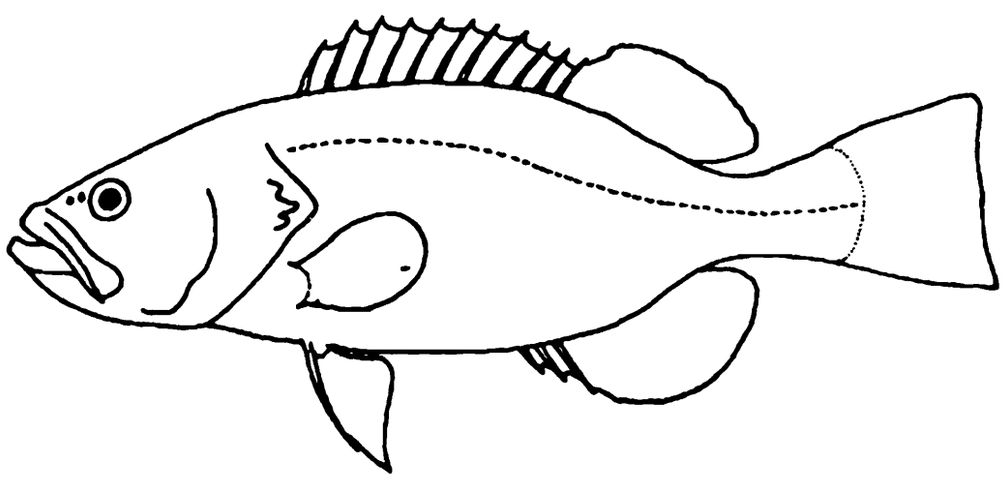

Fig. 25. Family : Serranidae

Species occurring in the region

Epinephelus tauvina (Forsskal)

Family : TERAPONIDAE
(Tigerperches)
(Fig. 26)

This is an Indo-Pacific family of small to moderate sized fishes found in marine and brackish water. A few species are usually conspicuously striped, with the stripes extending onto the caudal fin. The body is oblong to oblong-ovate, somewhat compressed. Opercle with two spines, the lower one larger and stronger. Dorsal fin single, with a small notch, anal fin with 3 strong spines and 7 to 12 soft rays; pelvic fins inserted behind base of pectoral fins; caudal fin usually emarginate. Lateral line single and complete. Scales adherent, finaly ctenoid.

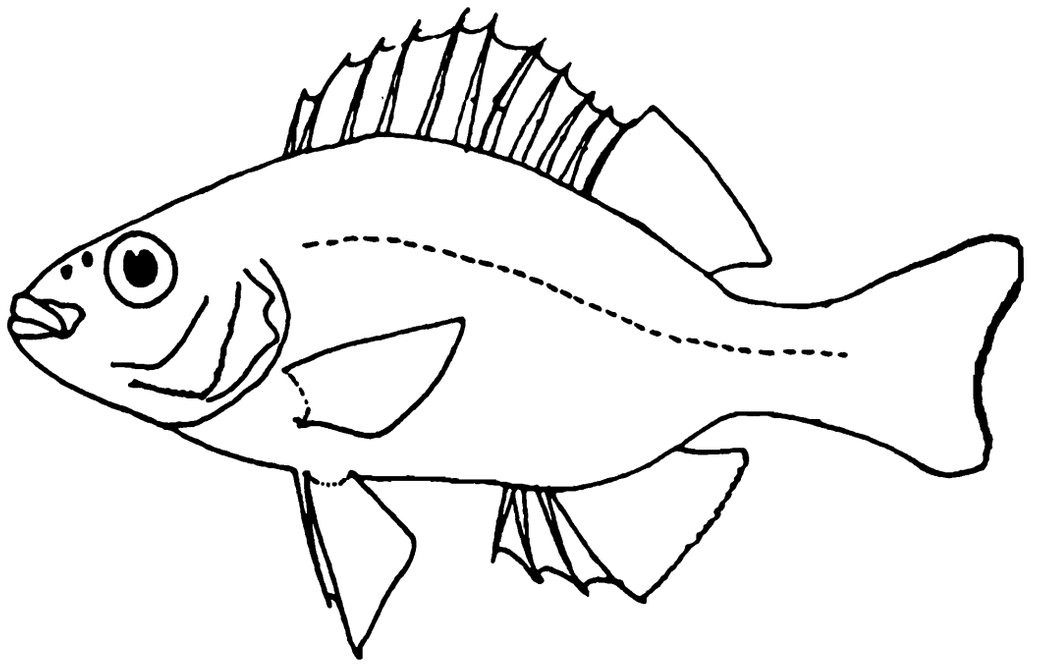

Fig. 26. Family : Teraponidae

Species occurring in the region

Terapon jarbua (Forsskal)
Terapon puta (Cuvier)
Terapon theraps (Cuiver)

Key to species

1. (a) Lateral line with 46 to 56 pored scales to hypural joint; 6 to 8 rows scales above lateral line to base of dorsal-fin sheath ..... *Terapon theraps*
   (b) Lateral line with 70 or more pored scales to hypural joint; 10 to 17 rows of scales above lateral line to base of dorsal-fin sheath 2
2. (a) Four narrow, straight longitudinal dark stripes along side of body ; gill rakers 18 to 24 on lower limb of first arch .....*Terapon puta*.....
   (b) Three downwardly curved longitudinal stripes along side of body; 12 to 15 gill rakers on lower of first arch ..... *Terapon jarbua*

Family : PRIACANTHIDAE
(Bigeyes)

Eyes very large. Body bright red coloured with small ctenoid scales, Inner ray of the pelvic fins connected by a membrane.

Species occurring in the region

Priacanthus tayenus Richardson

Family : APOGONIDAE
(Cardinal fishes)

Two seperate dorsal fins and two anal fin spines are the identifying features of the family. These fishes usually occur in shallow water.

Species occurring in the region

Apogon lateralis Valenciennes.

Family : SILLAGINIDAE
(Whitings)
(Fig. 27)

A small family of small fishes of sandy shores and estuarine waters. Body elongated; mouth small; two dorsal fin (little or no interspace), first with 9 to 12 spines and second with 16 to 26 soft rays; anal fin with two spines and 15 to 27 sort. rays. These are good fishes, the flesh is of excellent flavour.

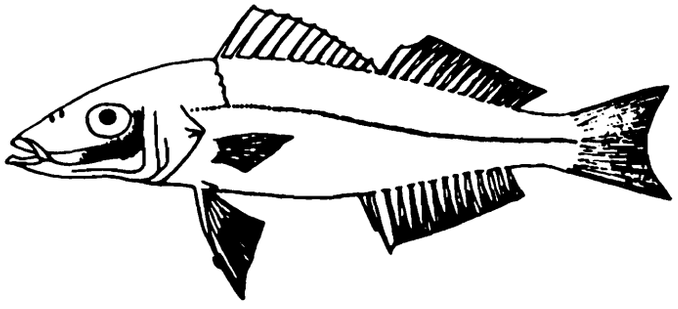

Fig. 27. Family : Sillaginidae

Species occurring in the region

Sillaginopsis panijus (Hamilton-Buchanan)
Sillago sihama (Forsskal)

Key to species

1. (a) Snout and head greatly depressed; second dorsal spine very elongate; eyes very small ..... *Sillaginopsis panijus.*

(b) Snout and head not depressed; second dorsal spine not elongate; eyesnormal ..... *Sillago sihama.*

Family : LACTARIIDAE
(False trevallies)
(Fig. 28)

Body oblong and strongly compressed. Mouth Large, with prominent lower jaw; each jaw with two small teeth at fornt. Two dorsal fins; soft rayed portion of dorsal and anal fins covered with scales (all scales easily shed); anal fin spines three.

A small family with a monotypic genus.

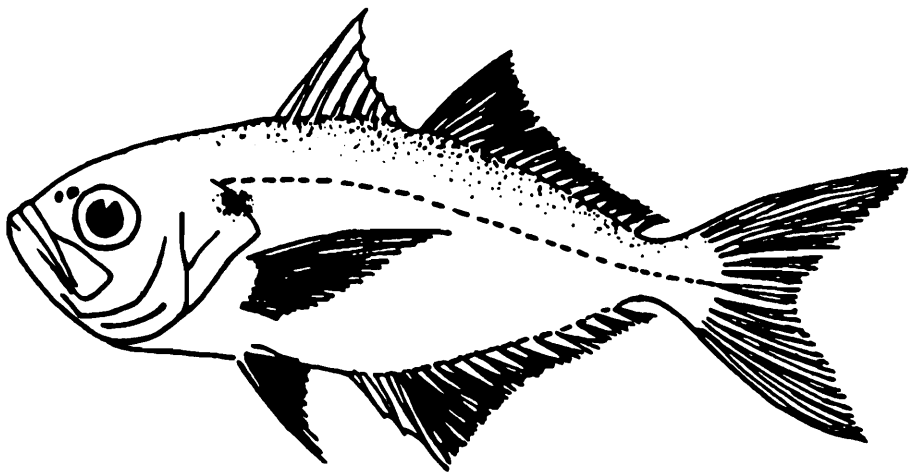

Fig. 28. Family : Lactariidae

Species occurring in the region

Lactarius lactarius (Schneider)

Family : ECHENEIDIDAE
(Remoras)
(Fig. 29)

These slim fishes are easily recognished by the flat sucking disc on the top of their head. Developed from the first dorsal fin, the cephalic disc consists of a series of ridges and spaces that create a vacuum between the remora and the surface to which it attaches-usually sharks and other fishes. The skull is wide, depressed to support the disc, and the body.

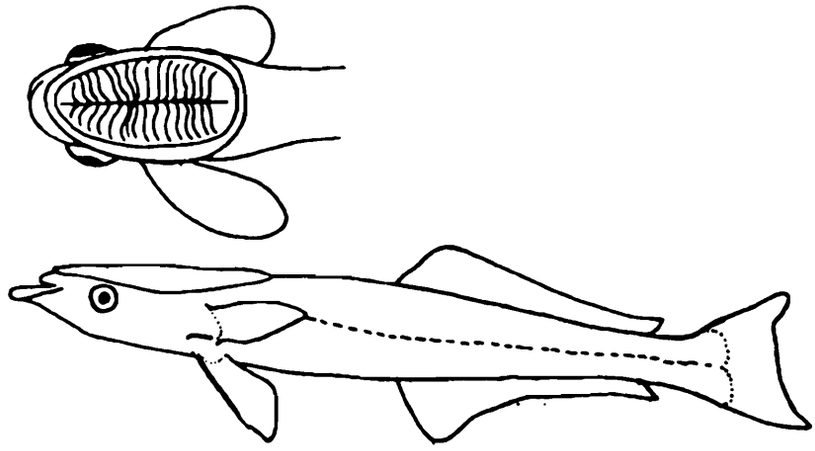

Fig. 29. Family : Echeneidae

Species occurring in the region

Echeneis naucrates Linnaeus

Family : CARANGIDAE
(Jacks, Scads)
(Fig. 30)

This important family comprises fishes which vary greatly in shape and sizes, but most of them one thing in common-they move with great speed. Many have extermely small scales, but at the end of the lateral line these are enlarged to from a keel. There are three anal spines with the first two detached from the rest of the fin. Caudal fin widely forked. Body generally compressed (but ranging from deep to fusiform); only small cycloid scales in most species.

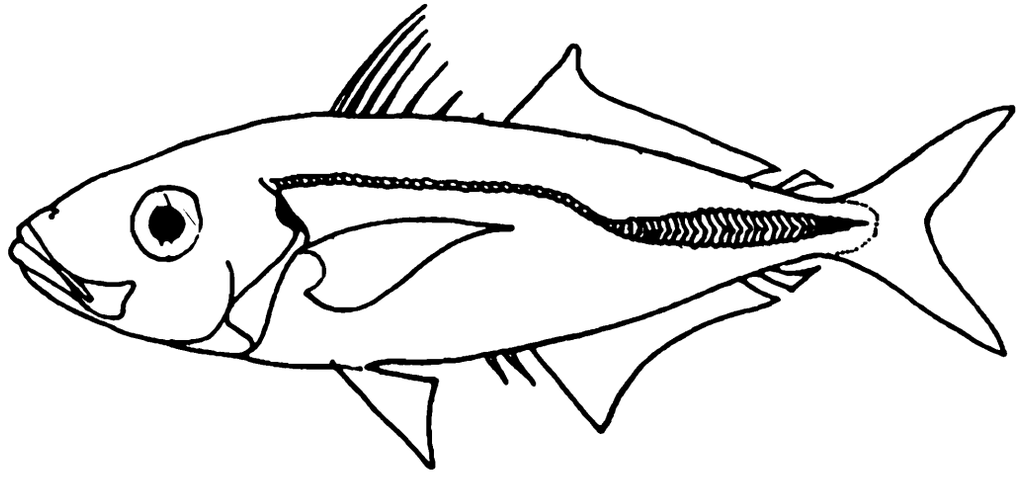

Fig. 30. Family : Carangidae

Species occurring in the region

Atropus atropus (Schneider)
Carangoides malabaricus (Bloch & Schneider)
Caranx carangus (Bloch)
Caranx sexfasciatus Quoy & Gimard
Megalaspis cordyla (Linnaeus)

Key to species

1. (a) One or more finlets behind second dorsal and anal fins ..... *Megalaspis cordyla.*
   (b) No finlet in dorsal nor anal fins 2
2. (a) A groove along belly ..... *Atropus atropus.*
   (b) No groove along belly 3
3. (a) Breast completely scaled ..... *Caranx sexfasciatus*
   (b) Breast naked ventrally with a small patch of scales immediately in fornt of pelvic fin 4
4. (a) Lower surface of breast with a small patch of scales ..... *Caranx canangus*
   (b) Naked area of breast exending anteriorily above pectoral-fin base nearly to orgin of lateral line as a triangular area bordering pecorals -fin base and operculum ..... *Carangoides malabaricus*

Family : CORYPHAENIDAE
(Dolphins)

Streamlined body, tapering sharply from head to tail, laterally compressed. Anal fin long, stretching over half the length of the body. Generally the dorsal fin and back are a deep oceanic blue, grading into green on the upper sides and yellow from the lateral line to the silvery belly. The large caudal fin, pectoral and pelvic fins yellow.

Species occurring in the region

Coryphaena hippurus Linnaeus

Remarks : *Coryphaena hippurus* is a pelagic species which inhabits open waters, sometimes approaching the coast, and is rather rare in West Bengal (Talwar *et al.*;1994: 289).

Family : PARASTROMATEIDAE
(Black Pomfert)

Body deep and compreesd. Dorsal fin with 4 or 5 short spines (embedded and not apparent in adults) followed by one spine and 42 to 44 soft rays ; anal fin with two rudimentary spine (embedded and not apparent in adults) followed by 1 spine and 35 to 39 soft rays. No pelvic fins in adult. A few enlarged scutes at end of lateral line in the form of keel. Scales small, cycloid, earily shed. Consists of a single widespread Indopacific species.

Species occurring in the region

Parastromateus niger (Bloch)

Family : MENIDAE
(Moonfish)
(Fig. 31)

Body extermely compressed, discoid, with sharp breast. Upper jaw protrusible; bands of villiform teeth in jaws. Anal fin very long and low, the rays very short and overgrown with skin.Several small round black spots on dorsal part of body.

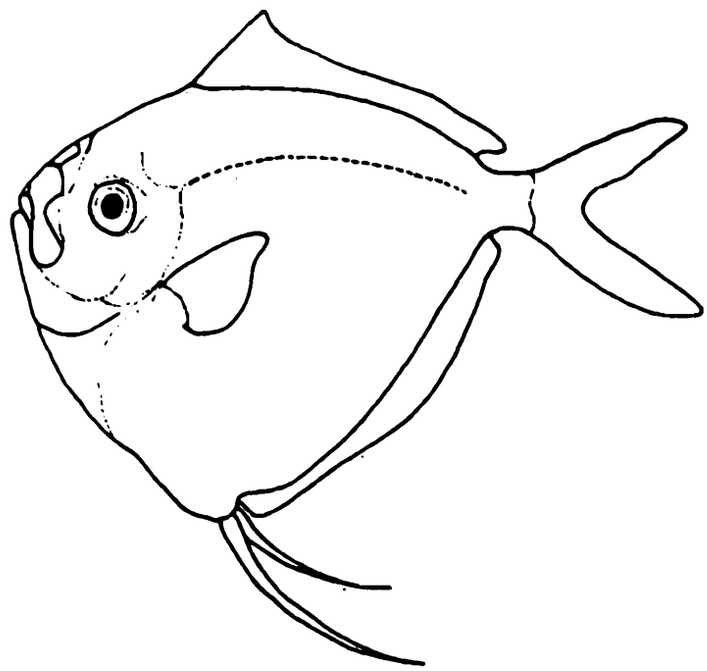

Fig. 31. Family : Meneidae

Species occurring in the region

Mene maculata (Bloch & Schneider)

Family : LEIOGNATHIDAE
(Slipmouths)
(Fig. 32)

These are small Indo-Pacific fishes, chiefly marine in habitat but sometimes living in brackish water. They have deep, laterally compressed bodies and strongly protruible mouths which form tubes when extended ; Both the dorsal and anal fins have spines along their bases. Another peculiarity slipmouths have luminous organs round the oeso phagus, the light produced by bacteria. They give off a 'soapy' mucous when handled.

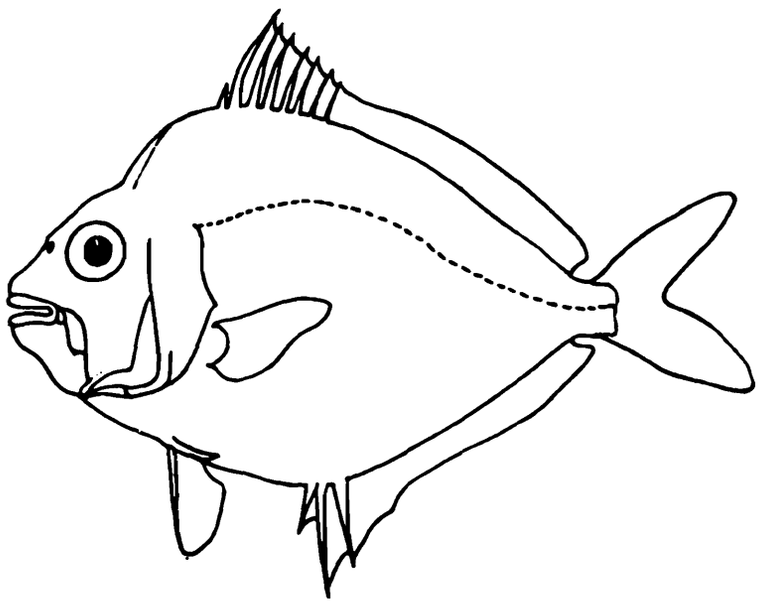

Fig. 32. Family : Leiognathidae

Species occurring in the region

Leiognathus equulus (forsskal)

Family : LUTJANIDAE
(Snappers)
(Fig. 33)

The snappers are shallow - water inshore species. The mouth is large and the eyes are set high on the head. The lateral line is distinct and the scales are large. Typically,

they have sharp teeth and a "snapper" look, which is due to the characteristically flattened top of the snout, giving the fish a shovel headed appearance. Further, they have pointed pectoral fins, ten or eleven spines in the first dorsal fine which is joined to the second dorsal fin, and three spines in the anal fin.

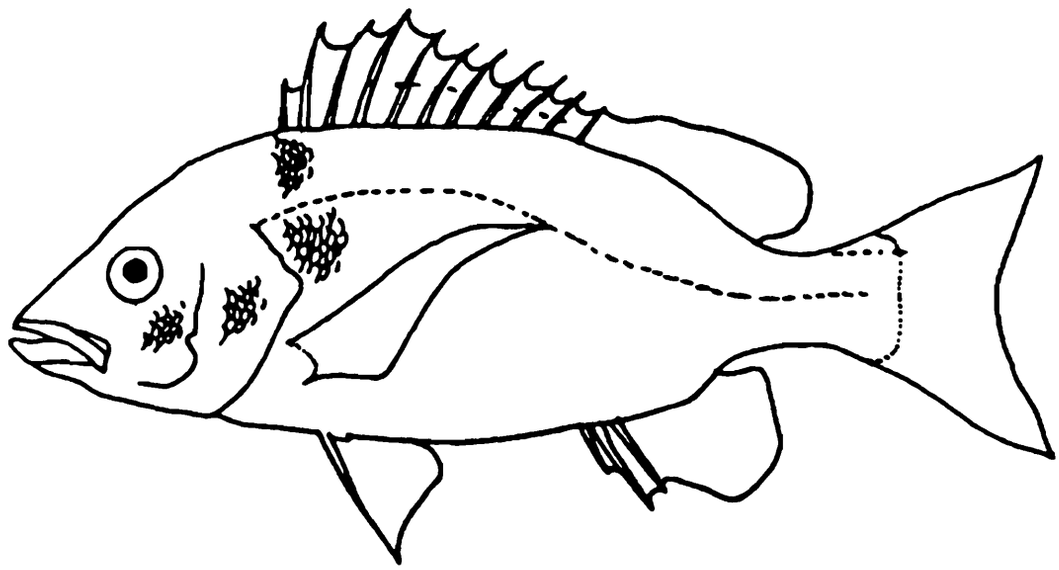

Fig. 33. Family : Lutjanidae

Species occurring in the region

Lutjanus argentimaculatus (Forsskal)
Lutjanus bengalensis (Bloch)
Lutjanus johnii (Bloch)
Lutjanus russelli (Bleeker)

Key to Species

1. (a) Ground colour pale (mainly yellow in life) with a series of four longitudinal blue stripes on side ..... *Latjanus bengalensis*
   (b) Colour not as above 2
2. (a) Scale-rows above lateral line entirely horizontal or some scale rising obliquely from middle part of dorsal 3
   (b) Scale-rows above lateral line oblique ..... *Lutjanus russelli*
3. (a) A large black spot on upper back present ..... *Lutjanus johnii*
   (b) No black spot on upper back ..... *Lutjanus argentimaculatus*

Family : LOBOTIDAE
(Tripletails)

Second dorsal and anal fins extend backward along the caudal peduncle so that the fish appear to have a three lobed tail. Colour is usually brownish green with dark mottlings along the side. Immediately behind eyes, the body slopes upward sharply.

Species occurring in the region

Datnioides quadrifasciatus (Sebastianov)

Family : GERREIDAE
(Mojarras)
(Fig. 34)

Mojarras are small, silvery fishes that have an extremely protrusible mouth. The upper jaw fits into a clearly discernible slot when the mouth is not extended. The body is greatly compressed and the caudal fin forked. The spinous dorsal fin is high in front, sloping into the second, or softrayed, dorsal fin.

Mojarras are most common along sandy shores, some moving into brackish waters.

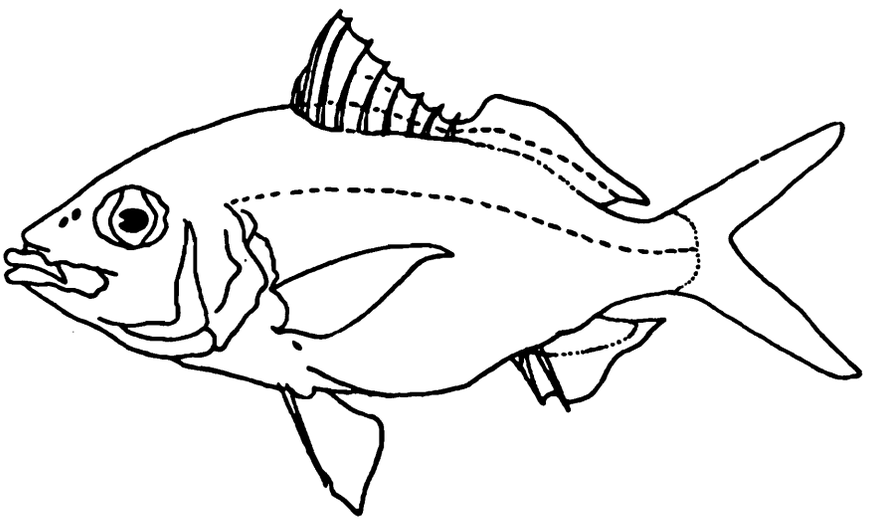

Fig. 34. Family : Gerreidae

Species occurring in the region

Gerres (Gerres) oyena (Forsskal)
Gerres (Gerres) poieti Cuvier
Gerreomorpha setifer (Hamilton - Buchanan)

Key to species

1. (a) Dorsal fin spines 10 ..... *Gerreomorpha setifer*
   (b) Dorsal fin spines 9 2
2. a) Second dorsal spine greatly elongated, longer than head .... *Gerres filamentosus*
   b) Second dorsal spine not forming a long filament, usually much shorter than head 3
3. a) Pectoral fins long, extending beyond anal fin origin ..... *Gerres oyena*
   b) Pectoral fins shorter, not extending to anal-fin origin ..... *Gerres poieti*

Family : HAEMULIDAE
(Grunts)
(Fig. 35)

The grunts look much like the snappers, but they differ from them primarily in the dentition, having very feeble jaw teeth and potent pharyngeal teeth. The dorsal fin is continuous, with 10 strong spines and 8-9 soft says; anal-fin spines three, the second spine often strong. Two pores and median pit on chin.

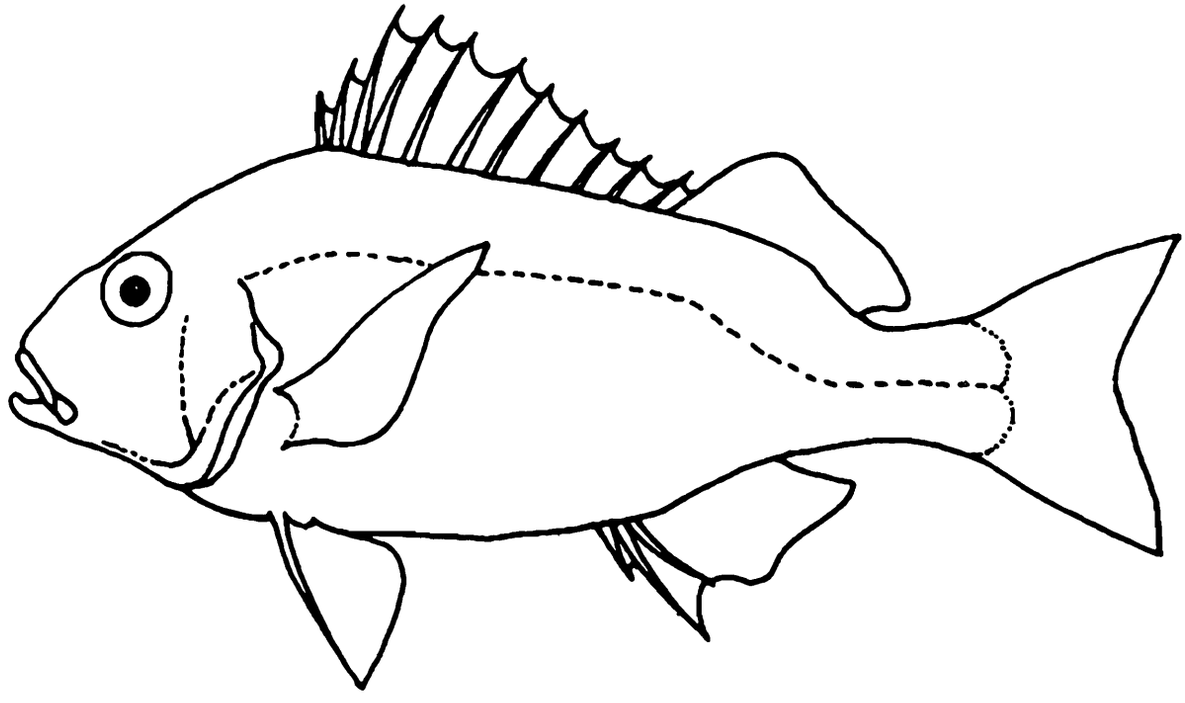

Fig. 35. Family : Haemulidae

Species occurring in the region

Pomadasys maculatum (Bloch)

Family : SPARIDAE
(Sea breams)
(Fig. 36)

Deep bodied fishes usually with strong canine or incisor teeth in the jaws. Eyes are placed high on the head just behind hind margin of the mouth.

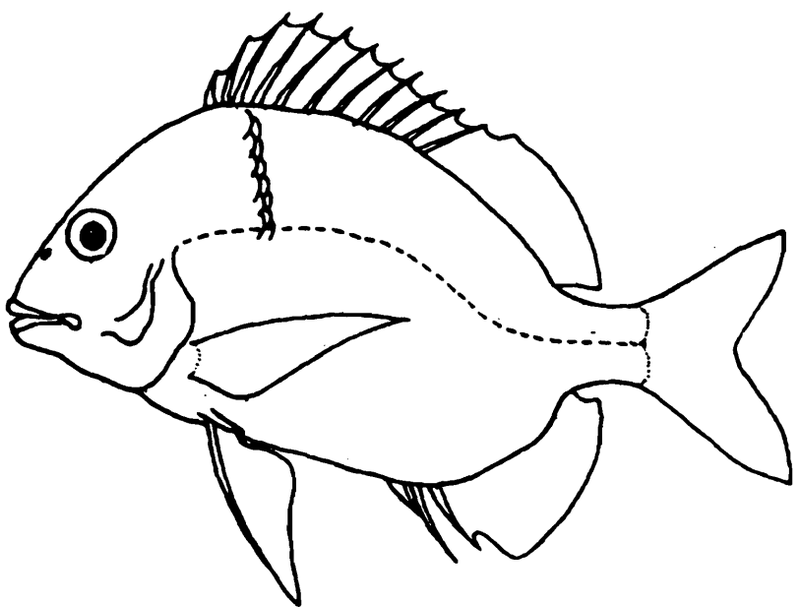

Fig. 36. Family : sparidae

Species occurring in the region

Acanthopagrus berda (Forsskal)
Acanthopagrus latus (Houttuyn)
Rhabdosargus sarba (Forsskal)

Key to species

1. (a) Second anal spine much longer than third anal spine 2
   (b) Second anal spine not longer than third anal spine ..... *Rhabdosargus sarba*
2. (a) Anal and pelvic fins blackish ..... *Acanthopagrus berda*
   (b) Anal and pelvic fins yellow ..... *Acanthopagrus latus*

Family : NEMIPTERIDAE
(Thread fin breams)
(Fig. 37)

The nemipterids are snapper like marine fishes that can often be recognised at a glance by the elongated rays of the upper lobe of the caudal fin and by similarly elongate rays of the pelvic fins. The dorsal fin is continuous, with 10 spines and 9 soft rays, anal fin with 3 spines and 7 soft rays. There are no teeth on the palate.

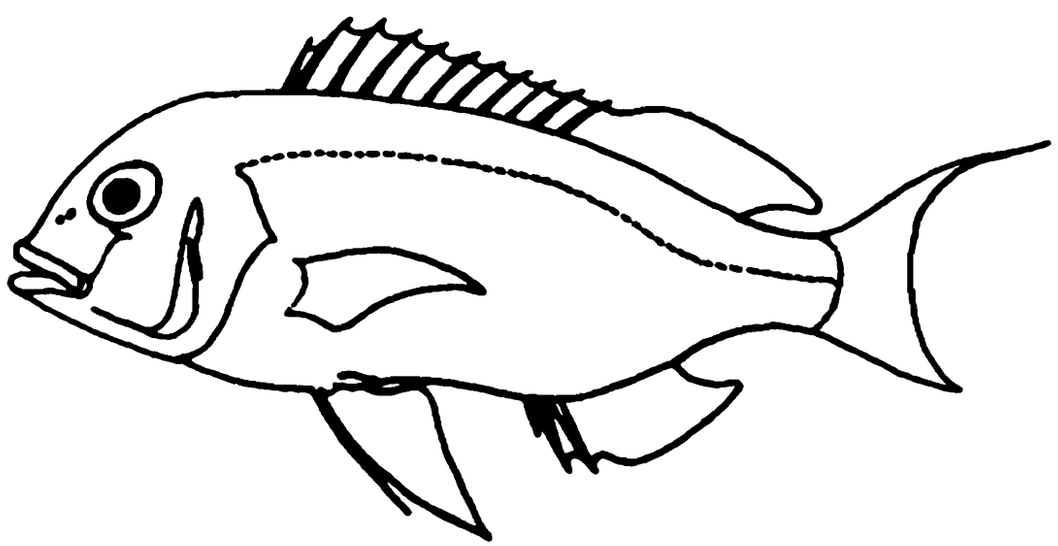

Fig. 37. Nemipteridae

Species occurring in the region

Nemipterus bipunctatus (Ehrenberg)
Nemipterus japonicus (Bloch)
Nemipterus tolu (Valenciennes)

Key to Species

1. (a) Upper lobe of caudal fin prolonged into a filament ..... *Nemipterus japonicus*
   (b) Upper lobe of caudal fin normal, with no filamentous prolongation 2
2. (a) Dorsal-fin spines much longer than its soft rays, very slender ..... *Nemipterus tolu*
   (b) Dorsal-fin spines more or less subequal with its soft rays ..... *Nemipterus bipunctatus.*

Family : SCIAENIDAE
(Croakers)
(Fig. 38A-38B)

Croakers are known for the noises they make. Typically, these fishes have a muscle close to the gasbladder, and when the muscle is vibrated, the bladder acts as a resonator and amplifies the sound. Almost all are inshore fishes usually found over sandy bottoms; some species move readily into brackish and fresh water. The croakers have a long dorsal fin, with deep notch separating spinous from soft portion; anal fin is short, with two spines; a rounded snout is typical of many of them and some have small barbels under the chin. The lateral line is exceptionally long, extending upto the caudal fin. The majority are considered marketable food fishes.

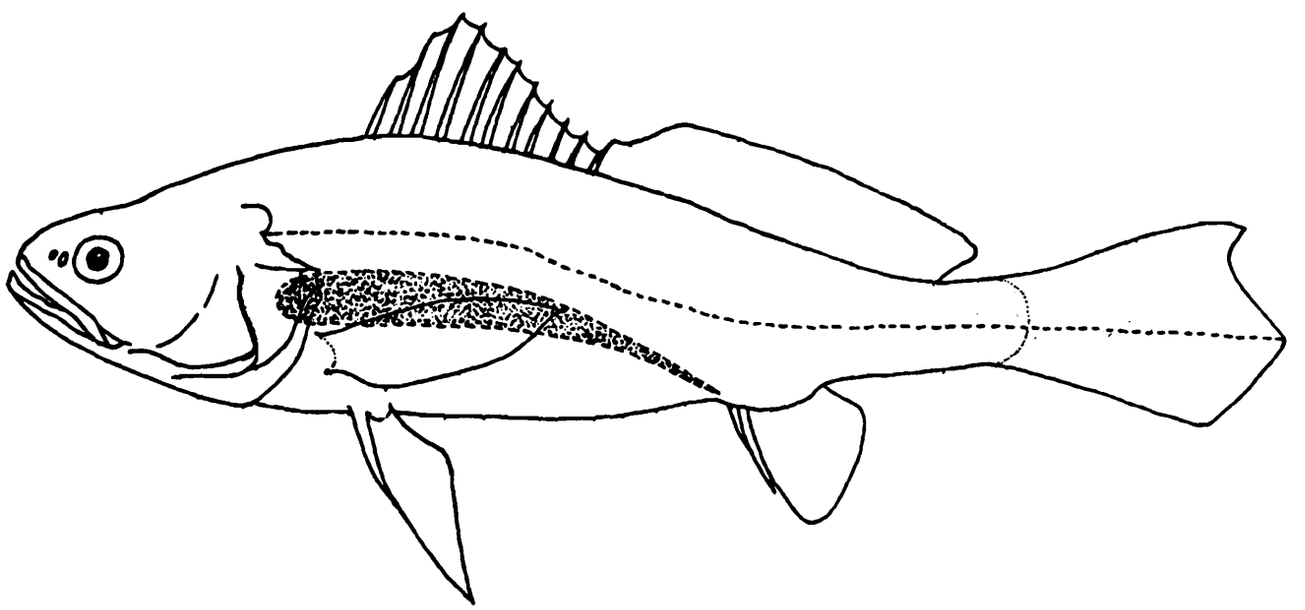

Fig. 38A. Family : Sciaenidae *Johnius* sp.

Species occurring in the region

Johnius (Johnius) belangerii (Cuvier)
Johnius (Johnieops) sina (Cuvier)
Johnious (Johnieops) ***vogleri*** (Bleeker)
Macrospinosa cuja (Hamilton-Buchanan)
Otolithoides biauritus (Cantor)
Pama pama (Hamilton - Buchanan)
Panna microdon (Bleeker)
Protonibea diacanthus (Lacepede)
Pterotolithus maculatus (Kuhl & van Hasselt)

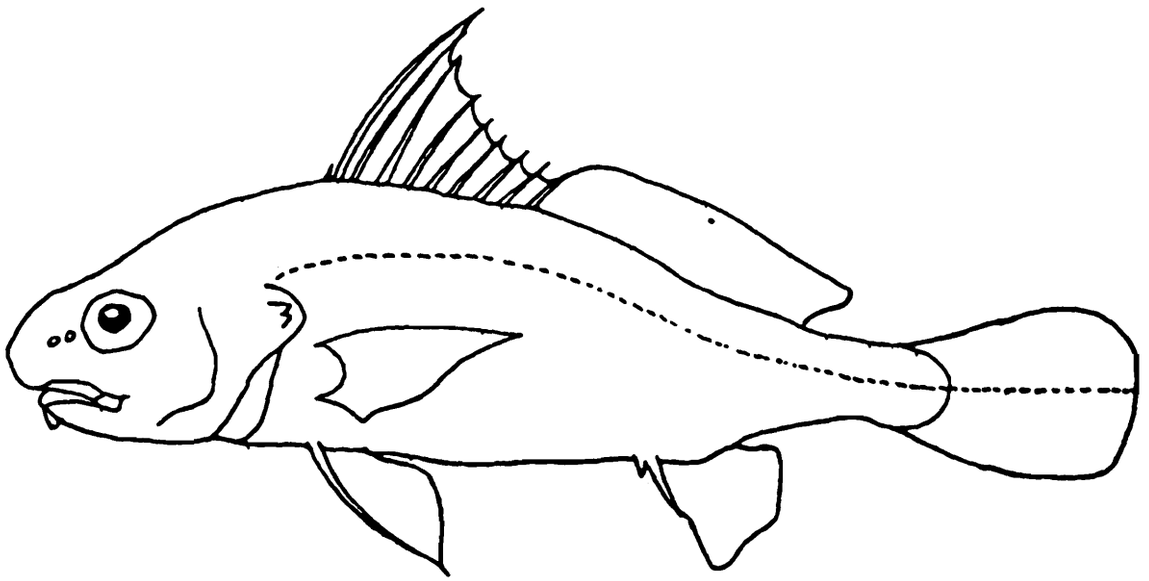

Fig. 38B. Family : Sciaenidae

Key to species

1. (a) Gasbladder with one or two branched appendages 2
   (b) Gasbladder with more than two pairs of arborescent (branched) appendages. 5
2. (a) Gasbladder appendages wholly directed forward from anterior end of bladder ..... *Macrospinosa cuja*
   (b) Gasbladder appendages with at least the main part lying parallel to bladder. 3
3. (a) Gasbladder without diverticulum on each side, attached near posterior end; caudal fin pointed 4
   (b) Gasbladder with diverticulum on each side arising from anterior end and immediately dividing into a cephalic and an abdominal branch .... *Panna microdon*
4. (a) Soft doral fin with 27 to 32 rays ..... *Otolithoides biauritus*
   (b) Soft dorsal fin with 40 to 45 rays ..... *Pama pama*
5. (a) Gasbladder carrot shaped 6
   (b) Gasbladder hammmer shaped 7
6. (a) Anterior pair of pores on front of chin separated by symphysis .... Pterotolithus maculatus
   (b) Anterior pair of pores on chin close together behind symphysis or united by a groove ..... *Protonibea diacanthus.*

7. (a) Teeth in lower jaw more or less enlarged 8
   (b) Teeth in lower jaw in a band, uniform in size ..... *Johnius belangerii*
8. (a) Gill rakers 13 to 15 on lower arm of first arch ..... *Johnius vogleri*
   (b) Gill raker 9 to 12 on lower arm of first arch ..... *Johnius sina*

Family : MULLIDAE
(Goatfishes)
(Fig. 39)

The goat fish in rather elongate in shape, and has widely seperate spiny - rayed and soft rayed dorsal fins; and a forked caudal fin, and fin with one or two small spines. Two long, tactile barbels under the chin enable the goatfishes to locate small items of food.

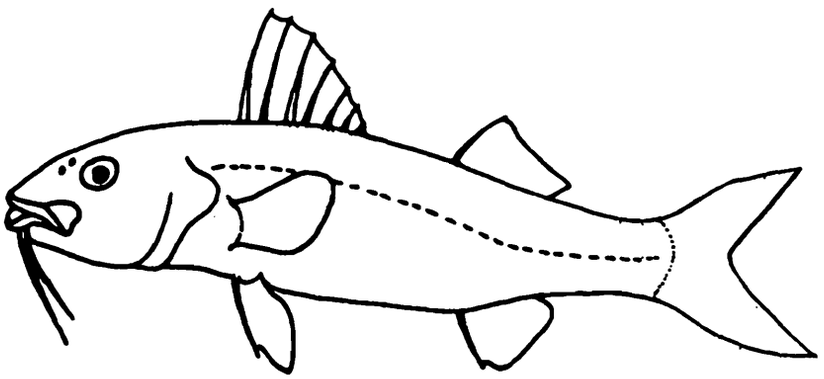

Fig. 39. Family : Mullidae

Species occurring in the region

Parupeneus indicus (Shaw)
Upeneus sulphureus Cuvier
Upeneus vittatus (Forsskal)

Key to species

1. (a) No teeth on roof of mouth; a large dark blotch at mid point of caudal penduncle ..... *Parupeneus indicus.*
   (b) Teeth on roof of mouth 2
2. (a) Caudal fin with black crossbars on both lobes ..... *Upeneus vittatus*
   (b) No crossbars on caudal fin ..... *Upeneus sulphureus*

Family : MONODACTYLIDAE
(Silver Batfish)

Body strongly compressed and deep. Mouth small, with feeble teeth. Single dorsal fin with a long base, with 7-8 spines. Pelvic fins minute. Scales small, ctenoid.

Species occurring in the region

Monodactylus argenteus (Linnaeus)

Family : TOXOTIDAE
(Archerfishes)

Body deep, laterally compressed. Eyes large. Mouth fairly large, highly protractile, lower jaw protruding. Single dorsal fin, with 4-5 strong spines and 12-14 soft rays.

Species occurring in the region

Toxotes chatareus (Hamilton - Buchanan)
Toxotes jaculator (Pallas)

Key to species

1 (a) Four or five black spots on upper sides of body ..... *Toxotes jaculator*
(b) Six or seven alternating large and small black spots ..... *Toxotes chatareus*

Family : EPHIPPIDIDAE
(Space-fishes)

Body deep, almost circular, and laterally compressed. Head fairly short, with a steep upper profile. Mouth small; no teeth on vomer and palatines. Gill membranes united to ishmus. Spinous portion of dorsal fin distinct from soft-rayed portion (except in platax), anal fin spines three.

Species occurring in the region

Drepane longimana (Bloch & Schneider)
Drepane punctata (Linnaeus)
Platax pinnatus (Linnaeus)

Key to species

1. (a) Spinous portion of dorsal fin continuous with soft portion; pectoral fins shorter than head, rounded ..... *Platax pinnatus*
   (b) Spinous portion of dorsal fin distinct from soft rayed portion; pectoral fins longer than head, falcate 2
2. (a) Dorsal fin with 8 spines, the third spine longest ..... *Drepane longimana*
   (b) Dorsal fin with 7 spines, the fourth spine longest ..... *Drepane punctata*

Family : SCATOPHAGIDAE
(Scats)
(Fig. 40)

Typical of the group, the body is high and greatly compressed. There are four strong anal spines first dorsal spine procumbent. These are coastal fishes primarily but move into shallow brackish waters.

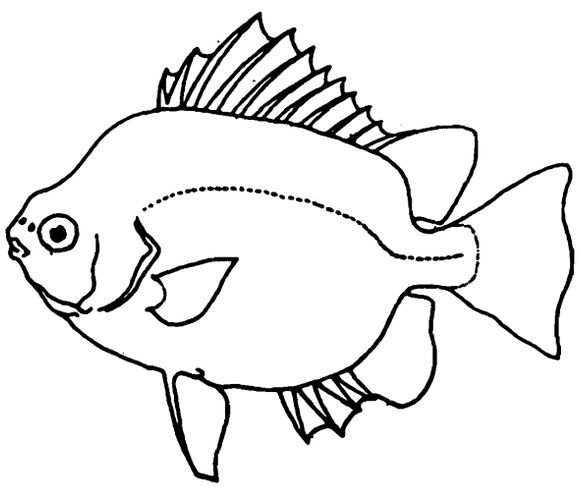

Fig. 40. Family : Scatophagidae

Species occurring in the region

Scatophagus argus (Bloch)

Suborder : MUGILOIDEI
Family : MUGILIDAE
(Mullets)
(Fig. 41)

The mullets are shallow water, schooling fishes usually found over sandy or muddy bottom. They are bluntnosed and small-mouthed; teeth small or absent;

widely separated spiny-rayed (with four spines) and soft-rayed dorsal fins; pelvic fins subabdominal. with one spine and five branched soft rays; lateral line absent or very faint; stomach muscular and intestine exceedingly long.

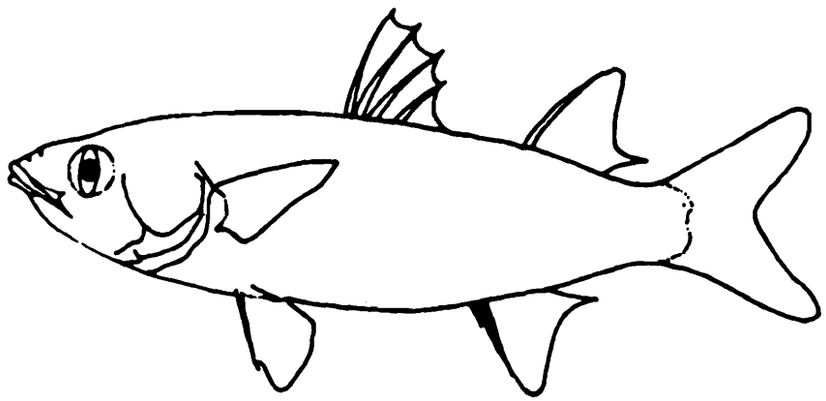

Fig. 41. Family : Mugilidae

Species occurring in the region

Liza parsia (Hamilton - Buchanan)
Liza tade (Forsskal)
Mugil cephalus Linnaeus
Rhinomugil corsula (Hamilton - Buchanan)
Valamugil cunnesius (Valenciennes)

Key to species

1. (a) Head concave between eyes, the latter projecting above this level .... *Rhinomugil corsula*
   (b) Head flattened dorsally, the eyes not projecting above this level 2
2. (a) Hind tip of maxilla not curved below tip of premaxilla; pectoral axillary scale very long ..... *Mugil cephalus*
   (b) Hind tip of maxilla curved below tip of premaxilla 3
3. (a) Scales without membranous digitated hind margin; pectoral axillary scale rudimentary or absent 4
   (b) Scales with membranous digitated hind margin; pectoral axillary scale very long ..... *Valamugil cunnesius*
4. (a) Second dorsal- fin origin on vertical through posterior half of anal-fin base. ..... *Liza tade*
   (b) Second dorsal fin origin over first half of anal-fin base ..... *Liza parsia*

Suborder : SPHYRAENOIDEI
Family : SPHYRAENIDAE
(Barracudas)
(Fig. 42)

Barracudas draw unusual interest because of their sharp, fearsome teeth. They have large forked caudal fins, large eyes, and usually dark blotches on a silvery background. The dorsal fins are widely separated, and the lower jaw projects beyond the upper. Slim and cigar-shaped, barracudas occur in warm waters throughout the world. When young, they travel in schools. Large individuals are typically solitary.

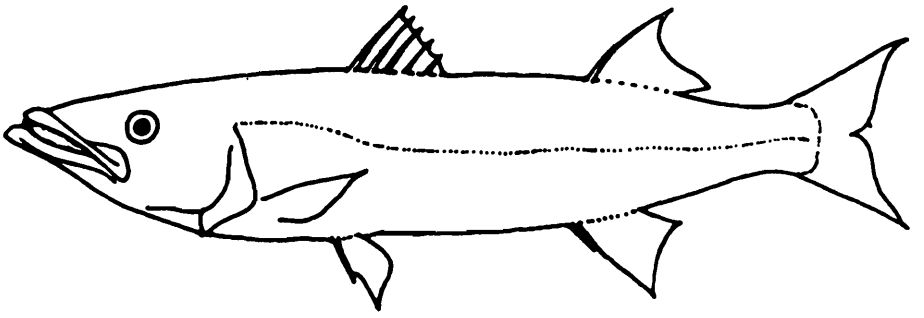

Fig. 42. Family : Sphyraenide

Species occurring in the region

Sphyraena jello Cuvier
Sphyraena obtusata Cuvier

Key to species

1. (a) Two gill-rakers present on first arch ..... *Sphyraena obtusata*
   (b) No gill-rakers on first arch ..... *Sphyraena jello*

Suborder : POLYNEMOIDEI
Family : POLYNEMIDAE
(Threadfins)
(Fig.- 43)

Typical of the threadfins has an anchovy-type head with rounded snout and recessed lower jaw; the mouth which is on the underside of the head, is not obvious unless it is open. The eyes are large. There are two dorsal fins, widely separated, and a deeply forked caudal fin. The pectoral fin is divided into two parts, the lower portion consisting of four to eight long, free filamentous rays not attached to each other.

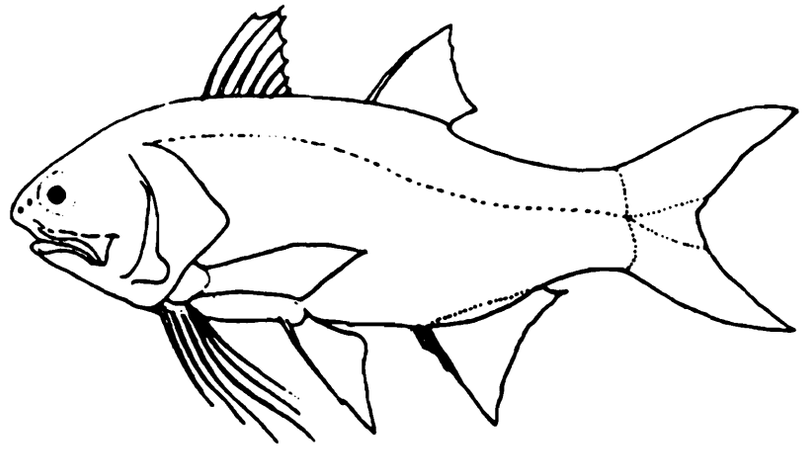

Fig. 43. Family : Polynemidae

Species occurring in the region

Eleutheronema tetradactylum (Shaw)
Polydactylus indicus (Shaw)
Polydactylus plebeius (Broussonet)
Polydactylus sextarius (Bloch)
Polynemus longipectoralis Weber & deBeaufort
Polynemus paradiseus Linnaeus

Key to species

1. (a) Pectoral fin inserted high on body, the upper part of its base in level with middle line of body; lateral line with its anterior part rising in a long, low curve 2

   (b) Pectoral fin inserted low, the upper part of its base well below the middle line of body; lateral line nearly straight 3

2. (a) Three upper pectoral filamentous rays, extending far beyond caudal fin tip ..... *Polynemus paradiseus*

   (b) Two upper pectoral filamentus rays extending far beyond caudal fin tip, but the third filament reaching only to tip of caudal fin ..... *Polynemus longipectoralis*

3. (a) Lower lip absent, except towards the rictus; teeth extending on exterior part of jaws ..... *Eleutheronema tetradactylum*

   (b) Lower lip fully developed, extending far forward; no teeth on exterior part of jaws 4

4. (a) Pectoral fin with five free filamentous rays 5

   (b) Pectoral fin with six free filamentous rays ..... *Polydactylus sextarious*

5. (a) Eyes small, the diameter about 7 times in head length; upper free pectoral filament reaching anal-fin origin ..... *Polydactylus indicus*

   (b) Eyes large, the diameter about 3.8 to 4 times in head length; upper free filament not reaching anal-fin ..... *Polydactylus plebeius*

Suborder : TRACHINOIDEI
Family : CONGROGADIDAE
(Eel-like blennies)

Body elongate with small cycloid scales. Dorsal and anal fins long; one spine before dorsal fin; no anal spines; pelvic fins absent. Caudal fin confluent with dorsal and anal fins, on slightly separated. Mouth protactile; gill membrances united; opercle with strong, posteriourly directed spine on upper margin. Three lateral lines.

Species occurring in the region

Halidesmus thomaseni (Nielsen)

Family : URANOSCOPIDAE
(Stargazers)

Head large and cuboid. Mouth extremely oblique; lips fringed. Eyes dorsal or nearly so. Dorsal and anal fins moderaterly long; pelvic fins narrowly seperated, with one spine and five soft rays, located under the throat. Two large, double grooved poison spines, with a venom gland at each base, just above the pectoral fin and behind the opercle. Body covered with small smooth scales.

Typically, the fishes lie buried with only their bulbous eyes and mouths protruding above the surface of the sand.

Species occurring in the region

Uranoscopus cognatus Cantor

Suborder : CALLIONYMOIDEI
Family : CALLINYMIDAE
(Dragonets)

A group of small, often highly coloured fishes. Body slender, anteriorly flattend. A sharp preopercular spine, usually in the form of a hook; a very small gill-opening on the upper part of the head Body naked.

Species occurring in the region

Callionymus recurvispinis (Linnaeus)
Eleutherochir opercularis (Valenciennes)

Key to species

1. (a) Operculum with a free flap of skin ..... *Elecutherochir opercularis*
   (b) Operculum without a free of skin 2
2. (a) Dorsal margin of preopercular spine with small antrose serrae ..... *Callionymus recurvispinnis*
   (b) Dorsal margin of preopercular spine with large curved points ..... *Callionymus sagitta*

Suborder : GOBIOIDEI
Family : ELEOTRIDAE
(Sleepers)

Body elengated, scales small or maderate. Pelvic fins separated either completely to the base or almost to it. Mouth moderate, teeth feeble.

Species occurring in the region

Eleotris fusca (Bloch & Schneider)
Eleotris melanosoma (Bleeker)

Key to species

1. (a) Scales in longitudinal series 45 to 55 ..... *Eleotris melanosoma*
   (b) Scales in longitudinal series 60 to 68 ..... *Eleoris fusca*

Remarks : The specimens of this family have a common habit of resting on the bottom as if 'sleeping' and rarely moving from this position unless disturbed.

Family : GOBIIDAE
Subfamily : GOBIINAE
(Gobies)
(Fig. 44)

Gobies are small bottom - dwelling fishes. The bases of their pelvic fins are united, forming a sucking disc with which they hold on to the bottom. In typical

members of the family there is no lateral line. The second, or soft rayed dorsal fin and the anal fin mirror each other in size and shape. Gobies commonly rest on the bottom, sometimes propped on their pelvic fins, and they dart quickly from place to place. Some live in burrows in the sand or mud. Many species of gobies live in tidal pools or close to shore.

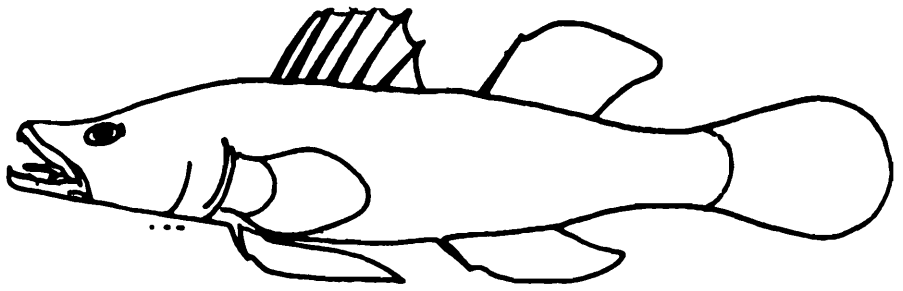

Fig. 44. Family : Gobiidae

Species occurring in the region

Apocryptes bato (Hamilton - Buchanan)
Bathygobius fuscus (Ruppell)
Boleophthalmus boddarti (Valenciennes)
Glossogobius giuris (Hamilton - Buchanan)
Periophthalmus pearsei Eggert
Pseudapocryptes lanceolatus (Bloch & Schneider)
Scartelaos histophorus (Valenciennes)

Key to species

1. (a) Teeth of lower jaw in a single row 2
   (b) Teeth of lower jaw in several rows 6
2. (a) Second dorsal fin base eleongated 3
   (b) Second dorsal fin base not elongated ..... *Periophthalmus pearsei*
3. (a) Free lower eyelid absent 4
   (b) Free lower eyelid present 5
4. (a) Teeth in lower jaw pointed ..... *Pseudapocryptes lanceolatus*
   (b) Teeth in lower jaw turncate or bilobed ..... *Apocryptes bato*
5. (a) Teeth in lower jaw pointed ..... *Scartelaos histophorus*
   (b) Teeth in lower jaw obliquely notched ..... *Boleophthalmus boddarti*
6. (a) Head depressed, gill membrane fused to a free fold across isthmus ..... *Glossogobius giuris*

(b) Head depressed, gill membranes attached with isthmus .... *Bathygobius fuscus*

Subfamily : AMBLYOPINAE
(Burrowing Gobies)

Like the true gobies, they usually have a sucking disc under the body. In life they are pink or blue in colour. The spine-rayed and soft-rayed portions of the extramely long dorsal fin are continuous rather than separate as in the gobies.

Species occurring in the region

Trypauchen vagina (Bloch & Schneider)

Suborder : KURTIODEI
Family : KURTIDAE
(Humpheads)

The body is oblong and much compressed, with small cycloid scales; head naked except the preopercle and opercle. Mouth large, teeth in villiform bands in jaws, smaller ones on palatines. Opercle bones thin and paperlike. Dorsal fin single, with spines and soft rays; anal fin with two spines and 31 or 32 soft rays; pelvic fin with one spine and 5 soft rays; caudal fin deeply forked. Lateral line short and rudimentary. Males with occipital hook, used for carrying eggs.

Species occurring in the region

Kurtus indicus Bloch

Suborder : ACANTHUOIDEI
Family : SIGANIDAE
(Rabbit fishes)

The siganids can be identified by the presence of two spines on each pelvic fin. The two spines are on the margins of the fins and are seperated by three soft rays. In addition, the rabbit fishes have an increased number of anal spines seven of them preceding the soft rays. These as well as the thirteen dorsal fin spines, have along the sides deep groves containing venom glands. Another pecularity is a very short first dorsal spine that is directed forward rather than backward.

Species occurring in the region

Siganus canaliculatus (Park)
Siganus javus (Linnaeus)

Key to species

1. (a) Last dorsal fin spine equal to or shorter than first dorsal spine .... *Siganus canaliculatus*

   (b) Last dorsal fin spine much longer than first dorsal spine .... *Siganus javus*

Suborder : SCOMBROIDEI
Family : TRICHIURIDAE
(Ribbonfishes)
(Fig. 45)

Much - flattend or compressed slvery body which is almost ribbonlike and tapers to a slim, usually pointed tail. The dorsal fin begins just behind the head and extends almost the full length of the body; there is a small anal fin.

Ribbonfishes are swift swimmers, usually staying close to the bottom. Common in shallow costal waters. The flesh is edible and tasty, but scanty.

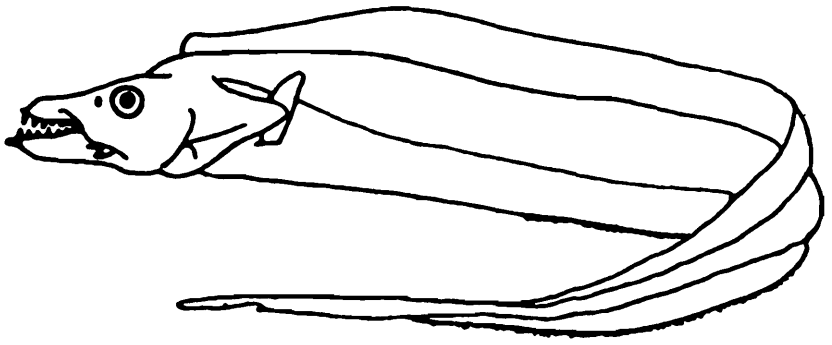

Fig. 45. Family : Trichuriade

Species occurring in the region

Eupleurogrammus muticus (Gray)
Eupleurogrammus glossodon (Bleeker)
Eupleurogrammus pantului (Gupta)
Lepturacanthus savale (Cuvier)
Trichiurus gangeticus (Gupta)
Trichiurus lepturus Linnaeus

Key t› species

1. (a) Pelvic fins scale-like; lower hind margin of gill cover convex 2

   (b) pelvic fin absent, lower hind margin of gill cover concave 3

2. (a) A pair of fangs at tip of lower jaw; eyes close to dorsal profile of head .... *Eupleurogrammus glossodon*

   (b) No fangs at tip of lower jaw; eyes not near head contour .... *Eupleurogrammus muticus*

3. (a) First anal spine large, half of eye diameter 4

   (b) First anal spine small, shorter than diameter of pupil 5

4. (a) Snout long, 2 to 2.5 in head length, eye small, its diameter 7 to 9 in head length ..... *Lepturacanthus savala*

   (b) Snout short, about 3 times in head length, its diameter 5 to 7 in head length ..... *Lepturacanthus pantului*

5. (a) Pectoral spine serrated ..... *Trichiurus gangeticus*

   (b) Pectoral spine not serrated ..... *Trichiurus lepturus*

Family : SCOMBRIDAE
(Mackerels)
(Fig. 46)

Characteristic torpedo - shaped powerful body. Two dorsal fins (depressible into grooves) with finlets behind second dorsal and anal fins; first dorsal fin inserted well behind head; pectoral fins inserted high on body; pelvic fins with six rays, placed beneath the pectoral fins. Scales cycloid and minute; slender caudal peduncle with two keel. The Scombridae is a family of epipelagic fishes that are important components of commercial fisheries.

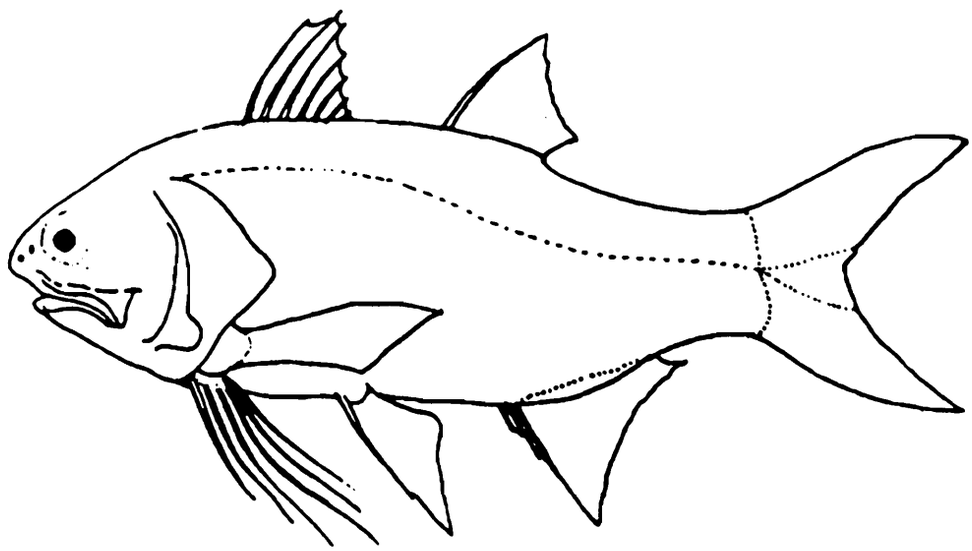

Fig. 46. Family : Scombridae

Species occurring in the region

Rastrelliger kanagurta (Curvier)
Scomberomorus commerson (Lacepede)
Scomberomous quttattus (Bloch & schneider)

Key to species

1. (a) A single pair of oblique keels near the end of caudal peduncle five dorsal and five anal finlets ..... *Rastrelliger kanagurta*
   (b) Two small keels with an additional midlateral keel on either side of caudal peduncle; 8 to 12 dorsal and 8 to 10 anal finlets 2
2. (a) Lateral line abruptly curving downward under second dorsal fin; numerous wavy vertical bars on sides of body ..... *Scomberomorus commerson*
   (b) Lateral line gradually descending posteriorly; dark prominent spots on sides of body ..... *Scomberomorus guttattus*

Family : ISTIOPHORIDAE
(Billfishes)
(Fig. 47)

Upper jaw prolonged into a long spear which is round in cross section. Two dorsal fins; first dorsal fin extremely high, sail like.

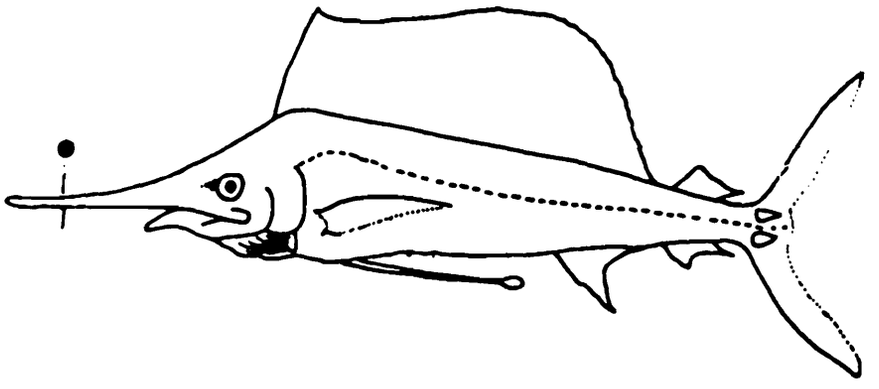

Fig. 47. Family

Species occurring in the region

Istiophorus platypterus (Shaw & Nodder)

Remarks : Chatterjee *et al.* (1998) reported this species from Digha coast.

Suborder : STROMATEOIDEI
Family : STROMATEIDAE
(Silvery Pomfrets)
(Fig. 48)

Schooling fishes, the pomfret has a nearly round body, as deep as it is long, and lacks pelvic fins. The pactoral fins are long and pointed, the snout blunt, and the teeth weak.

Pomfrets are pelagic, medium-sized fishes, inhabiting shallow waters, generally in coastal areas, sometimes entering estuaries.

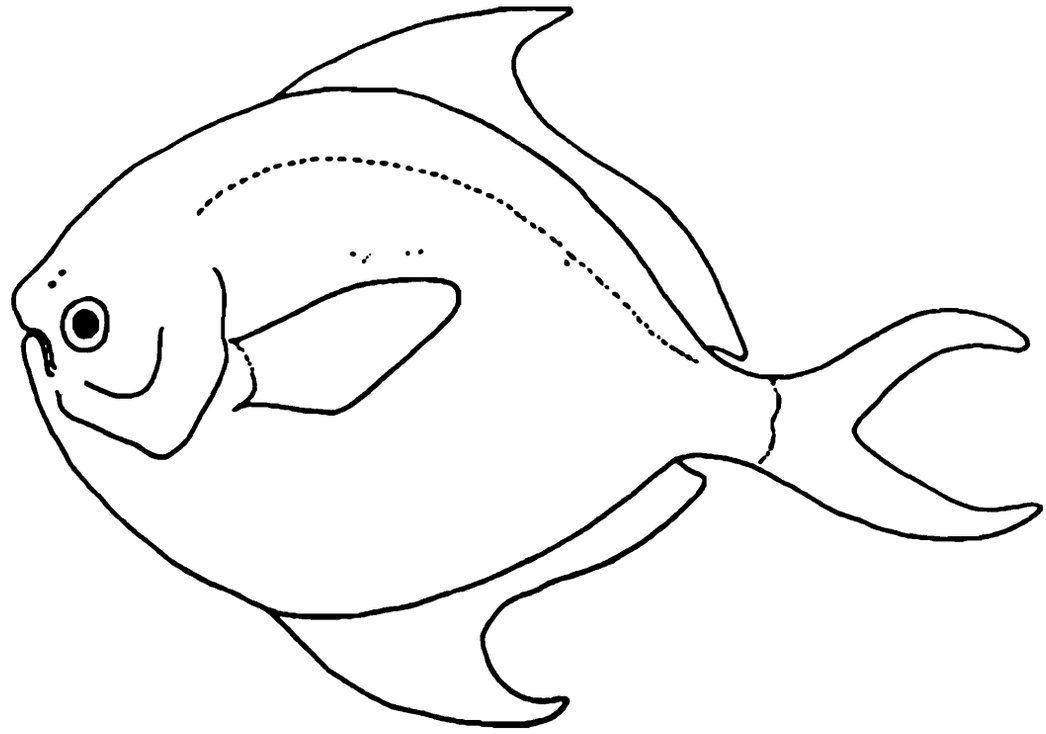

Fig. 48. Family : Stromateoidei

Species occurring in the region

Pampus argenteus (Euphrasen)
Pampus chinensis (Euphrasen)

Key to Species

1 (a) Five to ten flat blade-like spines preceding the median fins; deeply falcate .. .. *Pampus argenteus*

(b) No spines preceding median fins; fins never deeply falcate .... *Pampus chinensis*

Order : PLEURONECTIFORMES
Sub order : PLEURONECTOIDEI
Family : BOTHIDAE
(Left eye Flounders)

These are bottom-dwelling fishes, usually burrowing in sand or mud bottoms of the continental shelf. Eyes sinistral; pelvic fins without a spine; branchiostegal membranes connected. Edge of preopercle free.

Bothids have the ability to change colour rapidly in order to more nearly match their background

Species occurring in the region

Pseudorhombus arsius (Hamilton-Buchanan)
Pseudorhombus javanicus (Bleeker)

Key to species

1. (a) Pelvic fins equal ..... *Pseudorhombus arsius*
   (b) Left pelvic fin median with base much longer than that of the right .... *Pseudorhombus javanicus*

Family : CYNOGLOSSIDAE
(Tongue soles)
(Fig. 49)

The tongue soles have eyes on the left side of the head, a pointed tail, and no ribs. The dorsal, caudal and anal fins are united. There are no pectoral fins. The eyes are very small and set close together. The preopercle is hidden beneath the skin.

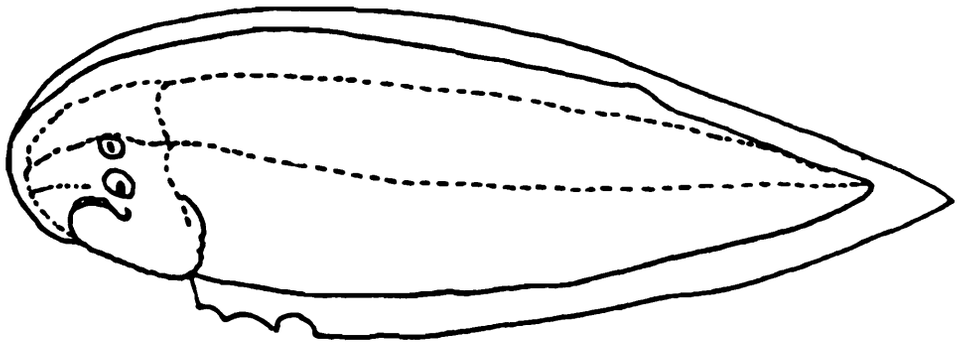

Fig. 49. Family : Cynoglossidae

Species occurring in the region

Cynoglossus cynoglossus (Hamilton-Buchanan)
Cynoglossus lingua Hemilton-Buchanan
Cynoglossus semifasciatus Day
Paraplagusia bilineata (Bloch)

Key to species

1. (a) Lips with rows of fringed tentacles ..... *Paraplagusia bilineata*
   (b) Lips smooth, not fringed 2
2. (a) Scales cycloid no blind side of body ..... *cynoglossus lingua*
   (b) Scales ctenoid on blind side of body 3
3. (a) Snout rounded and short, about 27% of head length ..... *Cynoglossus semifasciatus*
   (b) Snout somewhat pointed and longer, about 32% of head length ..... *Cynoglossus cynoglossus*

Family : SOLEIDAE
(Soles)
(Fig. 50)

Soles are flatfises that typically have a very rounded body. The small eyes are close together and are on the right side of the head; the preopecular edge is hidden under the skin and scales of the head. The dorsal fin is inserted far forward on head.

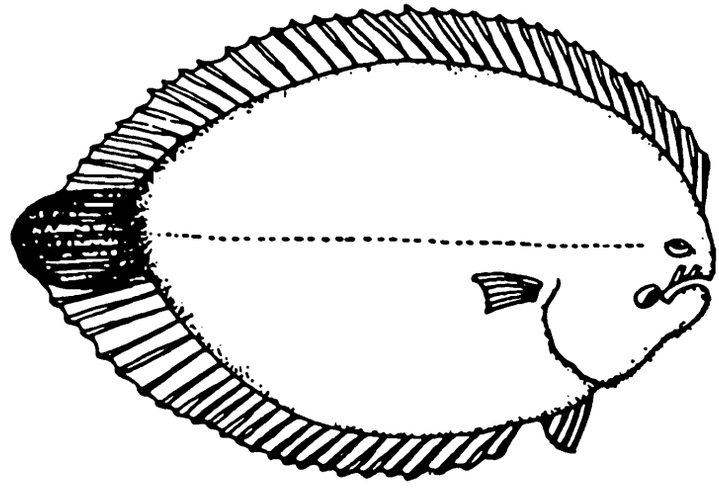

Fig. 50. Family : Soleidae

Species occurring in the region

Synaptura commersoniana (Lacepede)
Zebrias guagga (Kaup)

Key to species

1. (a) Opercular membrane on both sides of body joined to upper rays of pectoral fin ..... *Zebrias guagga*
   (b) Opercular membrane not joined to pectoral fins ..... *Synaptura commersoniana*

Order : TETRAODONTIFORMES
Suborder : BALISTOIDEI
Family : TRIACANTHIDAE
(Triplespines)
(Fig. 51)

These are shallow-water benthic fishes, restricted to the Indo-Pacific. The spinous dorsal fin with 20 to 26 soft rays. Pelvic spine long. Caudal fin deeply forked.

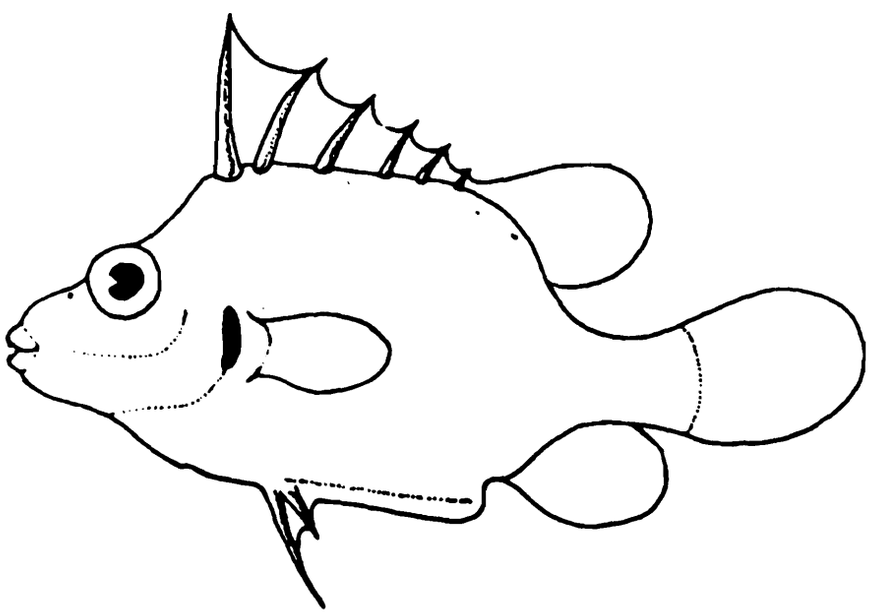

Fig. 51. Family : Triacanthidae

Species occurring in the region

Triacanthus biaculeatus (Bloch)

Family : ALUTERIDAE
(Leather - Jackets)
(Fig. 52)

Highly compressed body. No normal scales, those present being modified into rough or spinous projections. First dorsal fin represented by a single isolated large spine above or near eye. Locking erect by a rudimentary second spine.

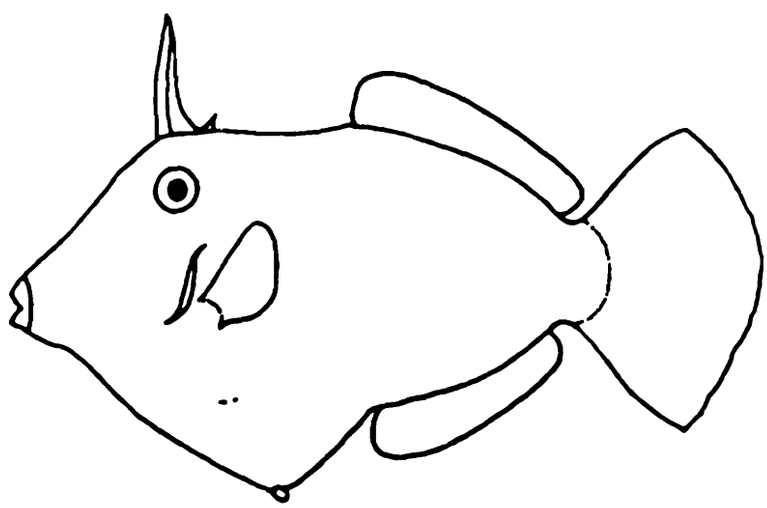

Fig. 52. Family : Aluteridae

Species occurring in the region

Alutera monoceros (Linnaeus)

Remarks : Talukdar *et al.* (1996:37) reported this species from Digha coast.

Suborder : TETRAODONTOIDEI
Family : TETRAODONTIDAE
(Puffers)
(Fig. 53)

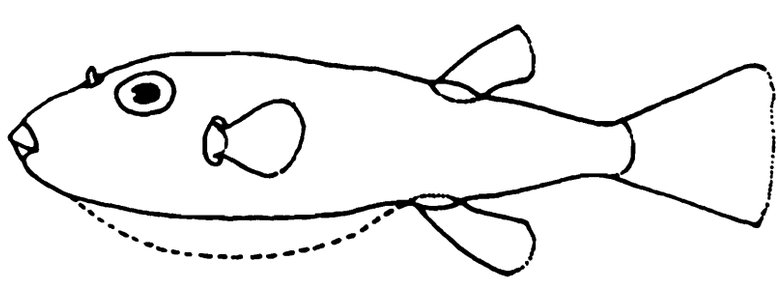

Fig. 53. Family : Terodontidae

Body naked or with only small scattered prickles. The tecth are fused to form a beak, but separated by a median suture. Dorsal and anal fins usually each with 7 to 12 soft rays. The body is rounded in cross-section.

Puffers have the ability to inflate their bodies with air or water or both, gulping quickly, and turning up side down so that they float to the surface. The flesh (especially the viscera) of some puffers contain the alkaloid poision tetraodotoxin, produced by the fish, which can be fatal.

Species occurring in the region

Arothrodon immaculatus (Bloch & Schneider)
Arothrodon nigropunctatus (Bloch & Schneider)
Chelonodon fluviatilis (Hamilton - Buchanan)
Chelonodon patoca (Hamilton - Buchanan)
Lagocephalus inermis (Temminck & Schlegel)
Lagocephalus lunaris (Bloch & Scneider)
Lagocephalus scleratus (Gmelin)

Key to species

1. (a) Nostril either an upraised cup with two fleshy lobes or a solid bifid tentacle 2
   (b) Nostril an upright sac with two openings 5
2. (a) A single lateral line on side of body 3
   (b) Two lateral lines, the upper joining the lower above or behind the origin of anal fin 4
3. (a) Body uniform or with longitudinal stripes ..... *Arothrodon immaculatus*
   (b) Small, round, black spots scattered on sides of head, body and tail ..... *Arothrodon nigropunctatus*
4. (a) Nostril a round depression surrounded by a row rim, produced into a posterior and an anterior flap ..... *Chelonodon patoca*
   (b) Nostril a short stem with two rounded lobes at its tip ..... *Chelonodon fluviatilis*
5. (a) No spines on back ..... *Lagocephalus inermis*
   (b) The whole, or almost whole of back spiny 6
6. (a) Caudal peduncle compressed; body without spots ..... *Lagocephalus lunaris*
   (b) Caudal peduncle depressed, wider than deep behind dorsal fin; body with spots superiorly ..... *Lagocephalus scleratus*

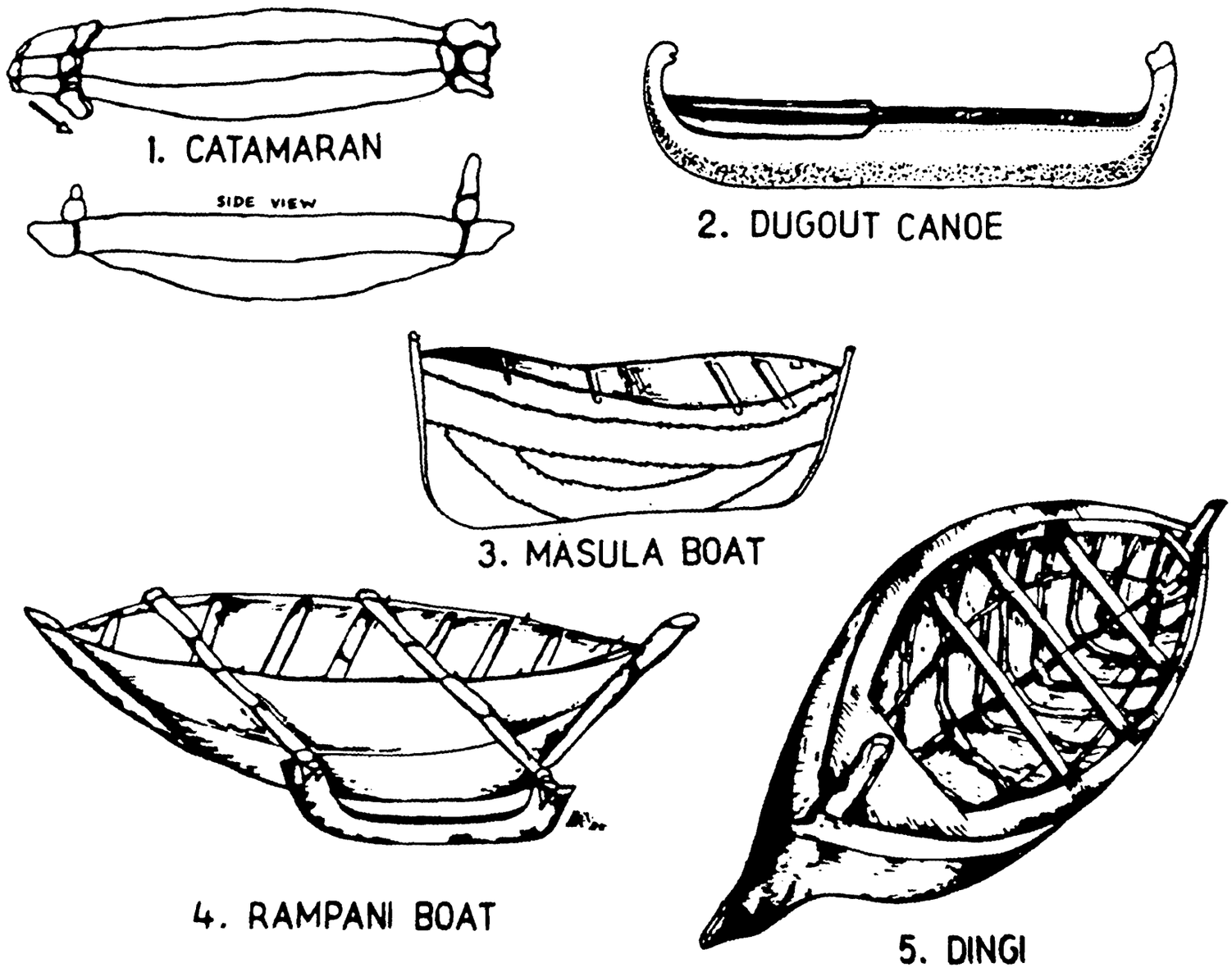

Fig. 54. Fishing crafts commonly used at Digha and Adjoining Coast

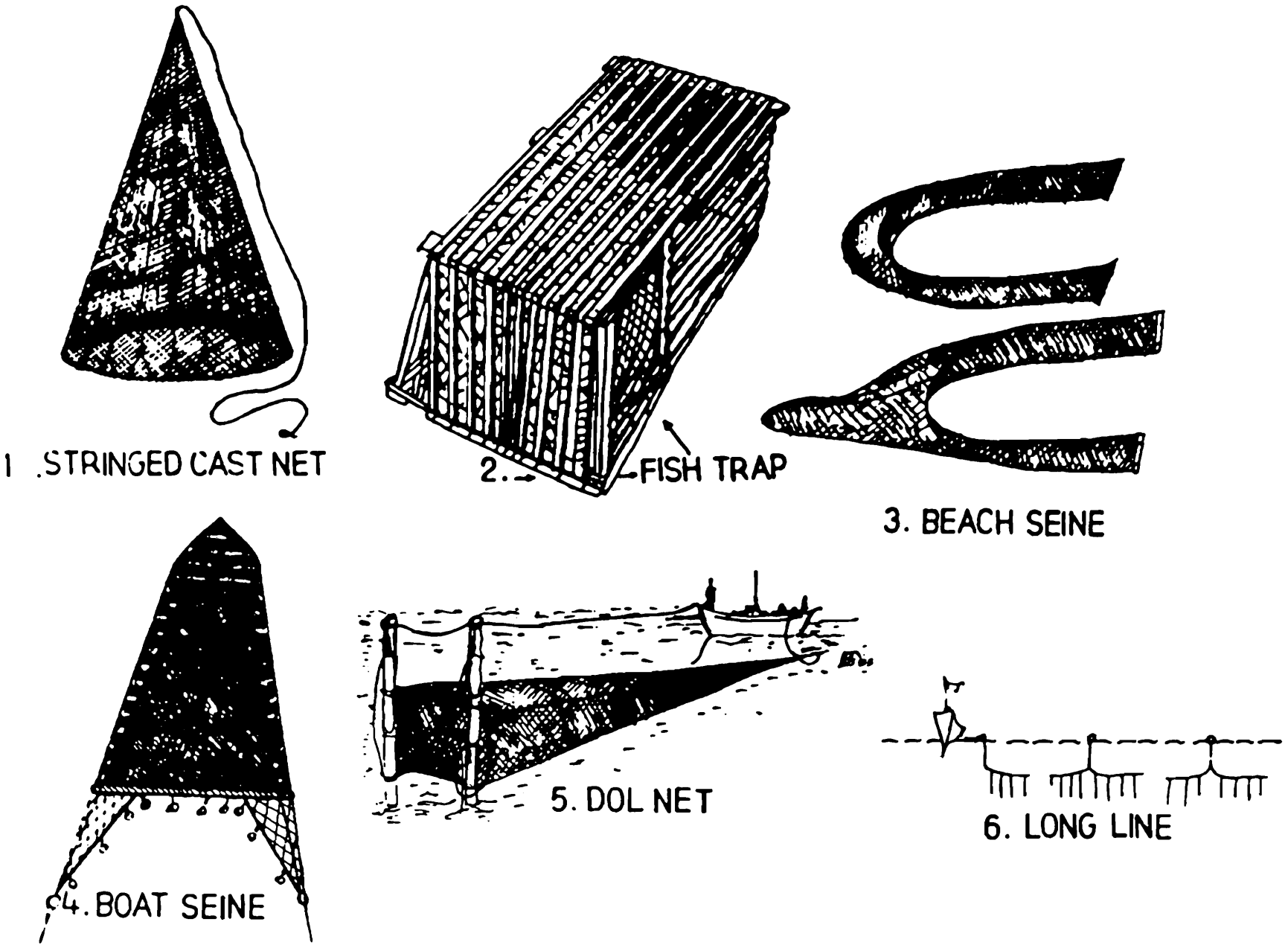

Fig. 55. Fishing gears commonly used at Digha and Adjoining Coast

COASTAL FISHERIES

The coastal area of Medinipur district offers a wide assemblage of biotic components which are being used by local population for sustenance. The data on coastal Medinipur, however, remain much less worked out. Unfortunately, the local fishermen have never been able to harness the potentially rich fishery resources to any significant level. The fishermen have been harnessing the resources with their traditional crafts and indigenous gears. However, in recent years there has been an evergrowing increse in the sea fish production with the aids of Government plans. Ramkrishna & Chatterjee (1997) have discussed in detail the present status of sea fishing around Digha Rasulpur coast. In this chapter, the present status of marine fisheries along Digha coast has been discussed in brief and attempts have been made to give a detailed account of commercial fish species/ groups available from this coast together with their seasons of occurrence and peak periods.

PRESENT STATUS OF SEA FISHING

The general picture of marine fishing was gloomy in early fifties not only at Digha coastal belt alone but also in rest of the West Bengal coast. The fishermen had to depend on the traditional crafts and indigenous gears. Non-powered boats had a restricted mobility and fishermen had little access to offshore waters. Thus sea fishing could not prove itself lucrative, since it could not ensure attractive returns.

As the first step towards development of marine fishing, the State Government launched a programme for developmental fishing with deep sea fishing vessels. For that purpose two wooden fishing trawlers and later three steel trawlers were procured from Denmark and Japan respectively. These vessels operated from base stations at Calcutta, but the venture did not meet with any success. One of the reasons for failure of deep sea fishing vessels operating from Calcutta base station was the unduly long cruising hours (Anon., 1984 a).

In the later part of fifties, a couple of motorised boats of smaller size were used for demonstrative fishing in coastal and inshore waters. The fishermen accepted these boats as more suitable fishing craft and realised the need of motorisation of fishing boats. Addition of outboard motor/engine to the boats could save time during the journey and increase the actual fishing hours. With the increase in the demand for motorisation, 40 motorised boats were constructed by the Fisheries Department in 1976 and later, in 1978, 25 more trawlers cum gill netters were introduced from Tamilnadu. During 1982 - 84, another 222 motorised boats were introduced.

Number of indigenous and motorised boats operating from Digha and adjoing bases during 1984 were as follows :

Base Station	No. of indigenous boats	No of motorised boats.
DIGHA	1000	200
JALDA	290	22
JUNPUT	300	50
DADANPATRA	200	—
Total	1790	272

(**Source** : Anon., 1984 b : 69)

RECENT DEVELOPMENTS

During the last ten years, a rapid progress in the motorisation of boats along West Bengal coast is noticed and at present, more than 600 motorised boats operate at Digha coast.

Most of the vessels go out upto 30 - 40 km and few up to 100 km into the sea. Marine landing from West Bengal coast varied between 5,226 tonnes in 1977 to 39,910 tonnes in 1984 with an average of 19,850 tonnes during the ten years of 1975 - 84 (Jhingran, 1991; 596). From a report of Fisheries Deptt. Govt. of W.B. (1991) it is learnt that fish production in marine sector from West Bengal reached about 90,000 tonnes in 1989 - 90. Present day catch from the coast of West Bengal forms 5 - 10% of the total catch from the coasts of India (which was about 24 lakh tonnes in 1995) i.e. approximately varying between 1,20,000 to 2,40,000 tonnes. In the absence of scientific documentation system of marine landings in the landing centres along Digha coast, it is difficult to assess the actual quantum of catches from this coast. However an assessment made on analysis considering number of fishing crafts in operation, average monthly catch per craft by random sampling and total fishing days, reveals that per annum catch from this coast ranges from 25,000 to 40,000 tonnes. Seasonal variation of commercial species/groups and tentative percentage composition are given in Table 1 & 2 respectively.

FISHING CRAFTS & GEARS

The commercial fishing from Digha coast is carried out by more than 1500 fishing crafts comprising mostly of plank-built boats (fig. 54) to suit the local condition. The motorization programme has made much headway and as many as 600 crafts have been motorized by fitting engines.

The principal traditional gears operated are cast nets, fish traps shore seines (Ber Jal), bag nets (Behundi Jal) boat seines (Bhasani Jal), bottom set gill nets and drift gill nets (Chhandi Jal), long lines, etc. (fig. 55) and a few modern gears introduced are bottom trawls, large gill nets, purse seines, etc.

From the start of March a strong breeze begins to blow from the south-west monsoon to about the middle of September, April and May are notorious for sudden storms known as Nor'Westers. During these six to seven months sea remains very rough and is closed to every kind of indigenous crafts. However, motorized crafts operate upto middle of February and again from the middle of June. Shore fishing by drag net is continued during these months except in the month of May when every kind of sea fishing is closed.

Recently due to high demand of tiger shrimp seeds *(Penaeus monodon)*, collection of shrimp post larvae has gained a momentum. Seed collection starts from mid/late December and reaches its peak in January-February and then falls from March and ends by early part of April with the onset of south wind, higher temperature and salinity. Availability of seeds mainly depends upon some meteriological and physico-chemical parameters like wind, temperature, salinity, etc. Seed collection has, although opened a new dimension of economic activities, created worries since over exploitation of the stock and destruction of seeds of non-commercial fish species may be detrimental to the eco-system.

COMMERCIAL SPECIES

The coastal waters of Digha teem with more than 200 species out of which about 100 are of commercial importance.

Elasmobranchs (Sharks & Rays) : From one of the important commercial fisheries. Although not popular in West Bengal, the elasmobranchs are widely used as food in some parts of the country. Additionally, they are used for making fish meal and manure. Shark liver oil has wide medicinal use. Liver oil of some sharks and rays is used to a large extent in the leather industry. There is also an export trade in dried fins. Rays are more abundant than sharks. Although, sharks are essentially marine, a few species enter into the estuaries. Sharks and rays are available at Digha coast almost throughout the year.

Important commercial species :

Sharks : ***Carcharhinus limbatus, Scoliodon laticaudus, Rhizoprionodon acutus, Anoxypristis cuspidatus, Pristis microdon, Rhynchobatus djeddensis, Rhinobatos granulatus.***

Rays : *Dasyatis zugei, Himantura uarnak, Gymnura paecilura, Aetobatus flagellum, Aetomylaeus nichofii.*

Eels : Not popular in West Bengal, but relished in some parts of India. Eels breed in open ocean and larvae are moved by current coastward. Most of the life is spent in streams and rivers and migrate seaward to spawn as maturity approaches.

Clupeoids : (Shads, Ilishas, etc.) : A valuable commercial fishery exists for clupeoids. The Hilsa, Sardine, Herring and their relatives form one of the most important group of food fishes. Most species form schools and swim near the surface usually in coastal waters. Along Digha coast, hilsa forms a lucrative fishery. Highest catch rate of clupeoids has been observed in 50 - 100m depth belt of this region.

Important commercial species :

Hilsa ilisha H. kelee, H. toli, Ilisha kampeni, I. megalaptera, I. melastoma, Anodontostoma chacunda, Pellona ditchela, Reconda russeliana, Nematalosa nasus.

Anchovies (Engraulids) : Small translucent silvery fishes occuring often in huge shoals in coastal waters including estuaries and form an important fishery.

Important commercial species : Coilia dussumieri, Coilia ramkarati, Coilia reynaldi, Setipinna phasa, Setipinna taty, Thryssa malabarica, Thryssa purava, Thryssa hamiltonii.

Chirocentrids (Wolf Herrings) : Marine coastal fishes and are pelagic inshore predators on small fishes and crustaceans.

Important commercial species : Chirocentrus nudus.

Sea catfishes : Occur in huge quantities almost throughout the year. They are mostly marine but occur in brackish water.

Important commercial species : Arius jella, Arius sona, Arius sagor, Arius thalassinus.

Bombay duck : Caught in tremendous numbers and is eaten fresh as well as dried in salted pans. The fish is not relished locally; dried and marketed to different states.

Important commercial species : Harpadon nehereus

Sea perches : Fairly large-sized bottom living fishes occurring in coastal waters and estuaries; highly esteemed food fish and marketed fresh. Caught with bottom trawls and gillnets.

Important commercial species : Lates calcarifer

Whitings : Small fishes of sandy shores and estuarine waters. These are good fishes, the flesh had an excellent flavour.

Important commercial species : Sillaginopsis panijus, Sillago sihama

Carangids (Jacks, Scads) : This is one of the most important families of commercial sea fishes and all species are used as food. Mostly schooling species, some species are of continental distribution and occur primarily in brackish environment and some are pelagic. Marketed mostly fresh. Salted and sundried carangids have a good market.

Important commercial species : Megalaspis cordyla, Atropus atropus, Caranx sexfasciatus, Caranx carangus, Carangoides malabaricus.

Black pamfrets : Occur in schools in deep coastal waters.

Important commercial species : Parastromateus niger

Leiognathids : Available in plenty and are mostly used for preparing poultry and fish food.

Important commercial species : Leiognathus equulus.

Snappers : Mostly demersal species found from inshore waters to considerable depth.

Important commercial species : Lutjanus argentimaculatus, Lutjanus bengalensis. Lutjanus johnii.

Sciaenids (Croakers) : Almost all are inshore fishers usually found over sandy bottom. The majority are considered as marketable food fishes. Sciaenids are available almost throughout the year.

Important commercial species : Johnius sina, Johnius vogleri, Johnius belangerii, Macrospinosa cuja, Otolithoides biauritus, Pama pama, Panna microdon, Protonibea diacanthus, Pterotolithus maculatus.

Mullets : Important food fishes in West Bengal. Most species are adaptable to great changes in salinity; usually found over sandy and muddy bottom.

Important commercial species : Liza parsia, Liza tade, Mugil cephalus.

Polynemids (Threadfins) Inhabit shallow coastal waters, some of which also enter into the estuaries. Highly appreciated in West Bengal.

Important commercial species : Eleutheronema tetradactylum, Polynemus paradiseus, Polydactylus indicus, Polydactylus sextarius.

Ribbon fishes : Abundantly found; have a good export market, usually sundried and exported.

Important commercial species : Lepturacanthus savala, Trichiurus lepturus, Eupleurogrammus muticus.

Mackerels : The Scombridae is a family of epipelagic fishes. In comparison to West Coast, abundance of mackerels is comparatively less in East coast. They form an important fishery and are relished in West Bengal.

Important commercial species : Rastrelliger kanagurta, Scomberomorus commerson, Scomboromorus guttatus.

Silver pomfrets : Schooling fishes and are among the finest of food fishes.

Important commercial species : Pampus argenteus, Pampus Shinensis.

The former species is found in coastal waters from 50 to 100m depth whereas the latter is found in shallow waters.

Flat fishes : Live mostly in sandy bottom in shallow waters, but reported to occur even down to about 200m depth. Form a good fishery, but not popular in West Bengal.

Important commercial species : Pseudorhombus arsius, Pseudorhombus javanicus, Cynoglossus cynoglossus, Cynoglossus lingua, Cynoglossus semifasciatus, Paraplagusia bilineata, Synaptura commersoniana, Zebrias guagga.

DISCUSSION

An analysis of the seasonal variation and peak periods of occurrence of the important commercial fish groups from Digha coast (table-1) reveals that elasmobranchs, different varieties of clupeoids, engraulids, sea catfishes, sciaenids, silvery pomfrets, etc. are available in the catches almost throughout the year. In the second quarter of the year (April to June), minium number of fish groups are recorded in the commercial catches. It is not out of place to mention here that no fishing takes place in the month of May. Catches suddenly increase in the third quarter of the year (July to September), which further increase to the maximum in the fourth quarter (October to December) and gradually declines in the next quarter, i.e., first quarter of the year (January to March)

The pelagic fishes significantly contribute to the total catch. In this group, Hilsa and other miscellaneous clupeoids and engraulids dominate with more than 25% of the catch. Other important fishes in this group are mackerels, ribbon fishes and carangids.

Among demersal fishes, sea catfishes and sciaenids dominate in the catch with

about 25% of each of this groups. The other important varieties are the silvery and black pomfrets, polynemids, silver bellies and elasmobranchs.

As already stated, the area of operation of the traditional and motorised fishing vessels is confined to inshore waters of less than 50m. depth in this coastal region. Hence, any increase from the present area of operation will be marginal. Moreover, since the limited area under operation is already subjected to overfishing, further expansion of fishing in this zone will invite depletion of the nutural resources. Extension of fishing activities beyond 50m depth can only augment fish production from this coastal area.

As already pointed out, in the absence of scientific documentation system available in the landing centres along this coast, it is difficult to assess the actual quantum of catches from this region. However an attempt was made by the authors to arrive at a rough estimate of annual catch from this coastal belt. Catch data were collected from fishing vessels from two landing centres : Digha 'mohana' and Sankarpur during the period from 1989 to 1994. All sea fishing activities in this coast are in the hands of private entrepreneurs and they are very conservative in disclosing their catch data. It was, therefore, possible to collect catch data only from a few vessel owners. The averages of catch per haul of these vessels were multiplied by averages of total number of hauls per year. Again, this figure was multiplied by approximate minimum and maximum number of vessels operating in the region. This calculation gives an idea that annual catch from motorised sector varies between 25,000 to 40,000 tonnes. Though this projection may not be scientifically very correct, it would serve the purpose of getting a good idea. For accurate assessment, it is necessary to assess catch per unit effort by random sampling in different years. For such an analysis, more studies are required, which is possible only with the active participation of the Fisheries Department of the state.

SUMMARY

This paper embodies a taxonomic account of fishes inhabiting Digha coast of West Bengal including Sankarpur harbour. Altogether 212 species belonging to 145 genera covering 88 families have been dealt with. The species in the earlier works whose status are doubtful have not been incorporated in this work. Keys to their identification are provided. Fisheries at this coast have been discussed.

REFERENCES

Anonymous, 1984 a. *Growth of marine fisheries in West Bengal.* Dept. of Fisheries, Govt. of West Bengal.

— 1984 b. *Report on Fisheries Development of West Bengal.* Marine products Export Development Authority.

Barua, D. and Bhattacharya, S., 1979. Some considerations on demarcation and evolution of the Digha-coastal littoral tract. *Geogr. Rev. India,* **41**(1) : 53-58.

—Barua, D, Bhattacharya, S and Bagchi, K. 1980. Geo-ecology of Digha-coastal littoral zone. *Ibid.*, **42**(1) : 79-82.

Chatterjee, T. K., Talukdar, S. and Ramkrishna, 1998. A record of the sail fish, *Istiophorus platypterus* (Shaw & Nodder) (Pisces : Istiophorus) from Digha coast, West Bengal, India. *Rec. zool. Surv. India,* **96** (1-4) : 81-82.

Compagno, L. J. V., 1984. F.A.O. species catalogue. Vol. 4 Sharks of the World. An annotated and illustrated catalogue of sharks known to date. Part-2 : Carcharhiniformes. *F.A.O. Fish. Synop.*, (125) **4** (2) : 251 - 655. Gilbert, C. R. 1967. A revision of the hammerhead sharks (family Sphyrnidae). *Proc. U. S. natn. Mus,* **119** (3539) : 1-58.

Goswami, B.C.B., 1992. Marine fauna of Digha coast of West Bengal. India. *J.mar.biol. Ass. India,* **34** (1-2); 115-137.

Jhingran, V. G., 1991. *Fish and Fisheries of India.*

Manna, B., and Goswami, B. C. B., 1985.

A checklist of marine and estuarine fishes of Digha, West Bengal, India. *Mahasagar,* **18** (4) : 489-499.

Nelson, J. S., 1994, *Fishes of the world.* 3rd ed.

Neogi, D., 1970. Quarternary geology and geo-morphology of the Kharagpur-Digha area. *Proc. 57th sci.congr.* Kharagpur (Abstract).

Ramkrishna and chatterjee, T. K., 1997. Need to conserve marine biotic resources for sustinable development of coastal fisheries at Digha-Rasulpur coast (West Bengal). *Proc. zoo. Soc. Calcutta,* **50** (1) : 63-68

Talukdar, S., Chatterjee, T. K. and Ramakrishna, 1996. On two new records of fish, *pterois volitans* ad *Alutera monoceros* from Digha Coast, West Bengal. *Proc. 83rd Sci. Congr.*, Patiala : 37 (Abstract).

Talwar, P. K. (in Talwar, P. K. & Kacker, R. K.), 1984. *Handbook of commerical Sea Fishes of India,* Zool. Surv. India : 1-997.

Talwar, P. K. and Jhingran, A. G. 1991. *Inland Fishes of India and adjacent Countries,* 2 vols.

— P. Mukherjee, P., Saha, D. Paul, S. N. and Kar, S., 1994. *Marine and estuarine fishes in State Fauna Series* 3 : Fauna of West Bengal, Part-2 : 243-342 (1992), Zool. Surv. India.

Table 1. Seasonal occurrence and peak period of catch of important commercial fish species

	MONTHS											
	J	F	M	A	M	J	J	A	S	O	N	D
Rhiniodon typus	+	+	+	+ +	—	+ +	+ +	+	—	+	+ +	+
Carcharhinus spp.	+	+	+	+ +	—	+ +	+ +	+	—	+	+ +	+
Ghyphis gangeticus	+	+	+	+ +	—	+ +	+ +	+	+	+	+ +	+
Anoxypristis cuspidatus	+	+	+ +	+ +	—	+	+	+	—	+	+	+
Rhynchobatus djeddensis	+	+	+	+ +	—	+ +	+	+	+	+ +	+	—
Dasyatis zugei	+	+	+	+ +	—	+ +	+	+	—	+ +	+	—
Gymnura spp.	+	+	+	+	—	+ +	+ +	+ +	—	+	+ +	+
Himantura spp.	+	+	+	+	—	+	+	+	—	+	+ +	+
Hilsa ilisha	—	—	+	+	—	+	+ +	+ +	+ +	+	+	+
Hilsa kelee	+	+	+	+	—	+ +	+ +	+ +	+	+	+	+
Sardinella spp.	+	+	+	+	—	+	+	+	+ +	+	+	+
Ilisha spp.	—	+	+	+	—	+ +	+ +	+ +	+	+	+	+
Setipinna phasa	+	+	+ +	+	—	+ +	+ +	+ +	+	+	+ +	+
Thryssa malabarica	+	+	+ +	+ +	—	+ +	+	+	+	+	+ +	+
Thryssa parava	+	+	+ +	+	—	+ +	+ +	+	+	+	+ +	+
Chirocentrus nudus	+	+	+	+	—	+	+	+	+	+ +	+ +	+
Arius thalassinus	+	+	+	+	—	+ +	+ +	+ +	+	+ +	+ +	+
Arius jella	+	+	+	+ +	—	+ +	+ +	+	+	+ +	+ +	+

Table 1 (*continu*) Seasonal occurrence and peak period of catch of important commercial fish species

	MONTHS											
	J	F	M	A	M	J	J	A	S	O	N	D
Harpadon nehereus	+	+	—	—	—	—	+	—	++	++	+	+
Lates calcarifer	+	+	—	—	—	—	—	—	—	+	+	++
Epinephelus tauvina	+	+	—	—	—	—	+	+	+	++	++	+
Sillginopsis panijus	+	+	—	—	—	—	—	+	++	+	+	+
Sillago sihama	+	+	—	—	—	—	—	—	++	++	+	+
Megalaspis cordyla	—	—	—	—	—	+	++	++	+	+	++	+
Parastromateus niger	+	—	—	—	—	++	+	+	+	++	++	++
Leiognathus equlus	—	+	—	—	—	—	—	+	+	+	++	+
Lutjanus spp.	++	++	+	+	—	+	+	+	+	+	++	+
Johnius spp.	++	++	+	+	—	+	+	+	+	+	++	+
Pama pama	++	++	+	+	—	+	+	+	+	++	++	+
Protonibea diacanthus	++	++	+	+	—	+	+	+	+	+	++	++
Liza tade	+	+	—	—	—	—	—	+	+	+	++	+
Mugil cephalus	++	+	—	—	—	—	—	+	+	+	++	++
Eleutheronema tetradactylum	+	+	—	—	—	—	+	++	++	++	++	+
Trichiurus sp.	—	+	+	+	—	+	+	++	++	++	+	+
Rastrelliger kanagurta	—	—	—	—	—	++	++	++	+	+	+	+
Pampus spp.	++	++	+	++	—	++	++	++	+	+	+	++

+ Available, — Not Availavble
++ Peak period of catch