

OCCASIONAL PAPER NO. 209

# **FISH FAUNAL RESOURCES OF SUNDERBAN ESTUARINE SYSTEM**

**WITH SPECIAL REFERENCE TO THE BIOLOGY OF  
SOME COMMERCIALY IMPORTANT SPECIES**

**R. A. KHAN**



**Zoological Survey of India**

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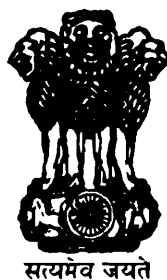
# RECORDS OF THE ZOOLOGICAL SURVEY OF INDIA

**Fish faunal resources of Sunderban  
Estuarine System with special  
reference to the biology of  
some commercially important species**

**R. A. KHAN**

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**Zoological Survey of India  
Kolkata**

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## INTRODUCTION

Fish fauna of Sunderban estuarine system exhibit far greater diversity as compared to adjacent fresh or marine waters. While many of the species occurring in estuarine zone can tolerate wide range of salinity fluctuations and move freely in the entire salinity gradient during major part of the year, some others, mainly marine species, are restricted only to lower zones. Most species enter the estuarine zones and pass varying period of their life span for the purpose of either feeding or spawning. However, there are certain species which have made the estuaries their almost permanent abode and pass major part of their lives.

Sunderban estuarine complex is formed by river Ganga and its distributories in Indian region. It is a criss-cross network of a large number of smaller distributories in lower Gangetic delta. The lower zone of the estuarine system falls under mangrove forests, which because of their abundant food supply and shelter, provide very suitable conditions, specially to young ones of many species. With the result, both diversity and density of fish species are always higher in lower zone as compared to middle and upper zones.

The fish fauna of entire Hugly-Matla estuarine system including lower zone falling under Sunderban, have attracted the attention of a number of scientists since the beginning of nineteenth century. Hamilton-Buchanan (1922) was the first worker who carried out the extensive survey of the region for a very long period and described fish fauna of the Ganga system including a large number of species new to science. Day (1877 and 1889) also made detailed study of the region. The works of Annandale (1907, 1922), Kemp (1917), Hora (1933, 1934, 1936, 1943), Perase (1932), Prasad *et al.* (1940), Koumans, (1942), Gupta (1967a, 1967b), Talwar (1991) and Talwar *et al.* (1992) etc. have also added considerably to our knowledge of fishes of Sunderban.

Similarly, the biology of several commercially important species have also been studied during nineteen fifties and sixties. Pillay (1958) worked out the length-weight relationship, condition factor, food and feeding habits, etc. of the most important fish of this region, *Hilsa (Tenulosa) ilisha* (Hamilton-Buchanan). Sarojni (1957, 1958) studied the biology of grey mullets (Family : Mugilidae), Pantalu (1961, 1962) determined the age and growth rate and some other biological parameters of few cat fishes, Krishnayya (1961) studied the age and growth and other related aspects of the biology of Gangetic whittings. Varghese (1961, 1973) reported his observations on the biology of few species of Clupeidae and Gupta (1967a, 1967 b) observed the biology of ribbon fishes. Besides these, Pillay and Ghosh (1962) analysed the composition of bag net fishery and Chandra (1962) analysed the abundance of larvae and juveniles of few important species.

After that period, not much concrete studies on the biological aspects of fishes of Sunderban region have been made, although nearly three decades have passed and

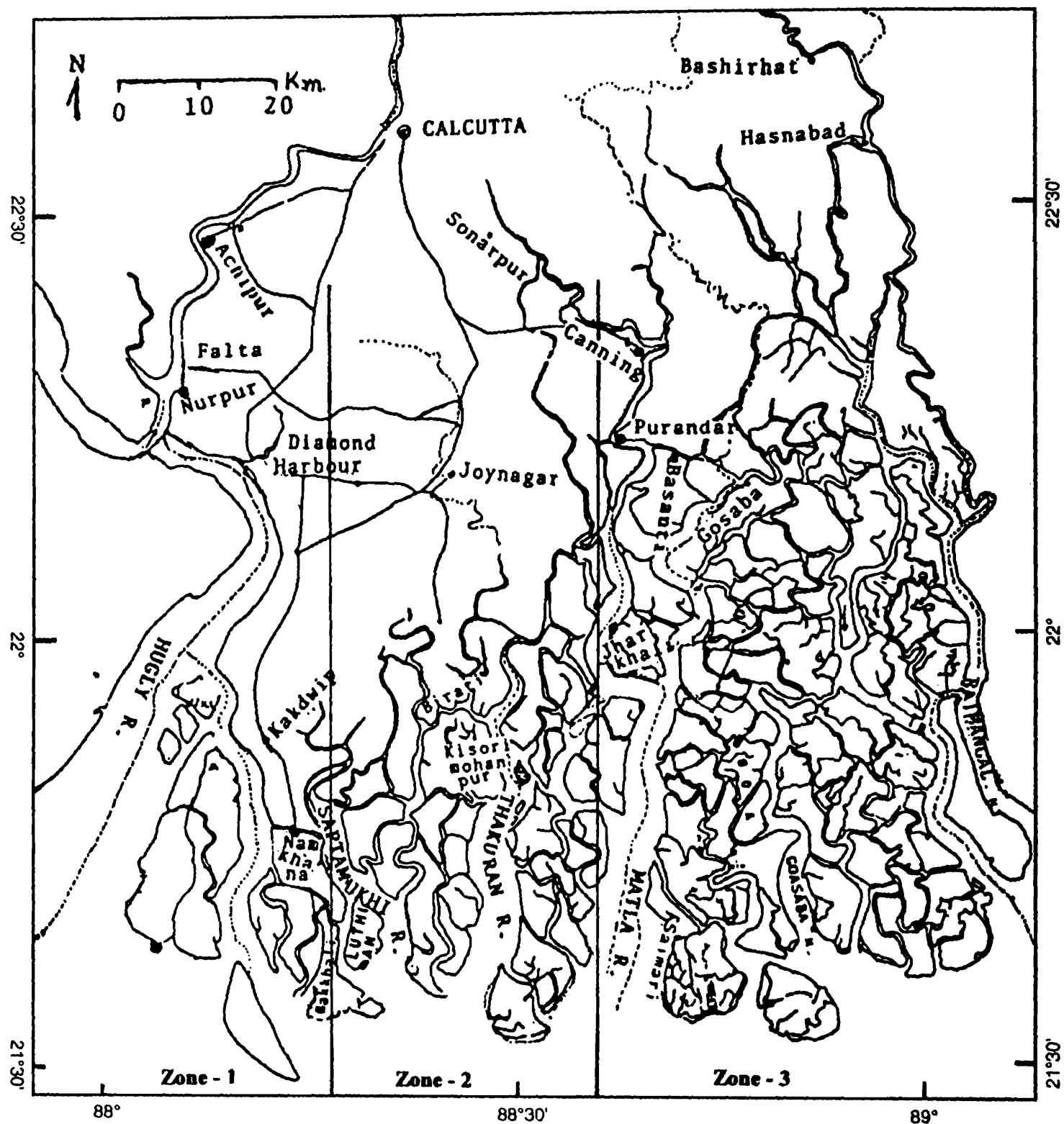


Fig. 1. Sunderban Estuarine Zone of Hugly-Matla System

apparent changes have occurred in the environmental conditions of the estuarine system. This has probably resulted in the alteration of faunal composition as well as life conditions of individual species. As evident from the present studies a large number of species recorded from the region by earlier workers, could not be collected inspite of surveys spanning to several years.

Taking these facts into consideration, the present work was undertaken during the period 1985-1995 in order to study the current availability of different species in the region alongwith the study of the biology of four commercially important and abundant species viz. Bombay duck, *Harpodon nehereus* (Hamilton-Buchanan), Rat-tailed anchovy, *Coilia ramcarati* (Hamiton Buchanan), Threadfin, *Eleutheronema tetradactylum* (Shaw) and Ribbon fish, *Lepturacanthus savala* (Cuvier).

## MATERIALS AND METHODS

### 1. The study Area

The details of Hugly Matla estuarine system, including the lower zone which forms the Sunderban region, have already been described (Khan, 1995). The present study is based on the materials from the Sunderban mangrove zone only. The entire Sunderban region was divided into following three major zones.

**Zone 1. Hugly estuarine zone :** This zone covers the area of Main river Hugly west of Saptamukhi including Muriganga. The important collection centres were Jambu island, Namkhana, Hatania Duania, Frasersgunj, Bakkhali and Kakdwip.

**Zone 2. Thakuran estuarine zone :** This covered the areas between east of Saptamukhi (including) and west of Matla. The important collection centers were Raidighi, Dhanchi, Kishorimohanpur, Ajmalmari-Kaikalmari and Kalas etc. Most of the collections from this zones were obtained from on-board commercial fishing collection and despatch centres, stationed near Kalas island during post monsoon fishery season.

**Zone 3. Matla-Raimangal zone :** This zone covered the rest of area falling in Indian Sunderban region from river Matla eastward upto the national boundry. This included important estuaries like, Goasaba, Harinbhanga, and western bank of Raimangal and Icchamati. Most of the areas of this zone fall under Sunderban Tiger Reserve and are not much disturbed. Fishing is allowed on restricted permit basis mainly by individual fishermen operating with country boats and bagnets. The important collection centres were chhotahardi, Gona, Choramayadwip, Matla, Jharkhali, Netidhopani, Sudhanyakhali, Jharkhali-Deolbari, Sajnakhali, Goasaba, Basanti-Sonakhali, Khatwajhuri, Rangabelia, Marichjhapi and Bagna etc. The areas around Canning like Dabu, Purandar, Golabari etc. also fall in Matla zone. (Fig. 1)

### 2. Assesment of Total annual catch & catch Composition

In order to assess the annual fish production and catch composition of the Hugly

Matla estuarine system in Sunderban region, the data compiled by Central Inland capture Fisheries Research Institute, Barrackpore were taken into consideration for analysis.

### 3. Collections

Qualitative collection for faunal resources were made during several extensive and intensive surveys spanned over several years. Most of the collection were obtained from fisherman operating in the area. Samples were preserved in 5% formalin for further study. Beside these, materials for biological studies were also obtained from major landing centres *viz.* Canning, Raidighi and Kakdwip/Namkhana and also from wholesale fish market at Sealdah.

For approximate estimate of catch composition, random samples from different landing centres were examined during different seasons, at the time of collections of samples for the study of biology. Random samples of the required species for biological studies were also collected roughly taking into consideration all available size groups. The post larvae and juveniles were collected by small fry nets and plankton nets periodically as these were not available from fishermen's catches. Since the entire estuarine system in lower zones has been taken into considerations, therefore, except for random samples for zonewise catch compositions, all samples for biological studies were pooled together. Most of the collections for biological study came from bag net fishery operations. Most of the measurement were carried out on fresh fishes immediately after collections and after measurements and removal of gonads and guts, fishes were disposed of.

Species identification was based mainly on Talwar and Kacker (1984).

### 4. Biological study

Total length was measured from tip of snout to caudal fin and standard length from tip of snout to caudal peduncle. Various other morphometric measurements were also recorded. Weight was taken to nearest 500 mg for which sometimes a jewellers hand balance was also used. Food and feeding habits were studied by analysing the gut contents. The intensity of feeding was determined by observing the distension of gut which was classified into 7 categories *viz.* Gorged, Full, 3/4 full, 1/2 full, 1/4 full, Traces and Empty guts. A fish was classified as actively fed if its gut fell under the first three categories. It was taken as moderately fed, if the guts belonged to next two categories and poorly fed if the condition of gut fell under Traces or Empty guts. All food contents of the guts were taken out and individual food items were separated, except semidigested/broken food, which were grouped together. Arbitrary points were allotted based on volumes determined by displacement method and also by frequency of occurrence (Hynes, 1950, Pillay, 1952). These points were converted into percentage of total food and expressed as relative composition. The length weight relationship was calculated by regression analysis as  $\log W = \log a + n \log L$  or  $W = aL^n$ , where  $W$  is weight,  $L$  is length and ' $a$ ' and ' $n$ ' are constants, to be obtained from the regression analysis. ANOVA was carried out to test the significance of differences between sexes or between juveniles and adults, wherever possible or required.

The relative condition factor 'Kn' was determined by dividing observed weight by calculated weight. Reproductive biological studies were based on the occurrence of mature individuals in the population during different seasons, the progressive morphological changes in ovaries and size frequency distribution of ova in maturing or mature ovaries. The maturity stages were classified into five major stages, viz immature–Stage I (corresponding to Stage 1 of ICSE), maturing vergin or recovery spent–Stage II (Stage II of ICSE), Maturing–Stage III (Stages III and IV of ICSE), ripe–Stage IV (Stages V and VI of ICSE) and spent–Stage V (Stage VII of ICSE). Size frequency of ova was determined by randomly measuring about 100 ova under a binocular microscope with the help of ocular micrometer. Fecundity was determined by counting all ova in a small weighed piece of mature ovary and then converted to total ovary weight.

For length frequency distribution studies the fishes were grouped into different size groups. Frequency of occurrence of different size groups was plotted against each size group and a polymodal curve was drawn from which different age groups and mean length at various ages were determined based on occurrence of modes.

Von-Bartalanffy (1938) growth equations were worked out based on length at age data following Beverton and Holt (1957) as :

$$L_t = L_{\infty} (1 - e^{-k(t-t_0)})$$

Where  $L_t$  is length at age  $t$  and  $L_{\infty}$  is asymptotic length,  $e$  is base of neperian logarithms,  $k$  is coefficient of catabolism and is a constant,  $t$  is age of the fish and  $t_0$  is the age at which the length of the fish would be 0.

To fit the equation it may be written as :  $L_{t+1} = L_{\infty} (1 - e^{-k}) + 1te^{-k}$

Where  $L_{t+1}$  and  $L_t$  are lengths of the fish at age  $t+1$  and  $t$ . This equation shows a linear relationship between  $L_t$  and  $L_{t+1}$ . The regression coefficient gives the value of  $k$  from which  $K$  can be calculated as  $K = (e^{-k})$ . The  $L_{\infty}$  was determined graphically where the straight line of this plot cuts the bisector, and also by equation  $\frac{1-k}{a}$ , Where  $k$  is the regression coefficient.  $t_0$  was calculated by plotting  $\log_e (1 - L_t/L_{\infty})$  against age and a regression line was drawn. The regression line, where it meets  $\log_e L_{\infty}$ , was estimated. For seasonal analysis, the seasons were divided as Premonsoon (March-June), Monsoon (July-October) and Post monsoon (November-February). Each Season was Sub-divided into an early, (I, the first two months) and Late (II, the last two months).

## RESULTS AND DISCUSSION

### A. FAUNAL RESOURCES

Although a large number of species have been reported to occur in sunderban estuarine system (Talwar, 1991, Talwar *et. al.*, 1992), the present report is based on actual collections

made during the period of present study and includes 'generally occurring' species. Altogether 106 species belonging to 82 genera and 42 families were recorded which are listed below :

Super Class    PISCES  
                   Class    CHONDRICHTHYES  
                   Order    CARCHARHINIFORMES  
                   Family    CARCHARHINIDAE

1. *Scoliodon laticaudus* Muller and Hinle

                  Order    RAJIFORMES  
                   Family    RHINOBATIDAE

2. *Rhinobatos granulatus* Cuvier

                  Family    DASYATIDAE  
                   Subfamily    DASYATINAE

3. *Dasyatis zugei* (Muller and Hinle)

4. *Himantura marginatus* (Blyth)

                  Sub Family    GYMNURINAE

5. *Gymnura japonica* (Schlegel)

6. *Gymnura poecilura* (Shaw)

                  Class    OSTEICHTHYES  
                   Order    ANGUILLIFORMES  
                   Family    ANGUILLIDAE

7. *Anguilla bengalensis* (Gray and Hardwicke)

                  Family    MURAENIDAE

8. *Lycodontis tile* (Hamilton-Buchanan)

                  Family    MURAENESOCIDAE

9. *Muraenesox bagio* (Hamilton-Buchanan)

10. *Congresox talabon* (Hamilton-Buchanan)

                  Family    OPHICHTHIDAE

11. *Pisodonopsis boro* (Hamilton-Buchanan)

                  Order    CLUPEIFORMES  
                   Family    CLUPEIDAE  
                   Subfamily    CLUPEINAE

12. *Escualosa thoracata* (Valenciennes)

## Subfamily ALOSINAE

13. *Hilsa (Tenulosa) ilisha* (Hamilton-Buchanan)
14. *Hilsa toli* (Valenciennes)

## Subfamily PELLONULINAE

15. *Corica soborna* (Hamilton-Buchanan)

## Subfamily DROSOMATINAE

16. *Anodontostoma chacunda* (Hamilton-Buchanan)

## Family PRISTOGASTERIDAE

17. *Ilisha elongata* (Bennett)
18. *Ilisha melastoma* (Schneider)
19. *Opisthopterus tardoore* (Cuvier)
20. *Pellona ditchela* Valenciennes
21. *Raconda russeliana* Gray

## Family ENGRAULIDIDAE

22. *Coilia dussumieri* Valenciennes
23. *Coilia ramcarati* (Hamilton-Buchanan)
24. *Coilia reynaldi* Valenciennes
25. *Setipinna phasa* (Hamilton-Buchanan)
26. *Setipinna taty* (Valenciennes)
27. *Setipinna tenuifilis* Valenciennes
28. *Stolephorus bagenensis* Hardenberg
29. *Thryssa dussumieri* (Valenciennes)
30. *Thryssa hamiltoni* (Gray)
31. *Thryssa purava* (Hamilton-Buchanan)

## Family CHIROCENTRIDAE

32. *Chirocentrus dorab* (Forsskal)

## Order GONORYNCHIFORMES

## Family CHANIDAE

33. *Chanos chanos* (Forsskal)

## Order SILURIFORMES

## Family BAGARIDAE

34. *Mystus gulio* (Hamilton-Buchanan)
35. *Mystus vittatus* (Bloch)

## Family ARIIDAE

- 36. *Arius arius* (Hamilton-Buchanan)
- 37. *Arius caelatus* Valenciennes
- 38. *Arius sona* (Hamilton-Buchanan)
- 39. *Arius jella* Day.
- 40. *Arius thalassinus* (Ruppel)
- 41. *Osteogeneiosus militaris* (Linnaeus)

## Family PANGASIDAE

- 42. *Pangasius pangasius* (Hamilton-Buchanan)

## Family PLOTOSIDAE

- 43. *Plotosus canius* Hamilton-Buchanan.

## Order AULOPIFORMES

## Family HARPADONTIDAE

- 44. *Harpadon nehereus* (Hamilton-Buchanan)

## Order GADIFORMES

## Family BREGMACEROTIDAE

- 45. *Bregmaceros maclellandi* Thompson

## Order CYPRINODONTIFORMES

## Family HEMIRAMPHIDAE

- 46. *Hyporhamphus limbatus* (Valenciennes)
- 47. *Zenarchopterus ectuntio* (Hamilton-Buchanan)

## Family BELONIDAE

- 48. *Strongylura strongylura* (Van Hasselt)

## Order SCORPAENIFORMES

## Family PLATYCEPHALIDAE

- 49. *Platycephalus indicus* (Linnaeus)
- 50. *Platycephalus scaber* (Linnaeus)

## Order PERCIFORMES

## Family AMBASSIDAE

- 51. *Chanda nama* (Hamilton-Buchanan)

## Family CENTROPOMIDAE

- 52. *Lates calcarifer* (Bloch)

Family TERAPONIDAE

53. *Terapon jarbua* (Forsskal)

Family SILLAGINIDAE

54. *Sillaginopsis panijus* (Hamilton-Buchanan)

55. *Sillago sihama* (Forsskal)

Family CARANGIDAE

56. *Alectis indicus* (Ruppell)

57. *Carangoides malabaricus* (Bloch)

58. *Caranx carangus* (Bloch)

59. *Scomberoides tala* (Cuvier)

Family CORYPHAENIDAE

60. *Coryphaena hippurus* Linnaeus

Family LEIOGNATHIDAE

61. *Lieognathus blochii* (Vallenciennes)

62. *Leiognathus equuals* (Forsskal)

63. *Secutor ruconius* (Hamilton-Buchanan)

Family LUTJANIDAE

64. *Lutjanus johni* (Bloch)

Family GERREIDAE

65. *Gerreomorpha setifer* (Hamilton-Buchanan)

Family HAEMULIDAE

66. *Pomadasys argenteus* (Forsskal)

Family SPARIDAE

67. *Acanthopagrus latus* (Houttuyn)

Family SCIAENIDAE

68. *Chrysochir aureus* (Richardson)

69. *Daysciaena albida* (Cuvier)

70. *Johnius sina* (Cuvier)

71. *Johnius belangerii* (Cuvier)

72. *Otolithoides biauritus* (Cantor)

73. *Pama pama* (Hamilton-Buchanan)

74. *Panna microdon* (Bleeker)

75. *Macrospinosa cuja* (Hamilton-Buchanan)

## Family EPHIPPIDAE

76. *Drepane punctata* (Linnaeus)

## Family SCATOPHAGIDAE

77. *Scatophagus argus* (Bloch)

## Family MUGILIDAE

78. *Liza parsia* (Hamilton-Buchanan)  
79. *Liza tade* (Forsskal)  
80. *Rhinomugil corsula* (Hamilton-Buchann)  
81. *Mugil cephalus* Linnaeus

## Family POLYNEMIDAE

82. *Eleutheronema tetradactylum* (Shaw)  
83. *Polydactylus indicus* (Shaw)  
84. *Polydactylus sextarius* (Bloch)  
85. *Polynemus paradiseus* Linnaeus

## Family GOBIDAE

86. *Acentrogobius globiceps* (Hora)  
87. *Apocryptes bato* (Hamilton-Buchanan)  
88. *Boleophthalmus boddaerti* (Valenciennes)  
89. *Boleophthalmus dussumieri* Valenciennes  
90. *Glossogobius giuris* (Hamilton-Buchanan)  
91. *Gobiopterus chuano* (Hamilton-Buchanan)  
92. *Periophthalmus keelreuteri* (Pallas)  
93. *Periophthalmus pearsei* Eggert.

## Family KURTIDAE

94. *Kurtus indicus* Bloch

## Family TRICHIURIDAE

95. *Lepturacanthus savala* (Cuvier)  
96. *Lepturacanthus pantului* (Gupta)  
97. *Trichiurus lepturus* Linnaeus

## Family STROMATEIDAE

98. *Pampus argenteus* (Euphrasen)  
99. *Pampus chinensis* (Eupharasen)

## Order PLEURONCE TIFORMES

## Family BOTHIDAE

100. *Pseudorhombus arsius* (Hamilton-Buchanan)101. *Pseudorhombus elevatus* Ogilby

## Family CYNOGLOSSIDAE

102. *Cynoglossus cynoglossus* (Hamilton-Buchanan)103. *Cynoglossus lingua* Hamilton-Buchanan104. *Cynoglossus puncticeps* (Richardson)

## Order TETRAODONTIFORMES

## Family TETRAODONTIDAE

105. *Chelonodon fluviatilis* (Hamilton-Buchanan)106. *Chelonodon patoca* (Hamilton-Buchanan)

As there are not many genera and species in a family, the key is given upto family level or sometimes at subfamily level. The important diagnostic character of each species is provided under the description of the species.

## Key to the Families

1. (a) Five separate gill openings on each side of body (Class Chondrichthyes- cartilaginous fishes) ..... 2
- (b) Single gill opening on each side of body (Class Osteichthyes- bonny fishes) . 4
2. (a) Gill opening on lateral side of head; ellongated body, eyes over mouth; two dorsal fins, base of first anterior to pelvic fin; pectoral fin ventral; anal fin present ..... CARCHARINIDAE
- (b) Gill opening ventral; anterior end of pectoral fin generally enlarged and attached to sides of head anterior to gill openings; anal fin absent ..... 3
3. (a) Body shark like, moderately depressed; pectoral fins not much enlarged; tail not distinctly marked off the body; snout wedge shaped and prolonged without teeth ..... RHINOBATIDAE
- (b) Body depressed, disc like; pectoral fins broadly enlarged; tails sharply marked of the body, long, whip like; eyes and spiracles on top of head. .... DASYATIDAE
4. (a) Body bilaterally symmetrical ..... 5
- (b) Body not symmetrical bilaterally, highly compressed. .... 43
5. (a) Body eel like, ellongated, round in cross section; narrow gill openings on sides of head. .... 6
- (b) Body not eel like; gill openings normal; pelvic fin present ..... 9
6. (a) Body with minute embeded scales; dorsal, pectoral anal and caudal fins developed ..... ANGUILLIDAE

- (b) Body without scales ..... 7
- 7. (a) Large canine teeth on vomer ..... 8
- (b) No large canine teeth on vomer; posterior nostril opening inside mouth on upper lip; tail sharp, spade like ..... OPHICHTHIDAE
- 8. (a) Pectoral fins well developed ..... MURAENESOCIDAE
- (b) Pectoral fin absent ..... MURAENIDAE
- 9. (a) Pectoral fins divided into two parts, the upper part normal, with rays attached, the lower with several free filamentous rays. .... POLYNEMIDAE
- (b) Pectoral fins normal, without free filamentous rays ..... 10
- 10. (a) Body generally with scales; weberian apparatus absent ..... 11
- (b) Body and head scaleless; Weberian apparatus present; barbles around mouth 16
- 11. (a) Mesocoracoid present ..... 12
- (b) Mesocoracoid absent ..... 19
- 12. (a) Dorsal fin inserted in posterior half of body. .... CHIROCENTRIDAE
- (b) Dorsal fin almost median ..... 13
- 13. (a) Lateral line present; jaws toothless ..... CHANIDAE
- (b) Lateral line absent ..... 14
- 14. (a) Articulation of lower jaw behind eyes; snout projected, pig like; lower jaw underslug. .... ENGRAULIDIDAE
- (b) Articulation of lower jaw before eyes. .... 15
- 15. (a) Anal fins moderate, less than 30 rays ..... CLUPEIDAE
- (b) Anal fins long, with more than 30 rays ..... PRISTIGASTERIDE
- 16. (a) Caudal fin rounded, extends far forwards on dorsal surface. .... PLOTOSIDAE
- (b) Caudal fin forked, not extending on dorsal surface of body. .... 17
- 17. (a) Anal fin base very long; Nasal barbles absent ..... PANGASIDAE
- (b) Anal fin base short; nasal barbles present ..... 18
- 18. (a) Gill memberane united to isthmus ..... ARIIDAE
- (b) Gill memberanes free from isthmus but joined together ..... BAGARIDAE
- 19. (a) Adepose dorsal fin present; caudal fin trilobed; body transluscent.....  
..... HARPADONTIDAE

- (b) Adepose dorsal fin absent..... 20
20. (a) Pelvic fin absent, if present, then inserted below pectoral fin ..... 21
- (b) Pelvic fin present on belly, not far from pectoral fins ..... 22
21. (a) Mouth very small; gill opening restricted; body with small bony platelets. Teeth united. .... TETRAODONTIDAE
- (b) Mouth large; gill opening normal; Caudal fin separate from dorsal and anal fin; first dorsal fin a single long ray on nape, second with long base. .... BERGMACEROTIDAE
22. (a) Fins without spines; opercular and preopercular bones serrated or spinous. 23
- (b) Spinous rays present, atleast in one fin ..... 24
23. (a) Mouth opening large, both jaws extended into a long beak; teeth needle shaped; scales small ..... BELONIDAE
- (b) Mouth opening large, only lower jaw prolonged into a long beak; scales large ..... HEMIRAMPHIDAE
24. (a) Suborbital stay present; head extremely depressed, bony with spines, much broader than deep ..... PLATYCEPHALIDAE
- (b) Suborbital stay absent; head not depressed; no head spines ..... 25
25. (a) Two short widely separated dorsal fins; pelvic fin subabdoiminal, situated almost midway between pectoral fin base and origin of first dorsal; lateral line absent ..... MUGILIDAE
- (b) Two dorsal fin bases contiguous with a notch; pelvic fin situated near the base of pectoral fins; lateral line present ..... 26
26. (a) A short occipital hook in males; lateral line short and rhudimentry ..... KURTIDAE
- (b) No occipital hook; lateral line not rhudimentry ..... 27
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## SYSTEMATIC ACCOUNT

Class CHONDRICHTHYES  
 (Cartilaginous fishes)

The sharks, skates and rays were represented mainly by six most important and abundant species in the collections belonging to three families. Although there are a few other species reported to enter the estuaries, those do not appear to be of much significance.

Order CARCHARHINIFORMES

Family CARCHARHINIDAE

The family is characterised by typical shark like cargo shaped body with five large lateral gill openings, the last one below pectoral fin origin. Two dorsal fins, first one anterior to pelvic fin. Only one species was common in the region.

### 1. *Scoliodon laticaudus* (Muller and Hinle)

1841. *Carcharias (Scoliodon) laticaudus* Muller and Hinle, *Syst. Besch. Plagiost* : 28 (type locality : India)

1984. *Scoliodon laticaudus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 62.

*Material examined* : (i) 1 ex, Kakdwip, 18.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Jambu island, 20.xii.83, Coll. N.C. Nandi, (iii) 2 ex, Hatania Duania, 31.xii.83, Coll. J. K. De, (iv) 2 ex, Haliday island, 6.xi.88, Coll. R.A. Khan, (v) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan.

*Length range* : 185-370 mm.

*Colour* : Body pale brown, buff or dull white on sides, fins dark.

*Salient features* : Small sharks. Sclerodermal fusiform body, flattened towel shaped head with depressed long mouth; 5 gill slits. Spiracles absent, upper labial furrow poorly

developed, only visible when mouth is closed. Free rear tip of first dorsal over mid base of pelvic fin. Dorsal margins of caudal fin irregular and rippled; pectoral pit present.

*Habitat* : Inshore waters, enters estuaries at lower reaches.

*Geographical distribution* : Indo-west pacific.

*Remarks* : The species is fairly common near the mouth of estuaries of the region.

*Common name* : Indian dog shark.

Order RAJIFORMES

Family RHINOBATIDAE

Commonly known as guitar fishes because of their resemblance with guitar. The main characteristics of this family are wedge shaped snout and indistinct separation of tail from body. Pectoral fins are not much enlarged, gills undersides of body. This family was also represented by only one species.

## 2. *Rhinobatos granulatus* Cuvier

1829. *Rhinobatus granulatus* Cuvier, *Regne Animal.*, (ed. 2): 396 (type locality : ? Pondicherry)

*Material examined* : 1 ex, Jambu Island, 23.xii.83, Coll. N. C. Nandi.

*Length range* : 510 mm.

*Colour* : Body brownish above, whitish below.

*Salient features* : Body and head depressed, snout narrow and pointed, very long rostral ridge closed together for almost entire length. Back of body coarse and tuberculated. Mouth wide, nearly 2.8 times in preoral distance. Anterior nasal flap extending across anterior margins of nostrils. Spiracles almost equal to eye in size or slightly shorter. Pectoral fins not extending to tip of snout; caudal fin not bilobed.

*Habitat* : Coastal waters.

*Geographical distribution* : Indo-west pacific.

*Remarks* : The species occurs in lower reaches of the entire estuarine system and coastal waters. Not of much commercial importance.

*Common name* : Granulated shovelnose-ray

Family DASYATIDAE

Sting rays have depressed, wide and flat disc like body with sides formed by enlarged pectoral fins and sharply marked off whiplike tail. Eyes and spiracles present on top of

**head.** Five ventral gill openings. Two important subfamilies, Gymnurinae (disc more than 1.5 times as broad as long, tail shorter than body) and Dasyatinae (disc at the most 1.3 times as broad as long, tail longer than disc) are represented by one species each.

### Subfamily DASYTINAE

#### 3. *Dasyatis zugei* (Muller & Henle)

1841. *Trygon zugei* Muller and Henle, *Syst. Besch. Plagiost*; 165 (type locality : Japan; China; India-Pondicherry).

1984 *Dasyatis zugei* : Talwar and Kacker, *Commercial Sea Fishes of India*; 100.

*Material examined* : 2 ex, Choramayadwip, 4.xi.89, Coll. R.A. Khan.

*Length range* : Total length 190 mm., Disc length 95 mm, Disc width 93 mm.

*Colour* : Body dark brown with yellowish sides, tail fold buff coloured.

*Salient features* : Disc as long as wide, nearly quadrangular, tail rough with tubercles, whip like, without upper and lower cutaneous folds and one serrated spine. Spiracles larger than eye, mouth undulated and without buccal papillae on floor of mouth.

*Habitat* : Coastal waters.

*Geographical distribution* : Tropical Indo-west Pacific.

*Remarks* : Caught in small numbers by mechanized boats and trawlers operating in the coastal waters near the mouth of Hugly and Thakuran rivers. Used as food by local poor.

*Common name* : Pale edged sting ray.

### Subfamily GYMNURINAE

#### 4. *Himantura marginatus* (Blyth)

1861. *Trygon marginatus* Blyth, *J. Asiat. Soc. Bengal*, 29 : 38. (type locality : Lower Bengal)

1969. *Dasyatis (Himantura) marginatus* : Misra, *Fauna of India, Pisces* (2nd ed.), 1 : 163.

*Material examined* : 2 ex, Frasergunj, 23.xii.88, Coll, N.C. Nandi.

*Length range* : Total length 200-210 mm, Disc length 95-98 mm, Disc width 105-109 mm.

*Colour* : Gary above, dull white below, margins blackish.

*Salient Features* : Disc quadrangular, broader than long, skin soft, head and mid dorsal region with dense denticles. Whip like tail, long, more than twice the disc length with no upper and lower cutaneous fold but with a large serrated caudal spine. Mouth small with two buccal processes, spiracles almost double the eye in size.

*Habitat* : Estuaries and coastal waters.

*Geographical distribution* : India, Sri Lanka and Myanmar.

*Remarks* : The species is fairly common in lower reaches of Hugli estuarine zone but also occur in other regions. Caught in small quantities and consumed locally.

*Common name* : Blackedged sting ray.

### 5. *Gymnura japonica* (Schlegel)

1850. *Pteroplatea japonica* Schlegel, *Fauna Japonica, Pisces*, 4 (15) : 309 (type locality : Nagasaki Bay Japan).

1984. *Gymnura japonica* : Talwar and Kacker, *Commercial Sea Fishes of India* : 106.

*Material examined* : 1 ex, Jambu Island, 23.xii.83, Coll. N. C. Nandi.

*Length range* : Total length 120 mm, disc width 250 mm.

*Colour* : Dorsal surface of the disc gray, tail with broad rings.

*Salient features* : Rhomboid disc, more than twice broader than long. Tail selendrical, distinctly marked from body, 1.3 times in length of disc. No upper and lower cutaneous folds; weak serrated spines in anterior region. No dorsal and caudal fins. No buccal papillae on the floor of mouth; spiracles open upwards, larger than eyes and situated closely behind eyes. Skin smooth.

*Habitat* : Mouth of estuaries, coastal waters.

*Geographical distribution* : Indo-west pacific.

*Remarks* : The species generally do not enter the estuaries and caught mostly from the mouth near sea face by mechanised trawlers.

*Common name* : Longtailed butterfly ray.

### 6. *Gymnura poecilura* (Shaw)

1804. *Raja poecilura* Shaw, *Gen. Zool.*, 5 : 291 (on Tenkee-Kunsal of Russel, 1803, *Fishes of Coromandel*, 1 : 4 (type locality : Vizagapatnam).

1969. *Gymnura (Gymnura) poecilura* : Misra, *Fauna of India, Pisces* (2nd ed.), 1 : 182.

*Material examined* : 1 ex, Sandeshkhali, 3.xi.88, Coll. R. A. Khan.

*Length range* : 150 mm, width 230 mm.

*Colour* : Dorsal surface of the disc dark brown, ventral surface white. Tail with broad black rings.

*Salient features* : Disc broad, width slightly lesser than twice the length; Snout broad and obtuse with slight projection; Tail whip like, 1-3 times in length of the disc, without

cutaneous folds and caudal spine. Dorsal and caudal fins absent. Mouth moderate, without buccal processes; spiracles facing upwards, larger than eyes. Skin smooth.

*Habitat* : Shallow coastal waters, near the mouth of the estuaries.

*Geographical distribution* : Indo-west pacific.

*Remarks* : The species rarely enters the estuaries and occur in coastal waters near sea face. Of small commercial value locally.

*Common name* : Longtailed butterfly ray.

#### Class OSTEICHTHYES

Bony fishes were represented by 100 species belonging to 76 genera and 39 families in the collections.

#### Order ANGUILLIFORMES

##### Family ANGUILLIDAE

The common 'freshwater eels' have elongated, cylindrical, snake like body with minute embedded scales; well developed dorsal, pectoral, anal and caudal fins and separate lateral gill opening. Only one species of the family was recorded.

#### 7. *Anguilla bengalensis bengalensis* (Gray & hardwicke)

1834. *Muraena bengalensis* Gray and Hardwicke, *Illust. Indian Zool.* : pl 95 (type locality Ganga R.)

1878. *Anguilla bengalensis* : Day, *Fishes of India* : 659.

*Material examined* : 1 ex, Buddhakhali, 7.xii.83, Coll. N.C. Nandi.

*Length range* : 290 mm.

*Colour* : Body brown on upper side, belly yellowish, Fins yellow.

*Salient features* : Body snake like, cyclindrical anteriorly. Mouth extending to eye; teeth small, conical and in cardiform bands. Lower jaw teeth divided by a longitudinal groove. Dorsal fin long inserted near tip of snout, midway between gill opening and anal fin base. No spine. Anal fin equally long, caudal fin continued round the tail end. Scales rudimentary, embeded in skin.

*Habitat* : Marine, estuarine and freshwater. Occurs in wide range of salinity.

*Geographical distribution* : Pakistan, India, Sri Lanka, Burma and East Indies.

*Remarks* : An important eel species occurring in almost all zones of the system. Attains a good length.

*Common name* : Long finned eel, Local name : *Bam Mach*.

## Family MURAENIDAE

The bodies of 'Morey eels' are also elongated, snake like, but flattened from side to side and without scales. Large canine teeth on vomer present. Only one species was of common occurrence.

8. *Lycodontis tile* (Hamilton-Buchanan)

1822. *Lycodonts tille* Hamilton-Buchanan, *Fishes of Ganges* : (Type locality Ganges estuary)

*Material examined* : (i) 1 ex, Sonakhali, 18.ii.87, Coll. N. C. Nandi, (ii) 1 ex, Ajmalmari, 7.iii.89, Coll. R.A. Khan.

*Length range* : 100-130 mm.

*Colour* : Body dark yellow above, whitish below.

*Salient features* : Body, elongated, cylindrical and compressed; abdomen rounded. Head large, conical and compressed; snout conical. Hind nostril not tubular. Mouth terminal, wide; eyes small; Jaws equal; well developed teeth acute or molariform, upper jaw teeth in one row, sharp and slightly canine like. Dorsal fin near the tip of snout; anal fin long, similar to dorsal fin. Caudal fin continuous with dorsal and anal fins forming a whip like tail. Scales minute.

*Habitat* : Estuaries and freshwaters.

*Geographical distribution* : Hugly-Matla estuarine system.

*Remarks* : Very common in the entire estuarine system, not of much commercial value because of its small size. The species has so far been described from this estuarine system only.

## Family MURAENESOCIDAE

Elongated body, cylindrical in from and compressed tail, scaleless; large fang like canines on vomer; absence of pectoral fin and location of anus before the midpoint of body are the important characters of this family. It was represented by two common species in the present collections.

9. *Muraenesox bagio* (Hamilton-Buchanan)

1822. *Muraena bagio* Hamilton-Buchanan, *Fishes of ganges* : 364 (type locality : Ganges estuary)

1984. *Muraenesox bagio* : Talwar and Kacker, *Commercial Sea Fishes of India* : 238.

*Material examined* : 1 ex, Sonakhali, 18.ii.87, Coll. N.C. Nandi

*Length range* : 250 mm.

*Colour* : Body light grey.

**Salient features :** Snake like robust eel without scales. Snout and head long, pointed; mouth wide, cleft extending beyond eye. Eyes lateral, moderate, nearly one third of snout length. Teeth in jaws in two series, large, outer teeth on lower jaw pointing straight upwards. Palatine with several rows of teeth, middle ones large and conical. Fang like canine teeth in front of lower jaw and on vomer. Median canines on vomer with distinct basal lobes. Dorsal fin origin slightly in front of gill opening. Pectoral fin well developed. Anal fin long, continued round the tail. Dorsal fin also confluent to caudal fin.

**Habitat :** Seas and estuaries, soft muddy bottom.

**Geographical distribution :** Tropical Indo-west pacific.

**Remarks :** Occurs occasionally, specially in lower reaches of the Hugly estuary and captured by trawlers operating near the mouth.

**Common name :** Common pikc-conger.

#### 10. *Congresox talabon* (Cuvier)

1829. *Conger talabon* Cuvier, *Regne Animal.*, 2 (ed 2) : 350. (On 'Talabon' of Russel, 1803, *Fishes of Coraomondel*, 1 : 27, type locality : Vizagapatnam)

1984. *Congresox talabon* : Talwar and Kacker, *Commercial sea fishes of India* : 235.

**Material examined :** 1 ex, Jambu Island, 23.xii.83, Coll. N. C. Nandi.

**Length range :** 275 mm.

**Colour :** Body dark olive green, pectoral and pelvic fin borders dark.

**Salient features :** Eel shaped snake like robust body without any scales. Mouth very large, upper jaw extends well behind eyes. Teeth very prominent, in three rows, outer row in lower jaw directed horizontally outwards. Front teeth of lower jaw fang like canines. Vomerine median canine conical and without basal lobes. Dorsal fin origin before gill opening; pectoral fin well developed.

**Habitat :** Coastal waters and estuaries on soft bottom.

**Geographical distribution :** India, Indonesia and Southeast Asia.

**Remarks :** A large sized eel, caught from mouth of the estuary by trawlers. Not very common.

**Common name :** Indian pike-conger,

#### Family OPHICHTHIDAE

The 'snake eels' are tail burrowers and have elongated cylindrical snake like body with sharp, strong spade like tail. The posterior nostril opens inside the mouth in upper lip. Dorsal fin extends to full length of body. This was also represented by only one species.

### 11. *Pisodonopsis boro* (Hamilton-Buchanan)

1822. *Ophisurus boro* Hamilton-Buchanan, *Fishes of Ganges* : 20 (Type locality Hooghly estuary near Calcutta).

1984. *Pisidonopsis boro* : Talwar and Kacker, *Commercial Sea Fishes of India* : 249.

*Material examined* : (i) 3 ex, Sudhanyakali, 18.iv.85, Coll, R. A. Khan, (ii), 1 ex, Saimari, 10.iii.89, coll. R. A. Khan, (iii) 1 ex, Jhingakhali, 15.iii.89, Coll. R.A. Khan.

*Length range* : 38-85 mm.

*Colour* : Body brownish above, yellowish in sides.

*Salient features* : Body elongated and almost cylindrical, depth of the body nearly one third of the total length. Head length nearly one tenth of the total length. Snout moderately developed, subconical. Mouth large, cleft extending behind eye. Lower jaw short. Granular teeth in several series. Dorsal fin origin behind tip of pectoral fin. Low dorsal and anal fins extending to near tail tip. Tail tip finless.

*Habitat* : Marine and estuarine, enters freshwaters.

*Geographical distribution* : Indo-west pacific.

*Remarks* : Frequently caught from the entire estuarine system but of little commercial value.

*Common name* : Bengal's snake eel.

## Order CLUPEIFORMES

### Family CLUPEIDAE

It is the most important group of fishes in Sunderban region. These are characterised by strongly laterally compressed bodies; keeled abdominal scutes; absence of lateral line and fins without spine. The family was represented by the members of four important subfamilies viz. Drossomatinae (Inferior mouth, flared lower jaw and filamentous first dorsal ray), Alosinae (Upper jaw with a distinct notch at centre), Pellonulinae (Single supramaxilla) and Clupeinae (two supramaxilla). A total of 10 species belonged to this family in the present collection.

### Subfamily CLUPEINAE

### 12. *Escualosa thoracata* (Valenciennes)

1847. *Kowala thoracata* Valenciennes, *Hist. nat. Poiss.*, 20 : 363 (type locality : Pondicherry)

1973. *Escualosa thoracata* : Whitehead, *J. mar. biol. Ass. India*, 14 (1) : 189.

**Material examined :** (i) 1 ex, Kechuberia, 3.xi.83, Coll. N.C. Nandi (ii) 1 ex, Jamboo island, 23.xii.83, Coll. N.C. Nandi, (iii) 2 ex, Saimari, 23.viii.1987, Coll. R. A. Khan, (iv) 1 ex, Haldibari, 7.i.88, Coll. R. A. Khan.

**Length range :** 70-100 mm.

**Colour :** Silvery white flank, back buff coloured, fins hayline (colourless).

**Salient features :** Strongly compressed flattened body with sharply keeled belly. Scutes prepelvic 18-19, post pelvic 11-12. Mouth terminal, upper jaw slightly notched, with two large supra-maxillae, the second being rectangular. Gill opening smooth, round without any dermal growth. Dorsal fin origin at midbody point with 12 branched rays. Anal fin with 16 branched rays and pelvic fin with 7 rays.

**Habitat :** Coastal waters and lower zones of estuaries.

**Geographical distribution :** Pakistan, India, Sri Lanka, Indo-Malayan Archipelago to Queensland.

**Remarks :** Caught in small numbers occasionally and does not constitute any fishery of its own. Sold alongwith other smaller clupeids as trash fish.

**Common name :** White sardine.

### Subfamily ALOSINAE

#### 13. *Hilsa (Tenuulosa) ilisha* (Hamilton-Buchanan)

1822. *Clupanodon ilisha* Hamilton Buchanan, *Fishes of Ganges* : 243 (type locality : Ganges estuaries)

1973. *Hilsa (Tenuulosa) ilisha* : Whitehead, *J. mar. biol. Ass. India*, 14 (1) : 199.

**Material examined :** (i) 1 ex, Jamboo Island, 23.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Frasergung, 20.xii.83, Coll. N. C. Nandi, (iii) 1 ex, Kakdwip, 7.4.84, Coll. J. K. Dey.

**Length range :** 140-310 mm.

**Colour :** Back blue green, flank silvery, sometimes black blotches along flank in smaller individuals.

**Salient features :** Fusiform body with large scales. Belly keeled with 17-18 prepelvic and 14-15 post pelvic sharp scutes. Upper jaw with a distinct median notch. Top of head covered with thick skin. Gill rakers very fine, pseudobranchs rather attenuated with a vertical ridge and groove below. No teeth on jaws. Dorsal fin origin at midbody point with 15-16 branched rays; anal fin lies behind dorsal fin base; caudal fin as long as head.

**Habitat :** Coastal waters and estuaries, enters rivers.

**Geographical distribution :** Indo-west pacific.

**Remarks :** The most important fish species of Hugly estuary and coastal waters of West

Bengal. Highly delicious, and fetches very high price in the region. Major fishery of the species occurs during monsoon months when it ascends rivers for breeding. The species migrates over a very long distance upwards and have been recorded from the river Ganga flowing through U.P. Bihar and West Bengal.

*Common name* : Hilsa, *Local name* : *ilish*.

#### 14. *Hilsa (Tenuulosa) toli* (Valenciennes)

1847. *Alausa toli* Valenciennes, *Hist. nat. Poiss*, 20 : 435 (type locality : Pondicherry, Bombay)

1973. *Hilsa (Tenuulosa) toli* : Whitehead, *J. mar. biol. Ass. India*, 14 (1) : 200.

*Material examined* : (i) 1 ex, Kakdwip, 7.iv.84, Coll. J. K. De, (ii) 1 ex, Rakkhaskhali-Kakdwip, 10.viii.84, Coll. J. K. De, (iii) 1 ex, Purandar, 5.iv.85, Coll. R. A. Khan, (iv) 1 ex, Kalas, 10.iii.89, Coll. R. A. Khan.

*Length range* : 45-100 mm.

*Colour* : Back grey, flanks silvery.

*Salient features* : Fusiform body with large adherant scales, about 40 in lateral line series. Belly keeled with 17 prepelvic and 12 post pelvic scutes. Upper jaw with distinct median notch. Head covered with thick skin without striated frontoparietal areas. Gill rakers fine, pseudobranch not attenuated, without ventral ridge and groove, no teeth on jaws. Dorsal fin with 15 branched rays, originating slightly before mid body point. Caudal fin longer than head.

*Habitat* : Coastal waters, estuaries and rivers.

*Geographical distribution* : India, Indo-Australian archipelago and northwards to Hong Kong.

*Remarks* : Occur in moderate numbers in the commercial catches of the entire estuarine system. Because of its comparatively smaller size and not very good taste as compared to *H. ilisha*, it commands low price.

*Common name* : Toli Shad, *Local name* : *Kajli ilish*.

#### Subfamily PELLONULINAE

#### 15. *Corica savorina* (Hamilton-Buchanan)

1822. *Corica savorina* Hamilton-Buchanan, *Fishes of Ganges* : 642. (type locality : Mahanadi R.)

*Material examined* : (i) 2 ex, Panchmukhani, 26.iv.85, Coll. R. A. Khan, (ii) 1 ex, Rangabelia, 13.xi.89, Coll. R. A. Khan, (iii) 3 ex, Dhanchi, 8.iii.89, Coll. R. A. Khan.

*Length range* : 20-45 mm.

*Colour* : Body silvery with faint stripes on sides.

**Salient features :** Body somewhat compressed, belly with sharp keel and scutes. Scutes starting from pectoral fin base with 10 prepelvic and 7 post pelvic. Maxilla extending to about middle of eye. Single supramaxilla present. Lower jaw articulation below eye centre. Dorsal fin origin slightly below the centre of body towards caudal fin base and with 12 branched rays. Anal fin with 11 branched rays, origin nearer to pelvic fin base. The last two rays separated from rest of fin. Pelvic fin with 8 rays.

**Habitat :** Coastal waters and estuaries, enters rivers.

**Geographical distribution :** Bay of Bengal.

**Remarks :** Small sized fishes occur mainly in upper reaches of the estuary. Not of much fishery importance.

**Common name :** Hamilton's Corica.

#### Subfamily DROSSOMATINAE

##### 16. *Anodontostoma chacunda* (Hamilton-Buchanan)

1822. *Clupanodon chacunda* Hamilton-Buchanan, *Fishes of Ganges* : 246 (type locality : Gangetic estuaries)

1973. *Anodontostoma chacunda* : Whitehead, *J. mar. biol. Ass. India*, **14** (1) : 207.

**Material examined :** (i) 1 ex, Frasergunj, 20.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Jharkhali, 13.ii.87, Coll. N.C. Nandi, (iii) 1 ex, Haldibari, 22.vii.87, Coll. R.A. Khan, (iv) 1 ex, Choramayadwip, 4.xi.88, Coll. R. A. Khan, (v) 5 ex, Ajmalmari, 5.xi.88, Coll. R.A. Khan, (vi) 3 ex, Pirkhali, 9.xi.88, Coll. R. A. Khan, (vii) 3 ex, Kalas, 10.iii.89, Coll. R.A. Khan, (viii) 4 ex, Arbessi, 15.iii.89, Coll. R.A. Khan.

**Length range :** 70-140 mm.

**Colour :** Body silvery with a prominent dark spot besides operculum.

**Salient features :** Body deep and compressed, somewhat oval shaped; belly with 17 prepelvic and 14-15 post pelvic scutes; Mouth inferior, maxilla straight, thin with its tip tapering, dentary flared outwards in front of maxillary; gill rakers fine, 60-80 on first arch. Dorsal fin with 14-branched rays and without any filamentous ray; anal fin with 18-20 and pelvic fin with 7-8 rays. A median series of predorsal scales present.

**Habitat :** Coastal waters and estuaries, pelagic.

**Geographical distribution :** Pakistan, India, Sri Lanka, Thailand to Indonesia.

**Remarks :** The species occurs in the entire estuarine region in good numbers and caught generally by small fishermen operating with small motorized boats. Forms part of mixed clupied marketable lot.

**Common name :** Chacunda gizzard-shad.

### Family PRISTOGASTERINIDAE

Commonly known as 'gizzard fishes' and are characterized by fully scuted belly, terminal upwardly directed mouth and long anal fin. It is represented by four genera and five species.

#### 17. *Ilisha elongata* (Bennett)

1830. *Alosa elongata* Bennett, Mem. Life of Raffles : 691 (Type locality : Sumantra).

1976. *Ilisha elongata* : Misra, Fauna of India, Pisces (2nd ed), 1 : 79.

**Material examined :** (i) 1 ex, Basanti, 31.iii.85, Coll. R. A. Khan, (ii) 1 ex, Purandar, 17.ii.87, Coll. R. A. Khan, (iii) 1 ex, Kishorimohanpur, 9.xi.88, Coll. R.A. Khan.

**Length range :** 110-160 mm.

**Colour :** Flank Silvery, back gray.

**Salient features :** Body fairly elongated and compressed, nearly 30% of standard length; belly strongly keeled, with 24-25 prepelvic and 10-12 post pelvic scutes. Mouth terminal, moderate, lower jaw projecting. Teeth in a single series in both jaws. Pseudobranch present. Dorsal fin with 14-15 branched rays, its origin nearer caudal fin base than snout tip; pelvic fin small with no auxillary scales. Anal fin with 40-42 branched rays.

**Habitat :** Estuaries and coastal waters.

**Geographical distribution :** South east coast of India, Sumatra, China and Japan.

**Remarks :** This small size ilisha is an important species of Sunderban estuaries and occurs in moderate numbers in commercial catches of almost entire estuary. Food fish of moderate importance.

**Common name :** Elongate ilisha.

#### 18. *Ilisha melastoma* (Schneider)

1801. *Clupea malastoma* Schneider, Syst. Ichth. Bloch. : (Type locality Indian Ocean near Coromandel)

1973. *Ilisha melastoma* : Whitehead, J. mar. bio. Ass. India, 14 : 212.

**Material examined :** 2 ex, Purandar, 17.ii.87, Coll. N.C. Nandi.

**Length range :** 120-130 mm.

**Colour :** Brown above, flanks silvery white, edge of dorsal fin with dark pigment.

**Salient features :** Strongly compressed body, bearily one third of standard length. Belly with strongly keeled scutes 18 prepelvic and 9 post pelvic. Pseudobranch completely nacked. Gill rackers 24 on lower arm of first arch, Teeth minute in single row on both jaws. Dorsal fin origin nearer to snout tip than caudal fin base. Anal fin long with 36 branched rays.

**Habitat :** Coastal waters, enters estuaries.

**Geographical distribution :** Bay of Bengal. Indonesia to Hong Kong, Lakshadwip.

**Remarks :** Occurs in small numbers and does not contribute any fishery.

**Common name :** Indian ilisha.

### 19. *Opisthopterus tardoore* (Cuvier)

1829. *Pristogaster tardoore* Cuvier, *Regne Animal*, (2nd ed.), 2 : 321 (On 'Tartdoore' of Russel, 1803, *Fishes of Coromandel*, 2; 74 (type locality : Vizagapatnam).

1973. *Ophisopterus tardoore* : Whitehead, *J. mar. biol. Ass. India*, 14 (1) : 215.

**Material examined :** (i) 1 ex, Rakkhaskhali-Kakdwip, 16.viii.84, Coll. J. K. Dey, (ii) 2 ex, Thakuran-Matla, 3.xi.88, Coll. R.A. Khan, (iii) 6 ex, Ajmalmari-Kaikalmari, 8.xi.88, Coll. R.A. Khan.

**Length range :** 51-130 mm

**Colour :** Back dark blue, flanks silvery white.

**Salient features :** Body elongated and strongly compressed, belly scutes prominent, numbering 30-32, head concave dorsally. Mouth directed upwards, with very prominent lower jaw, no toothed hypomaxilla, pseudobranch present. Short dorsal fin with 12-14 branched rays and originates from behind the mid point of body, Anal fin very long with 50-55 branched rays. Pelvic fin absent.

**Habitat :** Coastal waters and lower zones of estuaries.

**Geographical distribution :** Coasts of India, Sri Lanka, Indonesia.

**Remarks :** Small sized clupeid, very common in Sunderban estuaries.

**Common name :** Tardooree

### 20. *Pellona ditchella* (Valenciennes)

1847. *Pellona ditchella* Valenciennes, *Hist. nat. Poiss.* 20 : 314 (On 'Ditchelee' of Russel, 1803, *Fishes of Coromandel*, 2 : 72) (Type locality : Vizagapatnam)

**Material examined :** (i) 1 ex, Frasergunj, 20.xi.83, Coll. N.C. Nandi, (ii) 1 ex, Kakdwip, 4.iv.84, Coll. J.K. Dey, (iii) 7 ex, Rakkhaskhali-Kakdwip, 18.viii.84, Coll. J. K. Dey, (iv) 14 ex, Sudhanyakhal, 17.iv.85, Coll. R.A. Khan, (v) 7 ex, Saimari, 23.8.87, Coll. R.A. Khan, (vi) 3 ex, Haldibari, 7.i.88, Coll. R.A.Khan, (vii) 1 ex, Chhotahardi, 5.xi.88, Coll. R.A. Khan, (viii) 2 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan, (ix) 2 ex, Haliday Island, 6.xi.88, Coll. R.A. Khan, (x) 1 ex., Gosaba, 6.iii.89, Coll. R.A. Khan.

**Length range :** 55-170 mm.

**Colour :** Body brown dorsally, flank silvery.

**Salient features :** Body deeply elongated and compressed, belly with 8-9 prepelvic and 18-20 post pelvic strongly keeled scutes. Mouth moderate, lower jaw prominent, upper jaw with toothed hupomaxilla. Eyes prominent and very large. Dorsal fin origin midway between tip of snout and caudal fin base, anal fin very long, pelvic fin origin slightly ahead of dorsal fin origin.

**Geographical distribution :** East coast of Africa, India through the East Indies to the Philippines and northern tip of Australia.

**Remarks :** The species occurs abundantly in the entire estuarine system almost throughout the year and constitutes a good fishery from the lower reaches.

**Common name :** Indian pellona.

### 21. *Raconda russeliana* Gray

1831. *Raconda russeliana* Gray, *Zool. Miscellany*, 1 : 9 (type locality : Sangar Road India).

**Material examined :** (i) 1 ex, Frasergunj, 20.xi.83, Coll. N.C. Nandi, (ii) 2 ex, Jambu Island, 23.xii.83, Coll. N.C. Nandi, (iii) 3 ex, Rakkhaskhali-Kakdwip, 17.viii.84, Coll. J.K. Dey, (iv) 2 ex, haldibari, 7.i.88, Coll. R.A. Khan.

**Length range :** 140-170 mm.

**Colour :** Back dark green, flanks silvery, grey patches on shoulder.

**Salient features :** Body elongated and compressed; head profile concave dorsally and convex ventrally; keeled abdomen, very small week scutes. Mouth projected upwards, lower jaw forwardly projecting; no tooth on hypomaxilla. No dorsal and pelvic fins. Anal fin very long.

**Habitat :** Estuarine mouth and foreshore areas.

**Geographical distribution :** India, Sri Lanka, Indo-Malayan Archipelago.

**Remarks :** This clupied is very common in the entire estuarine system of Sunderban and caught in sufficient quantities, specially during winter fishery operations. The fish is not of high economical value and either consumed locally or dried.

**Common name :** Russel's Smooth back herring.

### Family ENGRAULIDIDAE

Commonly known anchovies, the members of this family are characterised by fusiform, subcylindrical, compressed bodies which sometimes tapers into a slender tail. The belly is with keeled abdominal scutes. Very prominent snout; mouth underside of head; lower jaw very small, giving the appearance of a chinless head. Fins without any spiny rays. This family was represented by 10 commonly occurring species in the present collections.

## 22. *Coilia dussumeri* Valenciennes

1848. *Coilia dussumeri* Valenciennes, *Hist. nat. Poiss.*, 21 : 81 (type locality : Bombay)

**Material examined :** (i) 4 ex, Muriganga, 11.xi.79, Coll. A.K. Mondal, (ii) 1 ex, Purandar, 4.iv.85, Coll. R.A. Khan, (iii) 1 ex, Sudhanyakhal, 16.iv.85, Coll. R.A. Khan, (iv) 1 ex, Nithidopani, 31.viii.87, Coll. R.A. Khan, (v) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan, (vi) 1 ex, Gona Island, 6.iii.89, Coll. R.A. Khan, (viii) 2 ex, Chulkati, 10.iii.89, Coll. R.A. Khan.

**Length range :** 100-180 mm.

**Colour :** Back brown, flank silvery. Pearly spot on lower flank arranged longitudinally.

**Salient features :** Body elongate, tapering to a very slender long tail (rat like), belly rounded, with 6 prepelvic and 8 post pelvic scutes; Mouth oblique, snout pointed, maxilla tip pointed and extending to gill opening. Dorsal fin origin nearer to tip of snout, a small spine before its origin. Pectoral fin with 5-6 filamentous rays, pelvic fin with 7 rays, anal fin very long, confluent with caudal fin.

**Habitat :** Coastal waters and estuaries.

**Geographical distribution :** India, Indo-Australian Archipelago.

**Remarks :** The species occurs in almost all regions of the estuarine system and along with another species, *Coilia ramcarati* constitute good fishery during major period of the year. However, due to its small size, it is not liked much and constitutes the part of mixed clupied catches commanding low price.

**Common name :** Gold-spotted grenadier anchovy.

## 23. *Coilia ramcarati* (Hamilton-Buchanan)

1822. *Mystus ramcarati* Hamilton-Buchanan, *Fishes of Ganges* : 233. (type locality : Ganges estuaries)

1878. *Coilia ramcarati* : Day, *Fishes of India* : 631.

**Material examined :** (i) 2 ex, Jamboo island, 23.xii.83, Coll. N.C. Nandi, (ii) 3 ex, Jamboo island, 20.xii.86, Coll. N.C. Nandi, (iii) 8 ex, Basanti, 31.iii.85, Coll. R.A. Khan, (iv) 1 ex, Kalinagar, 20.vi.86, Coll. R.A. Khan, (v) 1 ex, Sonakhali, 23.viii.87, Coll. R.A. Khan, (vi) 1 ex, Thakuran-Matla, 8.xi.88, (vii) 3 ex, Chhotahardi, 5.xi.88, Coll. R.A. Khan, (viii) 3 ex, Haliday island, 6.xi.88, Coll. R.A. Khan, (ix), 2 ex, Kalas, 10.iii.89, Coll. R.A. Khan (x) 2 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

**Length range :** 15-215 mm.

**Colour :** Body whitish, slightly brownish near dorsal fin, fins colourless. No pearly spots on the flank of body.

**Salient features :** Body compressed, tapering gradually to caudal fin, belly rounded under pectoral fin base but compressed behind pelvic with 5 prepelvic and 10 post-pelvic

scutes. A small spine before dorsal fin; pectoral fin with 6-7 filamentous rays; pelvic with 9 rays; anal fin long, confluent with caudal fin. Maxilla tip pointed, extending to articulation of lower jaw.

*Habitat* : Estuaries.

*Geographical distribution* : Ganga river estuaries (endemic)

*Remarks* : An important clupeid species of Sunderban estuarine system and forms main anchovy fishery along with *C. dussumieri*. It is an endemic species of Hugly Matla estuarine system.

*Common name* : Tapertail anchovy.

#### 24. *Coilia reynaldi* Valenciennes

1847. *Coilia reynaldi* Valenciennes, *Hist. nat. Poiss.*, 21 : 81 (type locality : Rangoon).

*Material examined* : (i) 1 ex, Frassergunj, 20.xii.83, Coll. N.C. Nandi, (ii) 2 ex. Jambu Island, 23.xii.83, Coll. N.C. Nandi, (iii) 1 ex, Kalinagar, 20.vi.86, coll. R.A. Khan, (iv) 5 ex, Saimari, 23.viii.87, Coll. R.A. Khan, (v) 2 ex, Haldibari, 7.i.88, Coll. R.A. Khan.

*Length range* : 120-160 mm.

*Colour* : Greenish above, flank and abdomen yellow, fins hayline.

*Salient features* : Body compressed, deepest below dorsal fin origin, tapering gradually to caudal fin, belly rounded and keeled from pectoral fin origin to vent. Scutes 7-8 prepelvic and 8-10 post pelvic. Maxilla not reaching to gill opening. Small spine before dorsal fin, pectoral fin with 11-13 filamentous rays, pelvic with 7 rays, anal fin long, confluent with caudal fin.

*Geographical distribution* : India and Burma.

*Remarks* : Fairly common, occurs alongwith other anchovys in commercial catches.

*Common name* : Korua grenadier anchovy.

#### 25. *Setipinna phasa* (Hamilton-Buchanan)

1822. *Clupea phasa* Hamilton-Buchanan, *Fishes of Ganges*, : 240 (Type locality : brackish rivers of Bengal)

1973. *Setipinna phasa* : Whitehead, *J. mar. bio. Ass. India*, 14 (1) : 238.

*Material examined* : (i) 1 ex, Kakdwip, 7.iv.84, Coll. J. K. Dey, (ii) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan, (iii) 2 ex, Haliday island, 6.xi.88, Coll. R.A. Khan, (iv) 1 ex, Thakuran-Matla, 8.xi.88, Coll. R.A. Khan, (v) 1 ex, Ajmalmari, 9.xi.88, Coll. R.A. Khan, (vi) 3 ex, Gona, 6.xi.89, Coll. R.A. Khan.

*Length range* : 115-230 mm.

*Colour* : Body gray above, flank silvery.

**Salient features :** Body fusiform, deeply compressed belly strongly keeled with 15 prepelvic and 6 post pelvic scutes. Snout blunt but slightly pointed; maxilla short, extending nearly to gill opening, supra maxilla absent. Dorsal fin origin nearer to snout; first ray of pectoral fin filamentous; anal fin with 72-80 branched rays.

**Habitat :** Coastal waters, estuaries and rivers.

**Geographical distribution :** Northern Bay of Bengal, Burma.

**Remarks :** One of the important fish of the Ganga river and estuarine system. Occur abundantly in the entire estuarine system and considerably distance upwards in Ganga river. It constitute a good fishery, specially during post monsoon fishery operations in the estuarine region. However, due to its poor food quality it fetches low marker price.

**Common name :** Gangetic anchovy, *Phasa*

## 26. *Setipinna taty* (Valenciennes)

1848. *Engraulis taty* Valenciennes, *Hist. nat. poiss.*, 21 : 60 (type locality : Pondicherry)

1973. *Setipinna taty* : Whitehead, *J. mar. biol. Ass. India*, 14 (1) : 237.

**Material examined :** (i) 1 ex, Haldibari, 7.1.88, Coll. R.A. Khan, (ii) 2 ex, Sandeshkhali, 4.xi.88, Coll. R.A. Khan, (iii) 3 ex, Kalas, 10.iii.89, Coll. R.A. Khan, (iv) 1 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

**Length range :** 127-145 mm.

**Colour :** Body bluish above, flank silvery.

**Salient features :** Deeply compressed fusiform body, sharply keeled belly with 22-29 prepelvic and 10-13 post pelvic scutes. Snout bluntly pointed; maxilla short but just reaching to gill opening. Serrae on gill rakers forming distinct clumps. Anal fin long with 50-56 branched rays, first ray of pectoral fin filamentous with 12-13 branched rays.

**Habit :** Estuaries and adjoining coastal waters.

**Geographical distribution :** East coast of India, Sri Lanka and East Indies.

**Remarks :** It occurs in small numbers alongwith *S. phasa* in all regions of the estuarine system but does not contribute much to anchovy fishery.

**Common name :** Hairfin anchovy.

## 27. *Setipinna tenuifilis* Valenciennes

1848. *Setipinna tenuifilis* Valenciennes, *Hist. nat. Poiss.*, 21 : 62 (type locality : Rangoon).

**Material examined :** (i) 3 ex, Muriganga, 11.ii.79, Coll. A.K. Mondal, (ii) 1 ex, Dabu Canning, 11.i.88, Coll. S.C. Saren, (iii) 1 ex, Chotardi, 5.xi.88, Coll. R.A. Khan, (iv) 2 ex, Haliday island, 6.xi.88, Coll. R.A. Khan (v) 1 ex, Kishorimohanpur, 9.xi.88, Coll. R.A. Khan.

*Length range* : 127-145 mm.

*Salient features* : Fusiform deeply compressed body, sharply keeled belly with 25-28 prepelvic and 11-12 post pelvic scutes. Maxilla short, not reaching to gill opening. Serrae on gill rakers in distinct clumps. Anal fin with 49-54 branched rays, pectoral fin with 12-13 branched rays, the first ray filamentous.

*Habitat* : Estuaries and adjoining coastal waters.

*Geographical distribution* : Bay of Bengal and Northern Borneo.

*Remarks* : Like *S. taty*, it also occurs in all regions but contributes little to commercial anchovy fishery.

*Common name* : Godavari anchovy.

## 28. *Stolephorus bagenensis* Hardenberg

1931. *Stolephorus bagenensis* Hardenberg, *Treubia*, **13**, 107 (type locality Rokhan river mouth.

1984. *Stolephorus bagenensis* : Talwar and Kacker, *Commercial Sea Fishes India*; 186.

*Material examined* : (i) 12 ex, Sitagunj Kakdwip, 4.11.83, Coll. N.C. Nandi, (ii) 2 ex, Purandar, 17.ii.88, Coll. R.A. Khan, (iii) 1 ex, Chotardi, 5.xi.88, Coll. R.A. Khan, (iv) 3, ex, Chaulamari, 9.xi.88, Coll. R.A. Khan, (v) 7 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan.

*Length range* : 30-120 mm.

*Colour* : Creamy above, belly lighter, bright silvery stripe on flanks, two rows of small spots on back and behind of dorsal fin.

*Salient features* : Fusiform body, slightly compressed, belly rounded. Scutes only between pectoral and pelvic fins, 7 in numbers and needle like. A distinctive spine on pelvic scute between fin bases. Snout somewhat rounded, slightly projecting, tip of maxilla reaching to gill opening. Hind border of preoperculum smooth. Dorsal fin with 12 rays and with a small predorsal spine. Anal fin with 18 rays.

*Habitat* : Coastal waters and estuaries, pelagic.

*Geographical distribution* : North east coast of India, Indo-Malayan archipelago.

*Remarks* : These small sized fishes occur in large numbers in shoals. Captured in small quantities and consumed fresh.

*Common name* : Spined anchovy.

## 29. *Thryssa dussumieri* (Valenciennes)

1848. *Engraulis dussumieri* Valenciennes, *Hist. nat. Poiss.*, **21** : 69 (type locality : not known).

1973. *Thryssa dussumieri* : Whitehead, *J. mar. biol. Ass. India*, **14** (1) : 232.

*Material examined* : (i) 1 ex, Toshkhali, 12.xi.88, Coll. R.A. Khan, (ii) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan, (iii) 3 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

*Length range* : 120-170 mm.

*Colour* : Black brown back, Silvery flanks, dark venulose area on shoulder.

*Salient features* : Strongly compressed fusiform body, belly keeled with 15-16 prepelvic and 6-8 post pelvic scute. Snout rounded, maxilla long, tip pointed and reaching atleast half of pectoral fin. Anterior supremaxilla absent. Gill rakers serrae in distinct clumps. Predorsal spine small, dorsal fin with 10-11 branched rays, anal with 30-33 branched rays. First pectoral ray not filamentous.

*Habitat* : Coastal waters and estuaries,

*Geographical distribution* : Pakistan, India, Malaysia, East Indies and north to Hong Kong.

*Remarks* : Fairly common in the entire estuarine system and alongwith the other two sibling species, constitute good fishery in the region.

*Common name* : Dussumier's thryssa.

### 30. *Thryssa hamiltonii* (Gray)

1835. *Thryssa hamiltonii* Gray, *Illust. Ind. Zool. Hardwicke*, 2 : pl 92 (type locality not given)

1973. *Thryssa hamiltonii* : Whitehead, *J. mar. biol. Ass. India*, 14 (1) : 234.

*Material examined* : (i) 1 ex, Jharkhali, 13.xi.87, Coll. N.C. Nandi, (ii) 2 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan, (iii) 4 ex, Deolbari, 7.xi.88, Coll. R.A. Khan, (iv) 3 ex, Kishorimohanpur, 8.xi.88, Coll. R.A. Khan, (v) 1 ex, Tushkhali, 11.xi.88, Coll. R.A. Khan, (vi) 3 ex, Kishorimohanpur, 7.iii.89, Coll. R.A. Khan.

*Length range* : 20-105 mm.

*Colour* : Back greenish brown, flank silvery.

*Salient features* : Strongly compressed fusiform body, keeled belly with 18-19 prepelvic and 10-11 post pelvic scutes. Snout rounded, maxilla short, extending little beyond the gill opening, but not to pectoral fin base, Predorsal spine present. Dorsal fin with 10-12 branched rays, anal fin with 34-38 branched rays, its origin just behind last dorsal ray.

*Habitat* : Coastal waters and estuaries, pelagic.

*Geographical distribution* : Pakistan, India, Sri Lanka, Andamans through the East Indies to North Queensland and Hong Kong.

*Remarks* : Fairly common and constitutes good fishery during post monsoon fishery season.

*Common name* : Hamilton's thryssa.

### 31. *Thryssa purava* (Hamilton-Buchanan)

1822. *Clupea purava* Hamilton Buchanan, *Fishes of Ganges* : 238 (type locality : Ganges estuaries).

1973. *Thryssa purava* : Whitehead, *J. mar. biol. Ass. India*, **14** (1) : 231.

*Material examined* : (i) 1 ex, Rakkhaskhali-Kakdwip; 18.viii.84, Coll. J.K. Dey, (ii) 1 ex, Mitakhali Canning, 2.v.86, Coll. N.C. Nandi, (iii) 1 ex, Nithidopani, 31.viii.87, Coll. R.A. Khan.

*Length range* : 120-180 mm.

*Colour* : Back brown, flank silvery, dark spot at shoulder.

*Salient features* : Strongly compressed fusiform body, abdomen keeled with 16 prepelvic and 18 post pelvic scutes, Maxilla long, reaching beyond pectoral fin base. Mouth oblique, serrae on inner edge of gill rakers not in distinct clumps. Predorsal spine sharp, dorsal fin with 10-12 and anal fin with 40-44 branched rays.

*Habitat* : Estuaries and coastal waters.

*Remarks* : A common species of the region occurring in large numbers in almost all zones. It also ascends river. Forms sizable fishery during post monsoon fishing season.

*Common name* : Gangetic anchovy.

### Family CHIROCENTRIDAE

These are highly predatory fishes occurring in estuarine or nearby coastal waters. They can be distinguished by large fang like teeth and placement of dorsal fin considerably nearer to tail than head. Commonly known as 'wolf herring' The family was represented by one of the two known species from the region.

### 32. *Chirocentrus dorab* (Forsskal)

1775. *Clupea dorab* Forsskal, *Decript. Animal.* : xiii, 72 (type locality : Djedda and Moccha, Red Sea)

1987. *Chirocentrus dorab* : Day, *Fishes of India* : 652.

*Material examined* : (i) 5 ex, Gosaba, 1.i.85, Coll. J.K. Dey, (ii) 1 ex, Kishorimohanpur, 9.xi.88, Coll. R.A. Khan.

*Length range* : 75-150 mm.

*Colour* : Deep blue on back, flanks silvery, upper part of dorsal fin black.

*Salient features* : Body deeply compressed and highly elongated, sharp belly but without scutes. Canine teeth in both jaws, two canines on premaxillae fang like. Origin of dorsal fin considerably nearer to tail than to snout; pelvic fin very small, placed almost midway

between pectoral fin base and anal fin origin. Pectoral fin size almost equal in distance from eye centre to border of gill cover. Caudal fin forked.

*Habitat* : Coastal waters and mouth of estuaries.

*Geographical distribution* : Indo-west pacific

*Remarks* : A good food fish, occurs in small numbers in the estuarine system. The catches from the mouth of the estuaries and adjoining coastal waters carried out by mechanized trawlers contain larger quantities of dorab as compared to catches from main estuarine system.

*Common name* : Dorab Wolf-herring.

Order CONORYNCHIFORMES

Family CHANIDAE

The Asiatic Milk fish is the only representative of this family. It has scuteless abdomen; very small terminal mouth and dorsal fin opposite to pelvic fin.

### 33. *Chanos chanos* (Forsskal)

1775. *Mugil chanos* Forsskal, *Descript. Animal.* : 74 (type locality : Djedda, Red Sea).

1976. *Chanos chanos* : Misra, *Fauna of India*, Pisces (2nd ed.), 2 : 186.

*Material examined* : (i) 1 ex, Wakil bazar-Kakdwip, 7.xi.83, Coll. N.C. Nandi, (ii) 5 ex, Phuldhubi Kakdwip, 11.xi.84, Coll. J.K. Dey, (iii) 1 ex, Basanti, 30.iii.85, Coll. R.A. Khan (iv) 11 ex, Jharkhali, 10.iv.85, Coll. R.A. Khan, (v) 20 ex, Bakkhali, 10.xi.87 Coll. M.K. DevRoy.

*Length range* : 40-60 mm.

*Colour* : Back brown green, sides silvery.

*Salient features* : Body elongated, torpedo shaped, no scutes along belly. Dorsal fin with 13-16 rays, its origin midway between front border of eye and caudal fin base. Anal fin short, close to caudal fin. Large axillary scales on pelvic and pectoral fins. Caudal fin deeply forked. Mouth terminal, small and without teeth, No supramaxilla, short maxilla, lower jaw with symphyseal tubercle. Aderose tissue covers the eye.

*Habitat* : Coastal waters, entering into estuaries and rivers.

*Geographical distribution* : Indo-west Pacific.

*Remarks* : One of the abundant species of the entire estuarine system, occurs almost throughout the year. A good food fish. Suitable for culture in ponds.

*Common name* : Asiatic Milk Fish.

## Order SILURIFORMES

## Family BAGARIDAE

The *Mystus* family, mainly the freshwater inhabitants, were represented by two species in the estuarine region. These have barbules around mouth, forked caudal fin, short anal fin base and free gill membranes from isthmus. Both species can tolerate considerable levels of salinity.

34. *Mystus gulio* (Hamilton-Buchanan)

1822. *Pimelodus gulio* Hamilton-Buchanan, *Fishes of Ganges* : 201. (type locality : Gangetic estuaries)

1981. *Mystus gulio* : Jayaram. *The freshwater fishes of India, Pakistan, Bangla Desh, Burma and Sri Lanka, A Handbook* : 200.

*Material examined* : (i) 1 ex, Kacharighat - Canning, 7.iv.85, Coll. R.A. Khan, (ii) 1 ex, Nezat, 19.vi.86, Coll. R.A. Khan, (iii) 1 ex, Sonakhali, 30.iv.85, Coll. R.A. Khan.

*Length range* : 82-150 mm.

*Salient features* : Body moderately elongated, compressed, abdomen rounded; head moderate, compressed; mouth terminal, jaws unequal. Occipital crest rugose, median longitudinal groove on head short extending slightly beyond posterior border of fontanelle, not reaching base of occipital process. Mouth terminal, jaws subequal, villiform teeth in bands on jaws and palate. Four pairs of barbules. Rayed dorsal fin inserted above one fourth of pectoral fin with 1 spine and seven rays. Adepore dorsal fin base shorter than anal fin base, commences after some distance from rayed dorsal fin. Pectoral fin with one serrated spine. Anal fin short, caudal fin forked.

*Habitat* : Seas and estuaries.

*Geographical distribution* : India, Pakistan, Bangla Desh, Sri Lanka, Burma, Thailand, Malaysia, Indonesia.

*Remarks* : An important catfish of the upper and middle reaches of Hugly-matla estuarine system. Occurs in lower zone also during monsoon and postmonsoon period when salinity is not very high. Forms minor fishery.

35. *Mystus vittatus* (Bloch)

1797. *Silurus vittatus* Bloch, *Ichthyol Hist. Nat.*, 11 : 40 (type locality : Tranquebar, S. India.)

*Material examined* : (i) 1 ex, Chimaguri, 10.ix.84. Coll. J.K. De, (ii) 1 ex, Jharkhali, 13.xi.87, Coll. N.C. Nandi, (iii) 3 ex, Thakuran, 8.xi.88, Coll. R.A. Khan.

*Length range* : 54-61 mm.

*Colour* : Dark greenish above, belly pale. Three or four longitudinal colour bands on either sides of lateral line. A dark shoulder spot. No spot on caudal fin base.

**Salient features :** Body short, compressed, abdomen rounded; Head compressed, snout obtuse, jaws subequal. Median longitudinal groove on head short, fontanelle not reaching base of occipital process. Teeth villiform in bands on jaws and palatine. Four pairs of barbles, one each of maxillary, nasal and two of mandibular. Dorsal fin inserted above last quarter of pectoral fin, with 1 spine and 7 rays. Pectoral fin with 1 spine and 9 rays, the spine serrated along inner edge. Anal fin very short.

**Habitat :** Mainly a freshwater species, enters estuaries in upper reaches and during low salinity periods.

**Geographical distribution :** India, Nepal, Burma, Malaya, Thailand, Sri Lanka,

**Remarks :** Essentially a freshwater species occurring occasionally in estuaries.

**Common name :** Tengra.

### Family ARIIDAE

The marine cat fishes are caught in huge numbers from the region. They differ from Bagarids in respect of having membrane united with isthmus. These have strong sharp spines in front of dorsal and pectoral fins. These fishes are known to exhibit parental care by incubating their eggs. The family was represented by four species of *Arius* and one species of *Osteogeneiosus*.

#### 36. *Arius arius* (Hamilton-Buchanan)

1822. *Pimelodus arius* Hamilton-Buchanan, *Fishes of Ganges* : 170 (type locality : estuaries of Bengal)

1984. *Arius arius* : Talwar and Kacker, *Commercial Sea Fishes of India* : 258.

**Material examined :** (i) 2 ex, Frassergunj, 20.xii.83, Coll. N.C. Nandi, (ii) 1 ex., Ajmalmari, 8.iii.89, Coll. R. A. Khan.

**Length range :** 160-200 mm.

**Colour :** Body silvery along back, white and silvery below, adipose dorsal fin with a prominent black spot.

**Salient features :** Body elongate and robust; head flat; snout rounded; eyes fairly large, nearly 2.2 times in interorbital width. Three pairs of barbles; median fontanelle groove on top of head shallow, not reaching to base of supra-occipital process. Dorsal and pectoral fins with strong spines, latter shorter in length than former. Tip of dorsal spine prolonged into a filament. Teeth in jaws villiform palantine teeth globular in two elliptical patches.

**Habitat :** Mainly estuaries, also enters coastal waters.

**Geographical distribution :** East and South-west coast of India, Bangladesh and Burma.

**Remarks :** Fairly common in Hugly estuarine zone. Grows to a large size. Caught mainly by drag nets.

**Common name :** Hamilton's Catfish.

### 37. *Arius caelatus* (Valenciennes)

1840. *Arius caelatus* Valenciennes, *Hist. nat. Poiss.*, 15 : 66 (type locality : Bombay).

*Material examined* : (i) 1 ex, Kalinagar, 20.vi.86, Coll. R. A. Khan, (ii) 1 ex, Chotardi, 11.xi.88, Coll. R. A. Khan, (iii) 1 ex, Kedo Khal, 12.iii.89, Coll. R.A. Khan, (iv) 1 ex, Kalas, 10.iii.98, Coll. R.A. Khan.

*Length range* : 180-290 mm.

*Colour* : Body blue black dorsally, and pale whitish ventrally. Dorsal fin black with a black blotch.

*Salient features* : Body robust and elongated, head depressed at nape, snout blunt and rounded with three pairs of barbules, maxillary barbules extending to the end of pectoral fin, median fontanelle groove on top of head shallow, not reaching to the base of short supra occipital process. Head shield granulated, basal plate before dorsal fin v shaped. Dorsal fin spine coarsely granulated, tip of dorsal fin spine produced into a long filament. Adepore fin large and pectoral fin spine strong but shorter than dorsal fin spine. Teeth on jaws small premaxillary teeth much longer than broad, teeth on palate villiform in two patches, one on each side, triangular in shape.

*Habitat* : Coastal waters and lower reaches of estuaries.

*Remarks* : The species occurs abundantly in the lower reaches of the estuarine system and sea face. It is one of the important constituents of Cat fish catches of the region. The main fishery is carried out from sandy regions of Hugly estuarine system.

*Common name* : Engraved catfish.

### 38. *Arius sona* (Hamilton-Buchanan)

1822. *Pimelodus sona* Hamilton-Buchanan, *Fishes of Ganges* : 172, 376 (type locality : estuaries of Bengal)

1877. *Arius sona* : Day, *Fishes of India* : 462.

*Material examined* : (i) 1 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan, (ii) 4 ex, Ajmalmari, 8.xi.88, Coll. R.A. Khan.

*Length range* : 150-200 mm.

*Colour* : Grey on top, pale whitish below, sides bluish, fins black terminally.

*Salient features* : Body elongate; head flat and broad; three pairs of barbules. Head shield granulated, granules in radiating series. Median fontanelle on top of head broad and flat and not extending to base of supra cecipital process. Basal plate before dorsal fin, narrow, S shaped. Dorsal and pectoral spines strong. Premaxillary teeth villiform, palatine teeth also villiform in two patches placed side by side laterally, in one connected group on either side. Outer patch large and triangular, anterior patch small.

**Habitat :** Coastal waters, enters estuaries.

**Geographical distribution :** Pakistan, India, Bangladesh, Sri Lanka and East Indies.

**Remarks :** Though not very common, the species occurs in all zones of the estuarine system. Does not contribute much to fishery.

**Common name :** Dusky catfish.

### 39. *Arius jella* Day

1877. *Arius jella* Day, *Fishes of India* : 467. (On 'Deddi-jellah of Russel, 1803, *Fishes of Coromandel*, 2 : 34) (type locality : Madras).

**Material examined :** 3 ex, Frassergung, 20.xii.83, Coll. N. C. Nandi.

**Length range :** 105-115 mm.

**Colour :** Silvery grey dorsally, white below. Adipose fin with a dark blotch.

**Salient features :** Elongated body with depressed head; three pairs of barbules. Median fontanelle on top of head broad and flat, reaching to the base of supraccipital process. Strong dorsal and pectoral spines, latter larger than former. Mouth terminal; teeth in jaws villiform, premaxillary teeth much larger than broad, palate teeth globular, ovoid shaped in patches, one patch on either side.

**Habitat :** Coastal waters and lower reaches of the estuaries.

**Geographical distribution :** East coast of India, Sri Lanka and Burma.

**Remarks :** One of the most important fishes of the region from fishery viewpoints as it constitutes major portion of cat-fish fishery. It enters into estuarine system in shoals.

**Common name :** Small-eye catfish.

### 40. *Arius thalassinus* (Ruppell)

1837. *Bagrus thalassinus* Ruppell, *Neue. Wirbelth. Fische Rothen Meeres* : 75 (type locality : Massaua, Red Sea)

1877. *Arius thalassinus* : Day, *Fishes of India* : 463.

**Material examined :** (i) 2 ex, Toshkhali, 12.xi.88, Coll. R.A. Khan, (ii) 2 ex, Choramayadwip, 13.xi.88, Coll. R.A. Khan.

**Length range :** 150-200 mm.

**Colour :** Body brown above, shining, with several parallel, transverse cross bands. Dorsal, adipose and caudal fins dark at the top.

**Salient features :** Body elongated and robust; snout rounded, dorsal profile before dorsal fin nearly straight. Three pairs of barbules. Head shield granulated, supraoccipital process

narrow, longer than broad at base. Dorsal fin with a large spine produced into a filament, pectoral fin almost equal in length to dorsal fin.

*Habitat* : Coastal and offshore waters, enters estuaries.

*Geographical distribution* : Indo-west pacific.

*Remarks* : This large cat fish constitute the bulk of cat fish fishery particularly during post monsoon fishing season. The major catches come from trawlers operating in deeper areas. Caught mainly by hook and lines.

*Common name* : Giant marine catfish.

#### 41. *Osteogeneiosus militaris* (Linnaeus)

1758. *Silurus militaris* Linnaeus, *Systema Naturae*, 1 (ed 10) : 305 (type locality : Asia)

1877. *Osteogeneiosus militaris* : Day, *Fishes of India* : 469.

*Material examined* : (i) 1 ex, Bakkhali, 4.i.83, Coll. N.C. Nandi, (ii) 1 ex, Kakdwip, 6.vi.83, Coll. J.K. Dey, (iii) 1 ex, Chhotahardi, 1.xi.88, Coll. R.A. Khan.

*Length range* : 130-190 mm.

*Colour* : Head and back of body shining blue black, belly silvery white with some black dots.

*Salient features* : Body elongate, head strongly depressed, mouth moderate with only one pair of stiff semioossified maxillary barbles, longer than head. Head smooth, median fontanelle not reaching to the base of supraoccipital base, teeth on palate in two longitudinal semioval patches, Dorsal and pectoral fin spines strong and serrated.

*Habitat* : Estuaries and shallower coastal areas.

*Geographical distribution* : Pakistan, India, Bangla Desh, Sri Lanka and East indies.

*Remarks* : This catfish occurs in estuaries and adjoining coastal waters in big shoals.

*Common name* : Soldier catfishes.

#### Family PANGASSIDAE

The Pangas cat fishes occur in wide range of salinity, and can be distinguished by very long anal fin base and absence of nasal barbles. Only one species has so far been recorded from the region.

#### 42. *Pangasius pangasius* (Hamilton-Buchanan)

1822. *Pimelodus pangasius* Hamilton-Buchanan, *Fishes of Ganges* : 376 (type locality : estuaries of Bengal)

*Material examined* : (i) 1 ex, Gosaba, 25.iv.85, Coll. R. A. Khan, (ii) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan, (iii) 1 ex., Kishorimohanpur, 9.xi.88

*Length range* : 111-195 mm.

*Colour* : Grey above, silvery below.

*Salient features* : Body elongated and compressed, belly somewhat rounded; head blunt, moderate. Two pairs of barbles, one each of maxillary and mandibular. Snout slightly pointed, granulated. Mouth subterminal; eyes large. Jaws subterminal upper jaw slightly projecting, teeth small, villiform in bands on jaws, palatine teeth in 4 patches.

*Habitat* : Estuaries, rivers and coastal waters, generally near human habitation.

*Geographical distribution* : India, Pakistan, Bangla Desh, Burma, Thailand, Malaya, Vietnam, Indonesia.

*Remarks* : The species occurs throughout the year in Hugly-Matla estuarine system. Caught in good quantities but fetches a low market price.

#### Family PLOTOSIDAE

Commonly known as eel fishes as their bodies are eel like with long anal fin confluent to rounded caudal fin and extends on dorsal surface of body. The dorsal and pectoral spines are connected with poison glands. Dangerous fishes, cause serious wounds. Only one species was recorded during present investigations.

#### 43. *Plotosus canius* Hamilton-Buchanan

1822. *Plotosus canius* Hamilton-Buchanan, *Fishes of Ganges* : 142 (type locality : rivers of lower Bengal)

*Material examined* : (i) 1 ex, Tushkhali, 11.xi.88, Coll. R.A. Khan, (ii) 1 ex, 12.xi.88, Tushkhali, Coll. R.A. Khan, (iii) 1 ex, Dhanchi, 10.iii.89, Coll. R.A. Khan.

*Length range* : 200-300 mm.

*Colour* : Head and body dark green, belly creamy, fins and barbles grey.

*Salient features* : Body ellongate; head depressed; covered with thin skin; mouth transverse, with thick fleshy papillated lips; 4 pairs of barbles, nasal extending behind eyes, maxillary to base of pectoral fin and mandibular considerably shorter. Eyes small, only 8-10% of total body length. Two dorsal fins, first short and second elongated; anal fin long, caudal fin pointed and confluent with dorsal and anal fins.

*Habitat* : Estuaries.

*Geographical distribution* : Pakistan, India, Sri Lanka, Bangla Desh and Indo-Australian Archipelago.

*Remarks* : This catfish is common in the entire estuarine system and occurs in shoals. Sold in local and Calcutta markets but not liked by many and commands a low price.

*Common name* : Canine cat fish, *Kan magur*.

Order AULOPIFORMES

Family HARPADONTIDAE

The 'Bombay duck' is the only representative of this family known from Indian waters and occurs abundantly in the region. Compressed head, anteriorly placed eyes, naked head and body, very large mouth and trilobed caudal fin are the distinguishing features of the family.

#### 44. *Harpadon nehereus* (Hamilton Buchanan)

1822. *Osmerus nehereus* Hamilton Buchanan, *fishes of Ganges* : 209 (type locality : mouth of Ganges river).

1877. *Harpadon nehereus* : Day, *Fishes of India* : 505.

*Material examined* : (i) 1 ex, sitagunj-Kakdwip, 4.xi.83, Coll. J. K. Dey, (ii) 1 ex, Jambu island 23.xi.83, Coll. N.C. Nandi, (iii) 2 ex, Bakkhali, 16.xi.87, Coll. M.K. DevRoy, (iv) 1 ex, Haliday island, 1.ix.87, Coll. R. A. Khan, (v) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan, (vi) 1 ex Kishorimohanpur, 9.xi.88, Coll. R.A. Khan, (vii) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan.

*Length range* : 74-400 mm.

*Colour* : body light grey, fins dark.

*Salient features* : Body elongate, and slightly compressed, translucent and very soft. Head short, snout very short and rounded, eyes very small and covered with adipose membrane. mouth very wide, jaws teeth selendrical, slightly covered and unequal in size. Palatine teeth large and depressible. Lower jaw enlarged. Pectoral fin long with tip extending beyond level of pelvic fin origin. Pelvic fin very long extending beyond anal fin origin.

*Habitat* : Coastal waters and estuaries.

*Geographical distribution* : Indo-west pacific.

*Remarks* : An important species of the region, occurs abundantly in all zones and compares the bulk of commercial catches specially from Hugly estuarine zone. Because of its soft body, it is quickly perishable. Part of catfishes are consumed fresh but major portion is sun dried.

*Common name* : Bombay duck, *nehere*.

Order GADIFORMES

Family BERGMACEROTIDAE

The distinguishing features of this family is two dorsal fin, of which the first one as a single long ray on the nape and second with a long base with middle rays shorter. The 'codlets' are represented by single species.

**45. *Bregmaceros macclellandi* Thompson**

1840. *Bregmaceros macclellandi* Thompson, *Mag. nat. Hist. Charlesworth*, 4 : 184 (type locality : Gangetic delta)

*Material examined* : (i) 2 ex, Kakdwip, 7.vi.84, Coll. N.C. Nandi, (ii) 2 ex, Jambu island, 20.xii.86, Coll. N.C. Nandi, (iii) 8, ex. Matla-Bidya, 29.viii.87, Coll. R.A. Khan.

*Length range* : 80-110 mm.

*Colour* : Body light brown above, faint silvery below with minute spots. Second dorsal fin black, other fins hyaline

*Salient features* : Body moderately elongated but compressed. Head very small, teeth minute on both jaws and on vomer but none on palatine. Gill opening wide, membranes united together but free from isthmus. Two dorsal fins, first a single long ray on head and reaching to second dorsal fin, second dorsal fin long with a deep notch in middle. Anal fin also long with a deep notch in the middle, almost like the dorsal fin in shape and size. Pelvic fin high and attached just at the end of small head, with three outer rays elongated, reaching to anal fin

*Habitat* : Coastal and estuarine waters.

*Geographical distribution* : Indo-West pacific.

*Remarks* : This small cod like fish occurs occasional in the estaurine system but does not constitute any fishery. Considered to be a trashfish.

Order CYPRINODONTIFORMES

Family HEMIRAMPHIDAE

"Half beaks", as the name indicates are characterised by elongated lower jaw and short triangular upper jaw. The body is compressed laterally in tail region. The fasmily was represented by two genera each with one species.

**46. *Hyporhamphus limbatus* (Valenciennes)**

1846. *Hemiramphus limbatus* Valenciennes, *Hist. nat. Poiss.*, 19 : 44 (type locality : Malabar coast, Bombay, Pondicherry)

*Material examined* : (i) 1 ex. Kalas, 10.iii.89, Coll. R. A. Khan, (ii) 2 ex, Haldibari, 13.iii.89, Coll. R. A. Khan.

*Length range* : 130-160 mm.

*Colour* : Dark green above, silvery below, a prominent lateral stripe on sides. Caudal and dorsal fin tips slightly darker otherwise all fin hayline.

*Salient features* : Body elongated and compressed. Head length from upper jaw tip to gill opening is about 35% of the trunk; upper jaw slightly convex, much broader than long. Lower jaw as long as head. Teeth minute tricuspid, in many rows both in upper and lower jaws. Nasal papillae not fimbriate. Dorsal fin close to caudal fin and above anal fin; pelvic fin origin midway between front border of eye and base of caudal fin. Caudal fin emarginate.

*Habitat* : Coastal waters and estuaries.

*Geographical distribution* : Persian Gulf, Sri Lanka, through the East Indies to the Phillipines and China.

*Remarks* : Occurs occasionally in the estuarine system.

*Common name* : Valenciennes halfbeck.

#### 47. *Zenarchopterus ectuntio* (Hamilton-Buchanan)

1822. *Zenarchopterus ectuntio* Hamilton-Buchanan, *Fishes of Ganges*; (type locality : Ganges R)

*Material examined* : (i) 17 ex, Nithidopani, 8.viii.87, Coll. R.A. Khan, (ii) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan, (iii) 1 ex, Dhanchi, 10.iii.89, Coll. R.A. Khan, (vi) 2 ex, Haldibari, 13.iii.89, Coll. R.A. Khan, (v) 2 ex, Arbessi, 15.iii.89, Coll. R.A. Khan.

*Length range* : 95-150 mm

*Colour* : Body greenish above, silvery below

*Salient features* : Body very elongate, subcylindrical, somewhat laterally compressed, abdomen rounded. Snout pointed, wide mouth, cleft extending to anterior border of orbit. Eyes small. Upper jaw consists of premaxillaries, trangular shaped, trangle longer than wide. Lower jaw elongated with a flap at the tip. Nasal barble elongated. Dorsal fin origin far back, slightly ahead of anal. Anal fin with 10-12 rays, 6th ray in males modified into a thick, wide and long stem. Anal fin separated into two parts, caudal fin rounded.

*Habitat* : Coastal waters and estuaries. Enters into rivers.

*Geographical distribution* : India, Madagascar, East Coast of Africa to Hong Kong, East Indies.

*Remarks* : Occurs abundantly in the estuarine system including upper riverine zone but not of much commercial value

*Common name* : Halfbeck.

## Family BELONIDAE

'Needle fishes have both jaws elongated into a long beak with numerous needle like teeth. They were represented by only one species in the collections.

48. *Strongylura strongylura* (van Hasselt)

1823. *Belone strongylura* Van Hasselt. *Alg. Konst. en Letterbode*, 1 : 130 (type locality : Vizagapatnam)

1984. *Strongylura strongylura* : Talwar and Kacker, *Commercial Sea Fishes of India* : 322.

*Material examined* : (i) 3 ex, Muriganga, 10.x.80, Coll. A.K. Mondal, (ii) 1 ex, Canning-Nikarighata, 7.iii.87, Coll. N.C. Nandi, (iii) 1 ex, Saimari, 23.viii.87, Coll. R.A. Khan, (iv) 1 ex, Chotahardi, 5.xi.88, Coll. R.A. Khan, (v) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan.

*Length range* : 282-370 mm

*Colour* : Body bluish green above, silvery below with a black spot on the base of caudal fin.

*Salient features* : Body elongate, subcylindrical and compressed, abdomen rounded. Eyes very small and superior, both jaws prolonged into a beak and with sharp teeth. Gill rakers absent. Origin of dorsal fin above anal fin, caudal fin emarginate, no lateral keel on caudal peduncle. Double lateral line.

*Habitat* : Estuarine and coastal waters.

*Geographical distribution* : Widespread in tropical Indo-west Pacific.

*Remarks* : The species is caught in fairly good number in the estuaries and adjoining coastal waters and constitute sizable fishery.

*Common name* : Roundtail needlefish.

Order SCORPAENIFORMES

Family PLATYCEPHALIDAE

Commonly known as 'spiny flatheads', these fishes have extremely depressed head with ridges and spines. The first (Spinous) dorsal fin is preceded by a single short spine. Two genera with one species each were recorded.

49. *Platycephalus indicus* (Linnaeus)

1758. *Callionymus indicus* Linnaeus, *Systema naturae*, ed 10 : 250 (type locality : Asia)

1984. *Platycephalus indicus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 340.

*Material examined* : (i) 1 ex, Namkhana, 11.xi.79, Coll. A.K. Mondal, (ii) 2 ex, Rakkhaskhali-Kakdwip, 17.vii.84, Coll. J.K. Dey, (iii) 2 ex, Saimari, 23.viii.87, Coll. R.A. Khan.

*Length range* : 80-110 mm.

*Colour* : Body brown above with spots, belly white.

*Salient features* : Body highly compressed with ctenoid scales in upper part and cycloid in lower; head with ridges of weak spines. Teeth villiform in upper jaw, lower jaw with a number of crowded teeth, vomer with teeth in one transverse patch. Two dorsal fins, first with 9 spines and second with 13 soft rays. Caudal fin truncate. Lateral line scales without spine.

*Habitat* : Marine, enters estuaries.

*Geographical distribution* : Central tropical indo-pacific.

*Remarks* : This flat head, though not of much fishery importance, occurs in almost all areas of lower zone.

*Common name* : Indian Flathead.

#### 50. *Platycephalus scaber* (Linnaeus)

1758. *Cottus saber* Linnaeus, *Systema Naturae*, ed 10, 1 : 264 (type locality : unknown)

1876. *Platycephalus scaber* : Day, *Fishes of India* : 275.

*Material examined* : (i) 1 ex, Jambu island, 21.xii.83, Coll. N.C. Nandi, (ii) 3 ex, Sudhanyakhali, 14.iv.95, Coll. R.A. Khan, (iii) 1 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan, (iv) 2 ex, Kalas, 18.iii.89, Coll. R.A. Khan.

*Length range* : 55-155 mm.

*Colour* : Body grey dorsally and white below. Black regular dots along lateral line, head and body. First dorsal fin clouded with black, soft dorsal fin with rows of black dots, pectoral, pelvic and caudal fins dusky with margins black.

*Salient features* : Body robust and compressed, subcylindrical, head spatula like, Villiform teeth on both jaws, vomerine teeth in two oval patches. Preopercular spine short, not extending to gill opening. First dorsal fin with 9 spines and second with 12 soft rays, caudal fin rounded. All scales on lateral line armed with backwardly directed spines with more than 50-52 robust spiny scutes.

*Habitat* : Seas and estuaries.

*Geographical distribution* : Indo-west Pacific.

*Remarks* : Available in small numbers.

*Common name* : Rough flathead.

Order PERCIFORMES

Family AMBASSIDAE

These very small semitransparent perches, commonly known as 'glass fishes', were represented by a widely occurring species. Slightly protactile moderate mouth, preopercle, opercle edges serrated and deeply forked caudal fin can separate these fishes from other allied perches.

51. *Chanda nama* (Hamilton-Buchanan)

1822. *Chanda nama* Hamilton-Buchanan, *Fishes of Ganges* : 371. (Type locality Bengal)

*Material examined* : (i) 3 ex, Sitagunj Kakdwip, 4.2.83, Coll. N.C. Nandi, (ii) 5, ex, Nezat, 19.6.86, Coll. N.C. Nandi,

*Length range* : 40-55 mm.

*Colour* : Semi-translucent body

*Salient features* : Body short, deep, compressed, belly rounded; head very short and compressed; snout short. Mouth protractile, extending to front border of orbit. Eyes large; jaws unequal, lower longer, teeth villiform on jaws, palate and tongue. Lower limb of preopercle with a double serrated edge, opercle without any spine. Two dorsal fin, first with 7 spines and second with 12-16 rays. A forwardly directed recumbent spine present. Anal fin with three spines and 12-15 rays. Caudal fin forked.

*Habitat* : Freshwater and less saline regions of the estuaries.

*Geographical distribution* : India, Pakistan, Nepal, Bangla Desh, Burma and Thailand.

*Remarks* : The species occurs abundantly in upper reaches of the estuarine systems, where salinity is low.

*Common name* : Chanda.

Family CENTROPOMIDAE

This family of single known species from the region is characterised by elongate and compressed body, concave dorsal profile near nape, large mouth, longer lower jaw and rounded caudal fin. Commonly known as sea perches.

52. *Lates calcarifer* (Bloch)

1790. *Holocentrus calcarifer* Bloch, *Naturges ausland Fische*, 4 : 100 (type locality : ? Indonesia)

1875. *Lates calcarifer* : Day, *Fishes of India* : 7.

*Material examined* : (i) 1 ex, Hingulgunj, 25.vi.86, Coll. R.A. Khan, (ii) 1 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan.

*Length range* : 105-185 mm

*Colour* : Dark blue or brown above, silvery below

*Salient features* : Body elongate and oblong, compressed with a deep caudal peduncle. Head pointed; dorsal profile concave anteriorly and convex posteriorly near dorsal fin. Operculum with a small spine and serrated flap, preopercle with a spine and serrated edge; upper jaw extend beyond eye; teeth villiform on jaws. Dorsal fin with 9 spines and 10 soft rays, with a deep notch between spines and soft rays. Anal, pectoral and caudal fin rounded.

*Habitat* : Marine fishes, ascends estuaries and backwaters for feeding

*Geographical distribution* : Indo-pacific.

*Remarks* : This is one of the most important fishes of the region and ranks next only to *Hilsa* in demand. It occurs almost in all zones of the estuarine system. The species is also cultured in brackishwater fish ponds. Stocking of the ponds are done naturally. During high tides juveniles enter in impoundments where they are retained. Harvesting is done after 6 months or when they are of marketable size.

*Common name* : Giant Sea perch. *bhetki*.

#### Family TERAPONIDAE

Small perches with conspicuous colour pattern of stripes on entire body including caudal fin, giving them the nickname of "Tiger perches" The opercles have two spines, the lower one larger and stronger. Only one species was recorded during the present investigations.

#### 53. *Terapon jarbua* (Forsskal)

1775. *Sciaema jarbua* Forsskal, *Descript. Animalium* : 159 : (Type locality : Djedda, Red Sea)

1987. *Terapon jarbua* : Vari, *Bull. Amm. Mus. nat. Hist.*, 159 : 255.

*Material examined* : (i) 1 ex, Jharkhali, 13.xi.87, Coll. N.C. Nandi, (ii) 1 ex, Haliday island, 1.xi.87 coll. R.A. Khan, (iii) 1 ex, Saimari, 5.xi.88, Coll. R.A. Khan, (iv) 1 ex, Ajmalmari, 9.xi.88, Coll, R.A. Khan.

*Length range* : 75-85 mm

*Colour* : Body shiny grey above, silvery white below, with 3-4 longitudinal downward covered stripes. Spinous dorsal fin with blackish border on upper two third of membrane, soft dorsal fin with first three membranes tipped black, caudal fin with dark tips and three horizontal stripes.

**Salient features :** Body moderately deep, slightly compressed; mouth oblique, upper jaw reaching to vertical, teeth strong, slightly recurved, in three rows. Palatine teeth not present in adults; preopercle serrate, preopercle spine strong but not reaching beyond edge of opercle lobe. Gill rakers 14 on lower arm of 1st arch. Dorsal fin notched with 11 spines and 10 soft rays; lateral line scales about 80.

**Habitat :** Inshore waters. Moves upwards in estuaries and freshwaters

**Geographical distribution :** Indo-west pacific.

**Remarks :** The species occurs in all regions of the system and caught occasionally.

**Common name :** Jarbua terapon.

#### Family SILLAGINIDAE

The 'Whittings' are very important and delicious fishes. These were represented by only two species. They have spoon shaped snout, elongated body, two closely situated dorsal fin, first spinous, with second spines filamentous, and second rayed.

##### 54. *Sillaginopsis panijus* (Hamilton-Buchanan)

1822. *Cheilodopterus panijus* Hamilton-Buchanan, *Fishes of Ganges* : 315 (type locality : Ganges estuaries)

1984. *Sillaginopsis panijus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 422.

**Material examined :** (i) 1 ex, chotahardi, 5.xi.88, coll. R.A. Khan (ii), 1 ex, Gona, 6.iii.89, Coll. R.A. Khan, (iii) 1 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

**Length range :** 51-245 mm

**Colour :** Body greenish yellow above, pale below. No dusky spots on dorsal fin membrane.

**Salient features :** Body elongate, partly cylindrical; Snout and head greatly depressed; eyes very small, mouth small with villiform teeth in bands in jaws and vomer, outer row slightly enlarged with two caninoids in upper jaw. Gill rakers 6 on lower side of first arch. First dorsal fin with 10 spines and second filamentous with 1 spine and 27 soft rays. Anal fin with two spines and 24-26 soft rays. Swim bladder absent.

**Habitat :** Coastal waters and estuaries.

**Geographical distribution :** South-west and East coasts of India, Burma and Malaysia.

**Remarks :** This is one of the commercially important species of the region constituting good fishery, specially during post monsoon fishery operations.

**Common name :** Gangetic whiting.

### 55. *Sillago sihama* (Forsskal)

1775. *Atherina sihama* Forsskal, *Descript. Animal* : 70 (type locality : Lohaja, Red seas.)

1876. *Sillago sihama* : Day, *Fishes of India* : 265.

*Material examined* : (i) 1 ex, Kakdwip-Rakkhaskhali, 11.xi.84, Coll. J.K. Dey, (ii) 1 ex, Kedokhal, 12.iii.89, Coll. R. A. Khan.

*Length range* : 116-135 mm

*Colour* : Body light brown above, silvery below.

*Salient features* : Body elongate with pointed snout; head not depressed; mouth small, terminal, villiform teeth on jaws and vomer. First dorsal fin with 11 spines, second with 1 spine and 22 soft rays. Anal fin with 2 spines and 22 soft rays. Lateral line scales 70. Swim bladder with two distinct post coelomic extensions.

*Habitat* : Shallow sandy bottoms of coastal shores and estuaries.

*Geographical distribution* : Indo-west Pacific.

*Remarks* : Found abundantly at the mouth of both Hugly and Matla estuaries. Caught in good numbers during post monsoon fishery operations.

*Common name* : Silver Sillago.

### Family CARANGIDAE

The family was represented by a number of species almost all of which are marine in origin and occur at the most near the mouth of the estuaries. They are commonly known as jacks or scades, have compressed bodies with slender caudal peduncle, a keel near the end of lateral line. Out of three anal spines, the first two are detachable. A large number of species have been reported to occur but most of them are confined to coastal waters. Only 4 species belonging to 4 genera were recorded during present investigations.

### 56. *Alectis indica* (Ruppell)

1828. *Scyris indicus* Ruppell, *Atlas Nordl. Afrika, Fische Rothen Meeres* : 128 (type locality : Djedda, Red sea)

1984. *Alectis indica* : Talwar and Kacker, *Commercial Sea Fishes of India* : 435.

*Material examined* : (i) 1 ex, Jambu island, 20.xi.86, Coll. N.C. Nandi.

*Length range* : 80 mm

*Colour* : Body pale above, silvery below, dusky spot on operculum.

*Salient features* : Body greatly compressed and very deep, nearly 1.8 times in standard length. Head with a marked hump above eye, profile slightly vertical. Eyes large. Teeth

on jaws villiform, upper jaw reaching to below vertical from front edge to middle eye. Skin smooth, scales minute. First dorsal fin with 6 spines and second with 1 spine and 18 soft rays. Soft dorsal and anal fins with anterior fulcate lobes. Anal fin with two detached spines, pectoral and pelvic fins long and fulcate. Lateral line strongly arched below soft dorsal fin.

*Habitat* : Shallow coastal waters and estuarine mouth.

*Geographical distribution* : Indo-west Pacific.

*Remarks* : This species was collected once from sea face and is not of much fishery importance.

*Common name* : Indian threadfin trevally.

### 57. *Carangoides malabaricus* (Bloch)

1801. *Scomber malabaricus* Bloch, *Syst. Ichth* : 31 (type locality : Tranquebar)

1984. *Carangoides malabaricus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 453.

*Material examined* : (i) 3 ex, Jambu island, 20.xi.83, Coll. N.C. Nandi, (ii) 1 ex, Kakdwip, 7.vi.84, Coll. N.C. Nandi, (iii) 1 ex. Kedokhal, 12.iii.89, Coll. R.A. Khan.

*Length range* : 50-150 mm.

*Colour* : Body bluish grey above, white below, black blotch on operculum.

*Salient features* : Body strongly compressed, somewhat ovate; head profile steep with a notch in front of eye. Maxilla reaching to below front border of eye. Villiform teeth in bands on jaw. Gill rakers 25 on 1st arch of lower arm. First dorsal fin with 1 forward pointing spine and 8 normal spines, second with 1 spines and 22 soft rays. Anal fin with two detachable spines followed by 1 spine and 17-18 soft rays. Pectoral fin fulcate. Lateral line forms an arch in anterior region. Scales small, breast naked from anal fin base to lateral line.

*Habitat* : Coastal waters and mouth of estuaries.

*Geographical distribution* : Tropical Indo-west pacific.

*Remarks* : Mainly occurs in coastal waters and at the mouth of Hugly estuary.

*Common name* : Malabar trevally.

### 58. *Caranx carangus* (Bloch)

1793. *Scomber carangus* Bloch, *Naturges ausland. Fische*, 7 : 69 (Type locality : Antilis, Atlantic Ocean)

1876. *Caranx carangus* : Day, *Fishes of India* : 215.

*Material examined* : (i) 1 ex, Tushkhali, 20.viii.87, Coll. R.A. Khan, (ii) 1 ex, Thakuran-Matla, 3.xi.88, Coll. R.A. Khan.

*Length range* : 150-160 mm.

*Colour* : Body silvery dark above, several faint cross bars, a prominent opercular spot. Caudal fin and soft dorsal margin darker.

*Salient features* : Body oblong and compressed, depth nearly 40% of the standard length. Eyes large, nearly 30% of the head length. Cleft of mouth origin opposite to lower third of eye; maxilla extending to behind middle of eye; teeth in narrow bands, outer one of upper jaw conical in shape. Two dorsal fins first with one precumbent spine and 8 normal spines, second with one spines and 20 soft rays. Anal fin with two detachable spine, followed by one spine and 17 rays. Pectoral fin fulcate. Triangular lateral area of breast partly scaled, ventrally almost naked. Anterior part of lateral line moderately arched, shorter than straight part.

*Habitat* : Coastal waters and mouth of estuaries.

*Geographical distribution* : India, Sri Lanka, East Indies to China, Japan, Philippines, Tropical atlantic.

*Remarks* : Occurs generally in lower reaches and caught by trawlers operating in adjoining coastal waters.

*Common name* : Blacktailed trevally

#### 59. *Scomberoides tala* (Cuvier)

1831. *Chorinemus tala* Cuvier, *Hist. nat. poiss.*, 8 : 337 (type locality : Malabar)

1973. *Scomberoides tala* : Smith-Vaniz and Staiger, *Proc. calif. Acad. Sci.*, 39 (13) : 199.

*Material examined* : 4 ex, Frassergunj, 20.xii.83, Coll. N.C. Nandi.

*Length range* : 80-90 mm.

*Colour* : Body silvery, six vertically elongated blotches on flanks.

*Salient features* : Body compressed and elongated, frontal profile concave with pointed snout, maxilla extending slightly behind posterior margin of pupil. Teeth in single row in upper jaw and in two rows on lower jaw. Gill rakers on 1st arch of lower arm 13. First dorsal fin with 1 forward pointing spine and 6 normal spines, second with one spine and 20 soft rays. Anal with two detachable spines followed by 1 spine and 18 soft rays. Pectoral fin short, not fulcate. Lateral line indistinct, almost straight, scales lanceolate, elongated and needle like.

*Habitat* : Coastal waters and estuarine mouth.

*Remarks* : The species occurs in sufficient numbers in coastal waters and mouth of Hugly estuary. It forms a moderate fishery during post monsoon fishery operations by machanised trawlers.

*Common name* : Deep queenfish.

## Family CORYPHAENIDAE

The dolphin fishes have very peculiar body form and can be recognised at a glance. The streamline body tapering from head to tail sharply with a high fore head and high inserted dorsal fin near eye which runs all along the body. These are represented by only one species.

60 *Coryphaena hippurus* Linnaeus

1758. *Coryphaena hippurus* Linnaeus, *System Naturae*, (ed 10) : 261 (type locality : Open seas)

*Material examined* : 1 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan.

*Length range* : 105 mm.

*Colour* : Body blue green shining above, flanks silvery with several dark blotches almost on entire body.

*Salient features* : Body elongate and compressed, slightly concave profile; cleft of mouth wide and oblique. Bands of teeth on jaws, palatines and vomer; small oval teeth on tongue. Dorsal fin very long, extending from above eye to caudal fin with 60 soft rays. Concave anal fin also long-from vent to caudal fin. Pectoral fin small, Lateral line curved upwards above pectoral fin. Minute cycloid scales.

*Habitat* : Coastal waters.

*Geographical distribution* : Tropical and subtropical seas.

*Remarks* : Found rarely in the estuaries, not of any fishery value.

*Common name* : Dolphin fish.

## Family LEIOGNATHIDAE

Slipmouths have highly protrusible mouth which forms tube when extended. Dorsal and anal fins are with spines along their bases. The family was represented by two genera and three species.

61. *Leiognathus blochii* (Valenciennes)

1835. *Equuala blochii* Valenciennes, *Hist. nat. Poiss.*, 10 : 84 (Type locality : Malabar)

1984. *Leiognathus blochii* : Talwar and Kacker, *Commercial Sea Fishes of India* : 505.

*Material examined* : (i) 1 ex, Taltola, 15.ii.87, Coll. N.C. Nandi, (ii) 1 ex, Haldibari, 23.viii.87, Coll. R.A. Khan, (iii) 4 ex, Haldibari 7.i.88, Coll. R.A. Khan, (iv) 4 ex, Jharkhali, 7.xi.88, Coll. R.A. Khan, (v) 12 ex, Dhanchi, 10.iii.89, Coll. R. A. Khan.

*Length range* : 30-65 mm

**Colour :** Body silvery, with dark blotches on nape, vertical stripes on back and sides of the body.

**Salient features :** Body compressed; nearly oval. Dorsal and ventral profiles are almost equally convex; snout pointed; mouth small, pointed downwards when protracted, cleft of mouth opposite to lower third of eye. Small teeth in single row in both jaws. Dorsal fin with 8 spines and 16 soft rays; anal fin with three spines and 14 soft rays. Minute scales on body and breast, head naked. Lateral line deeply convex.

**Habitat :** Shallow coastal waters and estuaries, bottom dweller.

**Geographical distribution :** India : Andaman Islands, Gulf of Thailand, Borneo and Philippines.

**Remarks :** Common in the catches, both from coastal waters and estuaries.

**Common name :** Bloch's ponyfish.

## 62. *Leiognathus equulus* (Forsskal)

1775. *Scomber equulla* Forsskal, *Descript. Animal* : 75 (type locality : Red sea)

1984. *Leiognathus equulus* : Talwar and Kacker, *Commercial sea fishes of India* : 510.

**Material examined :** (i) 1 ex, Jambu island, 23.xii.83, Coll. N.C. Nandi, (ii) 4 ex, Dabu, Canning, 11.x.88, Coll. R.A. Khan, (iii) 1 ex, Dhanchi, 10.iii.88, Coll. R.A. Khan, (iv) 1 ex, Kalas island, 11.iii.89, Coll. R.A. Khan.

**Length range :** 50-90 mm.

**Colour :** Body silvery with small, narrow vertical stripes on back, a prominent but small blotch on caudal peduncle.

**Salient features :** Body compressed and deep, depth nearly half of the standard length, dorsal profile strongly curved and more convex than its vertical profile. Mouth small, pointing downwards when protracted, cleft of mouth below lower edge of eye. Teeth on jaws in single row. Dorsal fin with 8 spines and 16 soft rays. Scales very minute, breast with thin and diaphanous scales, not visible clearly, head naked.

**Habitat :** Shallow coastal waters and estuaries, bottom inhabiting.

**Geographical distribution :** Widespread in the tropical Indo-west pacific.

**Remarks :** A common species of ponyfishes occurring in all zones and caught in moderate numbers during post monsoon fishing season.

**Common name :** Common ponyfish.

## 63. *Secutor ruconius* (Hamilton-Buchanan)

1822. *Chanda ruconius* Hamilton-Buchanan, *Fishes of Ganges* : 106, 307 (type locality : Estuaries of Ganga)

1984. *Secutor ruconius* : Talwar and Kacker, *Commercial Sea Fishes of India* : 519.

*Material examined* : (i) 2 ex, Matla-Thakauran, 8.xi.89, Coll. R.A. Khan, (ii) 2 ex, Nithidopani, 30.iii.85, Coll. R.A. Khan

*Length range* : 110-130 mm.

*Colour* : Body silvery with spots on upper half and a number of vertical bands and a distinct black line from orbit to chin. Tip of the dorsal fin black.

*Salient features* : Body deep and compressed, depth nearly two third of the standard length. Mouth small, pointing upwards when protracted; maxilla reaching nearly to lower margin of eye. Minute teeth in both jaws. Dorsal fin with 8 spines and 16 soft rays. Anal fin with 3 spines and 14 soft rays.

*Habitat* : Shallow coastal waters and estuaries. Bottom living, also enters rivers.

*Geographical distribution* : Tropical Indo-west Pacific.

*Remarks* : Available in fair numbers in all the zones of the estuarine system.

*Common name* : Deep pugnose ponyfish.

#### Family LUTJANIDAE

This important group of commercially important fishes, commonly known as 'snappers', are characterised by very sharp teeth, flattened top of the snout and pointed pectoral fins. Only one species was of common occurrence and recorded during present investigations.

#### 64. *Lutjanus johni* (Bloch)

1792. *Anthias johni* Bloch, *Naturges. ausland. Fische*, 6 : 113, 318 (type locality : Surat)

1889. *Lutjanus johnii* : Day, *Fauna of Br. India*, Fishes. 1 : 476

*Material examined* : (i) 2 ex, Frassergunj, 20.xi.83, Coll. N.C. Nandi, (ii) 1 ex, Sudhanyakhal, 16.vi.82, Coll. R.A. Khan, (iii) 1 ex, Sulkani, 22.vi.86, Coll. R.A. Khan, (iv) 5 ex, Matla-Thakauran, 8.xi.88, Coll. R.A. Khan, (v) 2 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan, (vi) 1 ex, Khatuajhuri, 15.iii.89, Coll. R.A. Khan.

*Length range* : 80-240 mm.

*Colour* : Body reddish with distinct dark spot on each scale, giving the appearance of longitudinal brown line along scale rows.

*Salient features* : Body moderately deep, head profile straight; preopercular notch small, no interocular knob; teeth small in narrow band with outer two enlarged with some canines in upper jaw. Teeth patch on vomer in triangular shape. Scales fairly large, longitudinal scale row above lateral line rise obliquely under posterior part of spinous dorsal fin. Dorsal fin with 10 spines and 14 soft rays, anal with three strong spines and 8 soft rays, second and third spine of same length.

*Habitat* : Shallow coastal waters and estuaries.

*Geographical distribution* : Indo-west pacific.

*Remarks* : A common perch of this region, found almost during all seasons in all part of the estuarine system. Constitutes moderate fishery during post monsoon fishing season.

*Common name* : John's Snapper.

#### Family GERREIDAE

Small silvery fishes with extremely protrusible mouth. The upper jaw fits perfectly into a slot when the mouth is closed. Commonly known as 'mojarras', these were represented by only one species.

##### 65. *Gerreomorpha setifer* (Hamilton-Buchanan)

1822. *Chanda setifer* Hamilton-Buchanan, *Fishes of Ganges* : 105, 370 (type locality : Ganges estuaries)

1984. *Gerreomorpha setifer* : Talwar and Kacker, *Commercial sea fishes of India* : 586.

*Material examined* : (i) 1 ex, Ajmalmari, 8.xi.88, Coll. R.A. Khan, (ii) 1 ex, Chotahardi, 15.xi.88, Coll. R.A. Khan.

*Length range* : 70-72 mm.

*Colour* : Body greenish above, silvery below, Spinous dorsal fin dark, a brown spot on each dorsal soft ray. Pectoral, pelvic and anal fins yellowish.

*Salient features* : Body slightly compressed and oblong. Mouth strongly protractile and small; fine villiform teeth in both jaws, no canines. Dorsal fin with 10 spines and 10 soft rays. Anal fin with three spines and 7 soft rays, Pectoral fin reaching nearly to origin of anal fin.

*Habitat* : Coastal waters and estuaries.

*Geographical distribution* : East coast of India and Sri Lanka.

*Remarks* : A common perch species of this estuarine system. Occurs in fairly good numbers in commercial catches.

*Common name* : Black tipped mojarra.

#### Family HAEMULIDAE

The 'grunts' are characterised by the absence of suborbital processes, very feeble jaw teeth, prominent pharyngeal teeth and chin with two pores. Only one species was collected.

##### 66. *Pomadasys argenteus* (Forsskal)

1775. *Sciaena argentea* Forsskal, *Descript. Animal.* : 49 (type locality : Arabia)

1992. *Pomadasys argenteus* : Talwar, *Fauna of West Bengal, part. 2, Marine and estuarine fishes.* : 293.

*Material examined* : (i) 1 ex, Matla-Thakuran, 3.xi.88. Coll. R.A. Khan, (ii) 1 ex, Tushkhali, 12.xi.88, Coll. R.A. Khan, (iii) 2 ex, Haldibari, 15.iii.89, Coll. R.A. Khan.

*Length range* : 90-125 mm.

*Colour* : Body silvery grey with prominent black spots.

*Salient features* : Body compressed and oblong, depth nearly 35-40% of Standard length; head blunt; mouth small, maxilla extending to front border of eye. Teeth small in narrow bands in both jaws, outer band enlarged. Head covered with ctenoid scales except snout. Dorsal fin with 12 spines and 14 soft rays, anal fin with three spines and 7 soft rays, second spine longer than third.

*Habitat* : Coastal waters and estuaries.

*Geographical distribution* : Indo-west Pacific.

*Remarks* : This species mainly occur in lower reaches near seaface. It occurs alongwith other perches in good numbers during post monsoon fishing season.

*Common name* : Blotched grunt.

#### Family SPARIDAE

Deep bodied perches, commonly known as seabreams. These are characterized by well developed, powerful canine, incisor and molar teeth, with eyes placed high on head; maxilla not reaching to eye and premaxillae overlap maxillae. Only one species has been recorded.

#### 67. *Acanthopagrus latus* (Houttuyn)

1782. *Sparus latus* Houttuyn, *Verh. Holland. Maatsch, wet. Haarlem*, 20 : 322.

1984. *Acanthopagrus latus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 629.

*Material examined* : (i) 1 ex, Tushkhali, 11.xi.88, Coll. R.A. Khan,

*Length* : 190 mm.

*Colour* : Body dusky grey above, belly yellowish, scales with silvery edges, dark spot at the origin of lateral line.

*Salient features* : Body deep and compressed, depth about 40% of standard length; head large; pointed; snout profile oblique; mouth small, maxilla not extending beyond middle of eye. Teeth in jaws well developed with 5 canine teeth in front of both jaws followed by a band of molar like teeth. Scales large, five series of scales on operculum. Dorsal fin with 11 spine and 11 soft rays; anal with three spine and 8 soft rays.

*Habitat* : Coastal waters and estuaries.

*Geographical distribution* : Indo-west pacific.

*Remarks* : The species occurs infrequently in the region.

*Common name* : Yellow fin seabream.

### Family SCIAENIDAE

These are the most important perches of the region forming fishery of their own. Commonly known as 'Croakers' as they produce sound by vibrating a specialised muscle close to gas bladder. The entire oblong body is scaled; rounded snout, with several pores and a long dorsal fin with a deep notch between the spinous and rayed fins. The family was represented by 8 species belonging to 7 genera.

#### 68. *Chrysochir aureus* (Richardson)

1846. *Otolithus aureus* Richardson, *Rep. Br. Ass. Advmt. Sci.*, 15 : 224 (type locality : Canton).

1966. *Chrysochir aureus* : Trewavas and Yazdani, *Ann. Mag. nat. Hist.*, (13) 8 : 249.

*Material examined* : (i) 1 ex, Thakuran-Matla, 3.xi.89, Coll. R.A. Khan, (ii) 2 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan.

*Length range* : 100-255 mm.

*Colour* : Body shiny blue above, silvery below, pectoral fin yellowish.

*Salient features* : Body elongated; snout pointed and large; horizontal mouth inferior. Teeth villiform on both jaws, outer rows in upper jaw enlarged with two pairs of canines at tip. Gill rakers 8 in lower arm of 1st arch, the first few short stumps. Dorsal fin with 10 spines, followed by a notch, second part with one spine and 26 soft rays. Anal fin with two spines and 7 soft rays, second spine weak; pectoral fin long and caudal fin rhomboid with pointed tip.

*Habitat* : Shallow coastal waters and mouth of estuaries.

*Geographical distribution* : Bay of Bengal, Malay Peninsula, Borneo and southern China.

*Remarks* : The species occurs in good numbers in the estuarine system alongwith other sciaenids. Good catches are obtained during post monsoon fishery operations.

#### 69. *Daysciena albida* (Cuvier)

1830. *Corvina albida* Cuvier, *Hist. nat. Poiss.*, 5 : 93 (type locality : Pondicherry, Mahe and Malabar)

1984. *Daysciena albida* : Talwar and Kacker, *Commercial Sea Fishes of India* : 639.

*Material examined* : (i) 3 ex, Jambo island, 21.xii.83, Coll. N.C. Nandi, (ii) 1 ex,

Choramayadwip, 4.xi.88, Coll. R.A. Khan, (iii) 1 ex, Tushkhali, 12.xi.88, Coll. R.A. Khan, (iv) 1 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

*Length range* : 140-230 mm.

*Colour* : Body grey above, silvery below, pectoral fin yellow, other fins grey.

*Salient features* : Body oblong; snout robust and projecting slightly beyond the tip of upper jaw; mouth terminal and inferior. A pair of barbles on chin. Teeth villiform, the outer row in upper jaw enlarged, caniniform. Dorsal fin with 10 spines followed by a deep notch, second part of dorsal fin with 1 spine and 26 soft rays. Anal fin with two spines and 7 soft rays, second spine long and strong. Caudal fin rhomboid. Gas bladder carrot shaped with 17-18 pairs of arborescent appendages.

*Geographical distribution* : India.

*Remarks* : This species occurs in fairly large numbers in the estuarine system particularly lower zone of Hugly estuary. It attains a fairly big size and individuals of 400-600 mm size group constitute the bulk of commercial catches. Because of its large size, it commands a good market price.

*Common name* : The bearded croaker.

#### 70. *Johnius sina* (Cuvier)

1830. *Corvina Sina* Cuvier, *Hist. nat. Poiss.*, 5 : 122 (type locality : Malabar)

1984. *Johnius sina* : Talwar and Kacker, *Commercial sea fishes of India* : 653.

*Material examined* : (i) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan, (ii) 2 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan, (iii) 2 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan, (iv) 2 ex, Kalas, 10.iii.89, Coll. R.A. Khan.

*Length range* : 120-180 mm.

*Colour* : Body dusky brown above, flanks and belly silvery.

*Salient features* : Body elongated; snout rounded but not projecting or inflated; mouth fairly large, inferior, the maxilla extending to below posterior part of eye. Teeth villiform, in narrow bands of different sizes in both jaws, the outer row in upper jaw and inner row in lower jaw enlarged, no canines. Gill rakers 14 on lower arm of 1st arch. Dorsal fin with 9 spines followed by a notch and then second part with 1 spine and 29 soft rays. Anal fin with 2 spines and 7 soft rays. Caudal rhomboid. Gas bladder hammer shaped with 15 pairs of arborescent appendages, 1st entering head.

*Geographical distribution* : Indian Ocean, from Natal to Malay peninsula.

*Remarks* : A small sciaenid, though not abundant but occurs fairly in commercial catches.

*Common name* : Sin croakers.

### 71. *Johnius belangerii* (Cuvier)

1830. *Corvina belangerii* Cuvier, *Hist. nat. Poiss.*, 5 : 120 (type locality : Pondicherry)

1984. *Jhonijs belangerii* : Talwar and Kacker, *Commercial Sea fishes of India* : 647.

*Material examined* : (i) 1 ex, Haldibari, 7.i.88, (ii) 2 ex, Matla-Thakuran, 8.xi.88, Coll. R.A. Khan, (iii) 2 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan, (iv) 2 ex, Kalas, 10.iii.89, Coll. R.A. Khan, (v) 2 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

*Length range* : 80-120 mm.

*Colour* : Dorsal side of body with dark pigments, looking like bars, ventral surface deep gray. Spinous dorsal fin darker.

*Salient features* : Body elongated; steeply rounded snout; mouth small, inferior, maxilla extending to below pupil. No barble on chin. Teeth villiform in broad bands on both jaws, differentiated in size only in upper jaw. No canine teeth. Gill rakers short, 9 on lower arm of first arch. Dorsal fin with 9 spines followed by deep notch and second part of fin comprising 1 spine and 30 soft rays. Anal fin with 2 spines and 7 soft rays. Caudal fin rhomboid. Cycloid scales on snout, ctenoid elsewhere. Gas bladder hammer shaped with 12 pairs of arborescent appendages, first entering head.

*Habitat* : Coastal waters and estuaries.

*Geographical distribution* : Arabian Sea along the coast of Indian peninsula and south east Asia to China and Japan and eastern coast of Australia.

*Remarks* : The species occurs in small numbers in lower reaches and caught commercially alongwith other sciaenids.

*Common name* : Belanger's croavey

### 72. *Otolithiodes biauritus* (Cantor)

1850. *Otolithus biauritus* Cantor, *J. Asiat. Soc. Beng.*, 18 (2) : 1039 (type locality : Penang, Malay Peninsula.)

1984. *Otolithoides biauritus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 661.

*Material examined* : 2 ex, Kedokhal, 12.iii.89, Coll, R.A. Khan.

*Length range* : 110-120 mm.

*Colour* : Body grey at head and back, flanks silvery, with golden tinge, lateral line golden. Fins light orange except pectoral which is brownish.

*Salient features* : Body ellongate, depth nearly one fourth of standard length; snout short; mouth terminal and large, lower jaw projecting; teeth on both jaws, in single row in lower and in double row in upper, two pairs of canines in upper and one pair in lower. Gill rakers 14 on lower arm of 1st arch. Dorsal fin with 10 spines, followed by notch and

second part with 1 spine and 29 soft rays. Anal fin with 2 spines and 8 soft rays, 2nd spine short and weak. Caudal fin rhomboid with a pointed tip. Gas bladder carrot shaped with large number of arborescent appendages, none entering head:

*Habitat* : Bottom inhabiting species occurring in coastal waters and estuaries.

*Geographical distribution* : India, Myanmar, Malay Peninsula, Sumatra, Borneo, Vietnam, Annam.

*Remarks* : One of the most important species of estuarine system comparing bulk of sciaenid fishery. Grows to a large size.

*Common name* : Bronze-Croaker.

### 73. *Pama pama* (Hamilton-Buchanan)

1822. *Bola pama*, Hamilton-Buchanan, *Fishes of Ganges* : (type locality : Genjes estuaries)

1975. *Pama pama* : Talwar, J. *Inland. Fish. Soc. India*, 7 : 36-42

*Material examined* : (i) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan, (ii) 1 ex, Dhanchi, 12.iii.89, Coll. R.A. Khan, (iii) 1 ex, Kedokhal, 12.iii.89, Coll. R.A. Khan.

*Length range* : 153-205 mm.

*Colour* : Body grey above light below.

*Salient features* : Body oblong, compressed, abdomen rounded. Head some what compressed and slightly convex. Snout obtusely pointed, two open pores on anterior surface and two on the free edge of skin. Mouth inferior; eyes superior. Jaws unequal, upper jaw slightly longer, lower jaw with a small open pore. Teeth villiform on both jaws with enlarged row in lower jaw. No teeth on palate. Preopercle crenulated. Two dorsal fins, continuous, inserted above pectoral fin base, first with 10 weak spines, filamentous, and second with one spine and 42-43 rays. Anal fin with two spines and 7 rays. Caudal fin wedge shaped, with central ray prolonged.

*Habitat* : Estuaries and fewshwaters.

*Geographical distribution* : North east coasts of India, Bangla Desh, Myanmar, Malaya, Sumatra.

*Remarks* : One of the most important species of the estuarine system, forms a fishery of its own. Basically a 'resident' estuarine species which enters freshwaters.

*Common name* : Coi-bola whiting.

### 74. *Panna microdon* (Bleeker)

1849. *Otolithus microdon* Bleeker, *Verh. Batav. Gen.*, 22 : 10 (type locality : Madura)

1984. *Panna microdon* : Talwar and Kacker, *Commercial Sea Fishes of India* : 666.

*Material examined* : (i) 2 ex, Budhakhali, Kakdwip, 31.xii.83, Coll. N.C. Nandi, (ii) 2 ex, Rakkhaskhali kakdwip, 12.viii.84, Coll. J.K. De, (iii) 1 ex, Chotahardi, 5.xi.88, Coll. R.A. Khan, (iv) 2 ex, Chulkati-Thakuran, 9.xi.88, Coll. R.A. Khan, (v) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan.

*Length range* : 80-140 mm.

*Colour* : Body brown above, lighter on flanks and belly.

*Salient features* : Body cylindrical; snout acute; large mouth terminal; maxilla extending slightly beyond vertical from hind edge of eye. Gill rakers 12 on lower arm of 1st arch. Villiform teeth on both jaws, outer band in upper jaw and inner band in lower jaw enlarged, 2 canines in upper jaw. Anterior part of dorsal fin with 10 spines followed by notch and posterior part with 1 spine and 36 soft rays. Anal fin with 2 spines and 7 soft rays, 2nd spine short and weak. Gas bladder with diverticulum of each side arising from anterior end and immediately dividing into a cephalic and an abdominal branch.

*Habitat* : Coastal water and estuaries.

*Geographical distribution* : India, Burma, Malay peninsula, Sumatra, Borneo and Vietnam.

*Remarks* : A medium sized sciaenid, very common in the entire estuarine zone. Caught in large numbers during post monsoon fishery operations. Also available in premonsoon and monsoon seasons.

*Common name* : Panna croaker.

### 75. *Macrospinosa cuja* (Hamilton-Buchanan)

1822. *Bola cuja* Hamilton Buchanan, *Fishes of Ganges* : (type locality : Ganges estuaries)

1970. *Macrospiniosa cuja* : Talwar, *Proc. zool. Soc. Calcutta*, **23** : 68.

*Material examined* : (i) 1 ex, Ajmalmari, 8.xi.88, Coll. R.A. Khan

*Length* : 120 mm.

*Colour* : Body dark brown above, flank and belly silvery.

*Salient features* : Elongated and compressed body, cylindrical abdomen; head moderately compressed; snout blunt with three small and 5 large pores. Mouth terminal; jaws nearly equal; teeth on outer row of upper jaw and inner row of lower jaw enlarged but not caninoid. No teeth on palate. Two opercular spines. Two dorsal fins, separated by a notch only, first with 10 spines and second with 1 spine and 27 rays. Anal fins with two spines and 7 rays, second spine long and robust, nearly one fifth of standard length. Caudal fin rounded.

*Habitat* : Estuaries, enters rivers.

*Geographical distribution* : India (estuaries of Ganga, only)

**Remarks :** An important species of the estuarine system. A resident species' occurs almost throughout the year. So far the species has only been recorded from this system.

#### Family EPHIPPIDAE

##### 76. *Drepane punctata* (Linnaeus)

1758. *Chaetodon punctata* Linnaeus, *Systema Naturae*, i (ed 10) : 273 (Type locality : Asia)

1875. *Drepane punctata* : Day, *Fishes of India* : 116.

**Material examined :** 3 ex, Gosaba, 11.ix.88, Coll. R.A. Khan

**Length range :** 80-120 mm.

**Colour :** Body silvery below and at sides, slightly darker on upper side, a prominent orange spot at the base of pectoral fin. Small black spots in several rows on upper half of body

**Salient features :** Strongly compressed and deep head and body, nearly circular, depth 90% or more of the standard length; mouth protractile; teeth pointed, slender and crowded together. Dorsal fin deeply notched with 9 spines and 20 soft rays, fourth dorsal spine longest. Anal fin with 3 spines and 18 soft rays; pectoral fin long and pointed, reaching to base of caudal fin. Deeply arched but symmetrical lateral line.

**Habitat :** Shallow coastal waters and estuaries.

**Geographical distribution :** Indo-west pacific.

**Remarks :** The species occurs infrequently in estuarine system.

**Common name :** Spotted drepane.

#### Family SCATOPHAGIDAE

The 'scats' have their bodies high and greatly elevated. Only one species occurs in the region which is fairly common, specially young ones.

##### 77. *Scatophagus argus* (Linnaeus)

1766. *Chaetodon argus* Linnaeus, *Systema Naturae*, ed 12, 1 : 464 (type locality : India)

1875. *Scatophagus argus* : Day, *Fishes of India* : 114.

**Material examined :** (i) 1 ex, Hatania Duania, 31.xii.83, Coll. J. K. De, (ii) 1 ex, Kakdwip, 6.iv.84, Coll. J. K. De, (iii) 1 ex, Jharkhali, 13.ii.87, Coll. N.C. Nandi, (iv) 1 ex, Thakuran-Matla, 3.xi.88, Coll. R.A. Khan, (v) 2 ex, Dhanchi, 10.iii.89, Coll. R.A. Khan

**Length range :** 48-115 mm.

**Colour :** Body dull greenish above with numerous large round brown spots, belly silvery.

*Salient features* : Body squarish in outline with bluntly pointed and triangular head; rostro-dorsal profile strongly ascending and followed by a deep concavity above the eye. Mouth small, not protrusible; teeth small, movable, tricuspid in bands in jaws. Notched dorsal fin with 11 strong spines, and 17 soft rays. Anal fin with 4 spines and 14 soft rays.

*Habitat* : Coastal waters and estuaries, enter rivers.

*Geographical distribution* : India, Sri Lanka, through East Indies to China, Taiwan, Phillipines, Melanesia, Polynesia and Queensland.

*Remarks* : Occurs in sufficient numbers in all zones of the estuary including upper zone of Hugly estuary. Good aquarium fishes.

*Common name* : Spotted butterfly, *Pyra Mach*

### Family MUGILIDAE

The 'mulletts' have cylindrical elongated, torpedo shaped body with flattened head and terminally inferior mouth; two widely separated spinous (4 spines) and rayed dorsal fins, subabdominal pelvic fin and no lateral line. Several species of mullets occur in abundance in the entire estuarine system. Four species belonging to three genera were collected.

#### 78. *Liza persia* (Hamilton-Buchanan)

1822. *Mugil parsia* Hamilton-Buchanan, *Fishes of Ganges* : 215 (type locality : River Hooghly)

1984. *Liza parsia* : Talwar and Kacker, *Commercial sea Fishes of India* : 721.

*Material examined* : (i) 1 ex, Namkhana, 31.xii.83, Coll. N.C. Nandi, (ii) 3 ex, Sonakhali, 18.11.87, Coll. N.C. Nandi, (iii) 1 ex, Saimari, 23.viii.87, Coll. R.A. Khan, (iv) 3 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan, (v) 5 ex, Dhanchi, 10.iii.89, Coll. R.A. Khan.

*Length range* : 60-180 mm.

*Colour* : Body greenish brown above, flanks and belly white, a golden spot on upper portion of operculum.

*Salient features* : Slendrical body; head moderately flattened on top. Adepse tissue covers most of the posterior iris of the eye; lips thin, lower lip with high symphyseal knob; Hind tip of maxilla reaching vertical between nostrils and eye. Two rows of short teeth present in upper jaw only. Two widely separated dorsal fins, first with 4 spines, second with 1 spine and 8 soft rays. Origin of first dorsal fin nearer to tip of snout than to caudal fin. Anal fin with three spines and 9 soft rays. Pectoral fin short, caudal fin slightly forked.

*Habitat* : Coastal waters and estuaries, enters freshwaters frequently.

*Geographical distribution* : India, Sri lanka and Pakistan.

**Remarks :** The commonest mullet of the estuarine system, occurs almost throughout the year in all regions. The juveniles are captured extensively by bag nets, mainly from sea face. Very delicious fish, commands a very high market price locally. Suitable for pond culture.

**Common name :** Goldspot mullet, *parse*.

#### 79. *Liza tade* (Forsskal)

1775. *Mugil crenilabris tade* Forsskal, *Descript. Animal* : 74 (type locality : Arabia).

1984. *Liza tade* : Talwar and Kacker, *Commercial sea Fishes of India* : 723.

**Material examined :** (i) 1 ex, Rakkhaskhali Kakdwip, 16.viii.84, Coll. J.K. De, (ii) 2 ex, Purandar, 17.ii.87, Coll. N.C. Nandi, (iii) 1 ex, Sudhanyakhali, 17.vi.85, Coll. R. A. Khan, (iv) 2 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan.

**Length range :** 75-98 mm.

**Colour :** Body pale above, silvery at belly and flanks.

**Salient features :** Elongated and slendrical body; wide and somewhat depressed head, with buldges at sides. Adepote tissue almost covers the iris. Lips thin, lower lip with high symphyseal knobs; tip of maxilla vertical between posterior nostril and anterior eye rim. 5-9 rows of small labial teeth in upper lip and one row of ciliiform teeth in lower lip. Preorbital wide, filling the space between lips and eye. Two widely separated dorsal fin, origin of first fin nearer to snout tip than caudal fin base. First dorsal fin with 4 spines and second with 1 spine and 8 soft rays. Anal fin with 3 spines and 9 soft rays; pectoral fin very short; caudal fin forked.

**Habitat :** Coastal waters, estuaries and also enters freshwater.

**Geographical distribution :** Red Sea, Pakistan, India, Sri Lanka, Bangladesh through the East Indies to China and Marianas

**Remarks :** One of the commonest species of the estuarine system and contributes substantially to mullet fishery along with *L. parsia*. Mostly juveniles are caught in bag nets.

**Common name :** Tade grey mullet, *Bhagona*

#### 80. *Rhinomugil corsula* (Hamilton-Buchanan)

1822. *Mugil parsia* Hamilton-Buchanan, *Fishes of Ganges* : 221 (type locality : Ganges R.)

1984. *Rhinomugil corsula* : Talwar and Kacker, *Commercial sea Fishes of India* : 728.

**Material examined :** (i) 4 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan,

**Length range :** 112-140 mm.

**Colour :** Body light brown above, silvery below.

**Salient features :** Body short and stout; head profile concave between eyes and projecting above this level. Eyes without adipose eyelids. Mouth protrusible and ventral. Teeth very minute, indistinct. Two widely separated dorsal fins, origin of first dorsal nearer to base of caudal fin than to the snout tip. First dorsal with 4 spines and second with 1 spine and 8 soft rays. Anal fin with 3 spines and 9 soft rays. Caudal fin slightly emerginate.

**Habitat :** Rivers and estuaries.

**Geographical distribution :** India, Bangla Desh, Burma.

**Remarks :** The species is not common in estuarine system but occurs in good numbers in the river Ganga upstrams.

**Common name :** Corsula mullet, *corsula*.

### 81. *Mugil cephalus* Linnaeus

1758. *Mugil cephalus* Linnaeus, *Systema Naturae* (ed 10), 1 : 316 (Type locality : 'European Ocean')

**Material examined :** (i) 2 ex, Haldibari, 22.viii.87, Coll. R.A. Khan, (ii) 1 ex, Toshkhali, 12.xi.88, Coll. R.A. Khan, (iii) 1 ex, Khatwajhuri, 15.iii.89, Coll. R.A. Khan.

**Length range :** 50-200 mm.

**Colour :** Body olive green above, silvery on sides and white below.

**Salient features :** Body slightly deep; head broad, flattened from above; adipose tissue covers almost whole eye, lips thin, high symphyseal knob; hind tip of maxilla not curved below tip of maxilla. Teeth labial, fine, 4 rows in upper lip, 2 rows in lower lips. Preorbital slender, filling only half of the space between lip and eye, not notched. Two widely separated dorsal fin, first with 4 spines and second with 1 spine and 8 soft rays. Anal fin with 3 spines and 8 soft rays, pectoral fin short not reaching to origin of dorsal fin. Caudal fin forked.

**Habitat :** Coastal waters, open seas, estuaries and rivers.

**Geographical distribution :** Widespread in temperate and tropical waters.

**Remarks :** This species occurs abundantly alongwith other mullets, also Common in freshwater zone of the river.

**Common name :** Flathead grey mullet.

### Family POLYNEMIDAE

Polynemids or thredfins have a peculiar characteristics of divided pectoral fins into two parts, the lower one consisting of 4-6 free long filaments. The thredfins are very

important estuarine fishes of this region and occur in almost all regions. Four species belonging to three genera were recorded.

### 82. *Eleutheronema tetradactylum* (Shaw)

1804. *Polynemus tetradactylum* Shaw, *General Zoology*, 5 : 156 (type locality : Vizagapaatnum)

1862. *Eleutheronema tetradactylum* : Bleeker, *Versl. Akad. Amesterdam*, 14 : 110.

**Material examined** : (i) 3 ex, Frassergung, 20.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Sudhanyakali, 17.4.85, Coll. R.A. Khan, (iii) 1 ex, Haldibari, 22.viii.87, Coll. R.A. Khan, (iv) 5 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan, (v) 1 ex, Arbessi, 15.xi.89, Coll. R.A. Khan.

**Length range** : 82-305 mm.

**Colour** : Body silvery grey above, pale yellow on sides and belly. Dorsal and caudal fins yellow, dusky at tips; pelvic and anal fins light orange; pectoral filamentous ray white.

**Salient features** : Elongated and somewhat compressed body; snout strongly projecting beyond mouth. Mouth very large, horizontal, upper lip absent, lower lip reduced to small folds. Teeth villiform, extending to exterior part of jaw. Two moderately separated dorsal fins, first with 8 spines and second with 1 spine and 14 soft rays. Anal fin with two spines and 16 soft rays. Pectoral fin inserted low on body with 4 filamentous unbranched rays, the upper part well below the middle line of body. A fold of skin projecting from the base of pectoral fin covers the base of filaments. Gas bladder absent.

**Habitat** : Estuaries and coastal waters.

**Geographical distribution** : Pakistan, India, Bangla Desh, Sri Lanka through East Indies, Phillipines and Queensland.

**Remarks** : The species occurs in fairly good numbers in the estuarine system and constitute the fishery of its own. A high prized fish much sought after.

**Common name** : Fourfinger threadfin, *Guchia*.

### 83. *Polydactylus indicus* (Shaw)

1804. *Polynemus indicus* Shaw, *General Zoology*, 5 : 155 (type locality : Vizagapatnam)

1984. *Polydactylus indicus* : Talwar and Kacker, *Commercial sea Fishes of India* : 749.

**Material examined** : (i) 1 ex, Jambu island, 23.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Saimari, 23.8.87, Coll. R.A. Khan, (iii) 2 ex, Matla-Thakuran, 8.xi.88, Coll. R.A. Khan, (iv) 2 ex, Tushkhali, 12.xi.88, Coll. R.A. Khan.

**Length range** : 105-320 mm.

*Colour* : Body dark grey above, with light spots on belly and flank. Fins yellow.

*Salient features* : Slightly compressed elongated body with projecting snout. eyes very small, nearly 15% of head length. Mouth large with small teeth on jaws, vomer and palatines. Two moderately separated dorsal fin, first with 8 spines and second with 1 spine and 14 soft rays. Anal fin with 2 spines and 12 soft rays. Pectoral fin divided into two parts, the lower part with 5 filamentous free rays, of which the first one is the longest and extends nearly to anal fin. Caudal fin strongly lunate with pointed lobes ending in filaments.

*Habitat* : Shallow muddy and sandy bottoms of coastal waters and estuaries. Enters rivers.

*Geographical distribution* : Indo-west Pacific.

*Remarks* : The species occurs in fair numbers in all the zones of the estuarine system and caught in substantial quantities during post monsoon fishery operations.

*Common name* : Indian threadfin.

#### 84. *Polydactylus sextaris* (Bloch)

1801. *Polynemus sextaris* Bloch, *Syst. Ichth.* : 18 (type locality : Tranquebar)

1984. *Polydactylus sextaris* : Talwar and Kacker, *Commercial sea Fishes of India* : 752.

*Material examined* : 1 ex, Jambu island, 23.xii.83, Coll. N.C. Nandi.

*Length range* : 110 mm.

*Colour* : Body yellowish grey above, white below. A black spot at the beginning of lateral line. Fins yellow.

*Salient features* : Elongated and slightly compressed body; snout projecting; mouth large with fully developed lips; teeth small on jaws, vomer and palatine. Two moderately separated dorsal fins, first with 8 spines and second with 3 spines and 11 soft rays. Pectoral fin inserted low on body and divided into two parts, lower part with 7 free filamentous rays and upper with simple branched rays. the upper two filamentous rays are longest and reaching to tip of pelvic fin.

*Habitat* : Shallow coastal waters and estuaries

*Geographical distribution* : Indo-west Pacific.

*Remarks* : Rare in the region

*Common name* : Blackspot threadfin.

### 85. *Polynemus paradiseus* Linnaeus

1758. *Polynemus paradiseus* Linnaeus, *Systema naturae*, 1 (ed 10) : 317.

**Material examined** : (i) 1 ex, Jambu island, 23.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Crabhat, 15.4.85, Coll. R.A. Khan, (iii) 2 ex, Kalinagar, 20.vi.86, Coll. R.A. Khan, (iv) 2 ex, Chulkati, 9.xi.88, Coll. R.A. Khan,

**Length range** : 140-175 mm.

**Colour** : Body redish yellow above, grey along belly and sides, fins grey.

**Salient features** : Body oblong, somewhat compressed; snout projecting; mouth subterminal and large; teeth small, villiform. Very small eyes. Two dorsal fins, first with 7 spines and second with 1 spine and 15 soft rays. Anal fin with 2 spines and 12 soft rays. Pectoral fins inserted high on body and divided into two parts, the upper with unbranched rays and lower with 7 free very long filamentous rays. The upper three are longest, nearly double the length of fish. Caudal fin deeply forked, upper lobe longer than the lower.

**Habitat** : Shallow sandy coastal waters and estuaries. Enters rivers.

**Geographical distribution** : Indo-west pacific.

**Remarks** : One of the most important food fish of the region and commands very high market price. It occurs in all zones of the system almost throughout the year. It is reported to breed in freshwater region of the river Hugly.

**Common name** : Paradise threadfin, *Topse*.

### Family GOBIDAE

Small fishes, characterized by united pelvic fin bases forming a sucking disc; absence of lateral line and identical in size and shape second dorsal and anal fins. The family was represented by a number of species including mud skippers but of little commercial value.

### 86. *Acentrogobius globiceps* (Hora)

1923. *Clenogobius globiceps* Hora, *Mem. Ind. Mus.*, 5 : 744.

1941. *Acentrogobius globiceps* : Kowmans, *Mem. Ind. Mus.*, 13 : 234.

**Material examined** : (i) 1 ex, Golabari, 11.x.88, Coll. K. N. Reddy, (ii) 3 ex, Panchmukhani, 5.iii.89, Coll. R.A. Khan.

**Length range** : 55-95 mm.

**Colour** : Body brown yellow with vertical faint bands on sides.

**Salient features** : Body elongated and compressed, abdomen rounded; head slightly compressed; mucos canal longitudinal over cheek, some open pore round the eye; snout obtuse; mouth oblique; cleft extending to anterior border of eye. Eyes moderate, lateral,

in anterior part of head. Jaws equal, teeth in both jaws in several rows, outer row enlarged, last teeth in outer row of lower jaw canine. Gill openings not continued forward. Two closely situated dorsal fins, first with 6 rays and second with 12 rays. Pectoral fin united, oblong; anal fin pointed.

*Habitat* : Brackishwater, enters freshwaters.

*Geographical distribution* : Chilka lake, Hugly-Matla estuarine system, Ennur backwaters and Java.

*Remarks* : The species is not of common occurrence and has got no commercial value.

### 87. *Apocryptes bato* (Hamilton-Buchanan)

1822. *Gobius bato* Hamilton-Buchanan, *Fishes of Ganges* : 365 (type locality : Ganges R.)

1941. *Apocryptes bato* : Cowmans, *Mem. Ind. Mus.*, 13 : 278.

*Material examined* : (i) 2 ex, Gosaba, 24.14.85, Coll. R.A. Khan, (ii) 1 ex, Sajnakhali, 14.xi.88, Coll. R.A. Khan

*Length range* : 40-48 mm.

*Colour* : Body greenish white with a number of transverse band.

*Salient features* : Body very elongate and compressed, abdomen subcylindrical; snout triangular; mouth oblique, cleft extending to below and border of eye. Eyes superior, situated in the middle of head. Lower jaw slightly longer, teeth in both jaws in single fixed row, lower jaw with one pair of canines. Gill opening moderate. Two closely situated dorsal fins, first with 6 flexible spines and second with 20 rays. Pelvic fins united. Long anal fin, caudal fin lanceolate.

*Habitat* : Inter-tidal mud-flats of the estuaries.

*Geographical distribution* : North-east coast of India, Bangla Desh, Burma

*Remarks* : Occurs frequently on the mud flats of the entire estuarine system. Not of commercial value, though eaten locally.

### 88. *Boleophthalmus boddarti* (Pallas)

1770. *Gobius boddarti* Pallas, *Spieilegia*, 8 : 11.

1941. *Boleophthalmus boddarti* : Cowmans, *Mem. Ind. Mus.*, 13 : 280.

*Material examined* : (i) 3 ex, Deolbari-Jharkhali, 13.iv.85, Coll. R.A. Khan (ii) 11 ex, Nezat, 19.vi.86, Coll. R.A. Khan, (iii) 3 ex, Kishorimohanpur, 3.xi.88, Coll. R.A. Khan, (iv) 3 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan.

*Length range* : 80-135 mm.

*Colour* : Body dark green with several dark spots (6-7) or bands.

**Salient features :** Elongated and compressed body, abdomen subcylindrical; head curved with warty skin and covered by scales. Snout blunt; mouth oblique; eyes on top of head close to each other, very large with well developed outer eyelids. Lower jaw slightly longer, single row of teeth on both jaws, upper jaw teeth conical, caninoid, lower jaw teeth small, flattened and notched. Gill opening oblique. Two closely situated dorsal fins, first with 5 and second with 25 rays. Pectoral fin without free silky rays with muscular base. Pelvic fin united and oblong; anal long fin. Caudal fin oblong and asymmetrical.

**Habitat :** Intertidal mudflats of estuaries and backwaters. Enters freshwaters.

**Geographical distribution :** Pakistan, India, Bangla Desh, Burma, Thailand, Malaya, East Indies.

**Remarks :** One of the commonest mudskippers of the region.

### 89. *Boleophthalmus dussumierei* Valenciennes

1837. *Boleophthalmus dussumierei* Valenciennes, *Hist. nat. Poiss.*, 12 : 207.

**Material examined :** (i) 3 ex, Gosaba, 24.iv.85, Coll. R.A. Khan, (ii) 2 ex, Haliday islands, 6.xi.88, Coll. R.A. Khan (iii) 1 ex, Panchmukhani, 5.iii.89, Coll. R.A. Khan, (iv) 1 ex, Printice island, 8.iii.89.

**Length range :** 42-120 mm.

**Colour :** Body olive green with faint stripes.

**Salient features :** Body very elongate, compressed, belly subcylindrical; head oblong, covered with warty skin; snout blunt. Cleft of mouth extending beyond anterior border of eye. Very prominent eyes situated on top of head, close together. Jaws subequal, single row of teeth on both jaws. Two dorsal fins, separate; pectoral fin without free silky rays; pelvic fin united; caudal oblong, asymmetrical.

**Habitat :** Same as *B. boddarti*

**Geographical distribution :** Iraq, Pakistan, India.

**Remarks :** This species also occurs commonly alongwith other mudskippers on the mudflats.

### 90. *Glossogobius giuris* (Hamilton-Buchanan)

1822. *Gobius guttum* Hamilton-Buchanan, *Fishes of Ganges* : 50 (type locality : Ganges estuaries)

1941. *Glossogobius giuris* : Cowmans, *Mem. Ind. Mus.*, 13 : 256.

**Material examined :** (i) 1 ex, Buddhakhali - Kakdwip, 7.xi.83, Coll. N.C. Nandi, (ii) 1 ex, Jharkhali, 3.ii.87, Coll. N.C. Nandi, (iii) 3 ex. Raidighi, 3.vii.87, Coll. M. K. Devroy, (iv) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan.

*Length range* : 60-100 mm.

*Colour* : Blackish green above, lighter below, head with irregular lines, first dorsal fin with one black spot.

*Salient features* : Body elongate, cylindrical anteriorly, abdomen rounded; head pointed and depressed; snout obtuse, rounded; Mouth cleft not extending up to eye border. Eyes large, superior, in the middle of head, iris without any process in pupil; Villiform teeth on jaws, uneven, tongue bilobed. Gill opening continued far forward below isthmus and narrow, Two closely situated dorsal fins, first inserted above half or more of pectoral fin, with 6 rays and second with 8 rays. Pectoral fin without free silky rays, base scaled. Pelvic fin united, oblong. Caudal fin oblong and rounded.

*Habitat* : Estuaries and backwaters. Enters freshwaters.

*Geographical distribution* : From east coast of Africa to Japan.

*Remarks* : Common gobiid found in estuaries, rivers and ponds of this region.

#### 91. *Gobiopterus chuno* (Hamilton-Buchanan)

1822. *Gobius chuno* Hamilton-Buchanan, *Fishes of Ganges* : 53 (type locality : Ganga R.)

1941. *Gobiopterus chuno* : Cowmans, *Mem. Ind. Mus.*, 13 : 297.

*Material examined* : (i) 7 ex, Kakdwip, 13.11.80, Coll. A.K. Mondal, (ii) 1 ex, Ajmalmari, 8.iii.89, Coll. R.A. Khan

*Length range* : 130-150 mm.

*Colour* : Body brown yellow with a series of black spots on the back from the origin of anal fin to base of caudal fin.

*Salient features* : Body elongated, compressed, abdomen rounded; head compressed; snout blunt; mouth oblique; eyes superior and in middle of head in anterior part. Jaws subequal, teeth large conical, in one row on both jaws, in upper jaw caninoid, in lower jaw anterior ones caninoid. No labial teeth, tongue bilobed. Two closely situated dorsal fins, first inserted above half of pectoral fin with 6 rays and second with 8 rays. Pectoral fin without silk like rays, pelvic fins united but free from belly. Caudal fin truncate.

*Habitat* : Brackishwater, enters freshwater.

*Geographical distribution* : India, Bangla Desh, Thailand, Singapore.

*Remarks* : Available occasionally in the estuarine system.

#### 92. *Periophthalmus koelreuteri* (Pallas)

1770. *Gobius koelrcuteri* Pallas, *Spicilegia Zool*, 8 : 8.

1941. *Periophthalmus koelreuteri* : Kowmans, *Rec. Ind. Mus.*, 13 : 289.

**Material examined :** (i) 2 ex, Kakdwip, 5.iv.83, Coll. J. K. De, (ii) 4 ex, Canning, 8.iv.85, Coll. R.A. Khan, (iii) 6 ex, Hasnabad, 22.vi.86, Coll. R.A. Khan (iv) 3 ex, Kishorimohanpur, 7.iii.89, Coll. R.A. Khan

**Length range :** 60-100 mm.

**Colour :** Body black or brown above, lighter below, some spots on operculum.

**Salient features :** Body elongated and slightly compressed, abdomen subcylindrical; head short and flattened; snout blunt. Head profile from eyes to snout very steep. Mouth horizontal; eyes close together, vary large, placed on top of head in the anterior part. Jaws subequal, uneven conical teeth in single row, anterior ones caninoid. Gill opening narrow. Two dorsal fins separated by interspace, first inserted above pectoral fin base with 8-17 rays and second with 14 rays. Pectoral fin with a muscular base. pelvic fin united, caudal fin asymmetrical.

**Habitat :** Estuarine mud flats.

**Geographical distribution :** India (Sunderban, Andaman & Nicobar)

**Remarks :** Common mudskipper

### 93. *Periophthalmus pearsei* Eggert

1935. *Periophthalmus pearsei* Eggert, Zool. jahrb. (Syst.), 67 : 57.

**Material examined :** (i) 7 ex, Sonakhali, 1.iv.85, (ii) 1 ex, Sajnakhali, 14.xi.88, Coll. R.A. Khan, (iii) 4 ex, Raidighi, 4.vii.87, Coll. M.K. Devroy.

**Length range :** 40-60 mm.

**Colour :** Body brown above, lighter below.

**Salient features :** Body oblong, slightly compressed, abdomen subcylindrical, head short, snout blunt, profile from eye to snout very steep. mouth horizontal. Eyes close together very prominent, placed on top of head. Jaws subequal, unequal teeth in single row on jaws. Tongue rounded. Two closely situated dorsal fin, first with 15 rays and second with 12 rays. First dorsal 12 rays. Pectoral fin with muscular base. Pelvic fin united at the base only. Caudal fin asymmetrical.

**Habitat :** Mudflats of estuaries and backwaters.

**Geographical distribution :** India (West Bengal), Bangla Desh, Myanmar.

**Remarks :** Occurs alongwith other mudskippers in all zones.

**Common name :** Mud Skipper.

### Family KURTIDAE

Commonly known as humpback, the fishes have oblong and compressed body covered with cyclopid scales, large mouth with several bands of villiform teeth, thin paper like and single dorsal fin. Males have characteristics occipital hook for carrying eggs.

94. *Kurtus indicus* Bloch

1786. *Kurtus indicus* Bloch, *Naturges. ausland. Fische*, 2 : 122 (type locality : India)

*Material examined* : 5 ex, Jambu island, 20.xii.83, Coll. N. C. Nandi.

*Length range* : 105-120 mm.

*Salient features* : Body oblong and strongly compressed with elevated back. Mouth large; teeth villiform in bands on jaws and minute on vomer and palatines. Opercular bone thin and paper like. Dorsal fin with 5 rudimentary spines preceeded by a recumbent spine directed anteriorly and 12 soft rays. Anal fin with 2 spines and 32 soft rays. Pelvic fin with one spine and 5 soft rays. Small cycloid scales. lateral line ending near opposite end of soft dorsal fin. Males with a very prominent occipital hook.

*Habitat* : Enters inshore waters and estuaries.

*Geographical distribution* : Indo-Malay.

*Remarks* : The species occurs near the mouth of estuaries during post monsoon cold period and caught in sufficient numbers.

*Common name* : Indian humphead.

## Family TRICHIURIDAE

The ribbon fishes have long, much flattened body with silvery belly, tapering to thin pointed tail, ribbon or tape like. Mouth very large with strong jaw teeth, the front one fang like. These were represented by three species.

95. *Lepturacanthus savala* (Cuvier)

1829. *Trichiurus savala* Cuvier, *Regne Animal*, 2, (ed 2) : 219.

1967. *Lepturacanthus savala* : James, *Mem. Mar. Biol. Ass. India* (1) : 24.

*Material examined* : (i) 5 ex, Jambo island, 23.xi.83, Coll. N.C. Nandi, (ii) 3 ex, Nikarighata-Canning, 3.iii.87, Coll. N.C. Nandi, (iii) 2 ex, Deolbari-Jharkhali, 13.14.85, Coll. R.A. Khan, (iv) 2 ex, Purandar, 17.viii.87, Coll. R.A. Khan, (v) 1 ex, Haldibari, 7.i.88, Coll. R.A. Khan.

*Length range* : 250-350 mm.

*Colour* : Body bright silvery blue with metallic reflection.

*Salient features* : Body very elongated, strongly compressed, ribbon like, tapering gradually to tail end. Mouth large with fang like teeth. Eyes about 12% of the head length. Gill rakers 10-11 on lower arm of first arch. Lower hind margin of operculum concave. Dorsal fin long, covering almost entire body from nape to tail with 114-116 soft rays. Anal fin reduced and in spine form; pectoral fin with 1 unserrated spine and 10 soft rays. Pelvic and anal fins absent. Post anal scutes prominent and dagger like, soft anal rays with pungent spinules.

**Habitat :** Coastal waters, estuaries, generally bottom inhabitant.

**Geographical distribution :** Persian Gulf, India, through the East Indies to China.

**Remarks :** One of the few most important fishes of the estuarine system, caught in large numbers during post monsoon season alongwith the other important ribbon fish species, *T. pantului*.

**Common name :** Small-headed ribbonfish.

#### 96. *Lepturacanthus pantuli* Gupta

1966. *Trichiurus pantuli* Gupta, *Proc. Zool. Soc. Calcutta* : 19 : 170 (type locality : Frassergung, Hooghly estuary).

1994. *Lepturacanthus pantuli* : Talwar Fauna of West Bengal, Part

**Material examined :** (i) 4 ex, Hatania Duania, 31.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Dabucanning, 11.i.88, Coll. S.C. Saren, (iii) 1 ex, Thakuran Matla, 3.xi.88, Coll. R.A. Khan, (iv) 2 ex, Chotahardi, 5.xi.89, Coll. R.A. Khan, (v) 1 ex, Kishori Mohanpur, 9.xi.88, Coll. R.A. Khan

**Length range :** 130-400 mm.

**Colour :** Silvery white body.

**Salient features :** Body very elongate, compressed, ribbon like, tapering gradually to tail. Head length nearly 12% of total length. Mouth large with fang like canine teeth, palatine teeth in 4 rows. Eyes small, nearly 18% of head length. Dorsal fin long running from nape to tail end with 3 spines and 120 soft rays. Anal fin reduced to spines, buried in the skin. Pectoral fin small, Pelvic and caudal absent.

**Habitat :** Coastal and estuarine waters.

**Geographical distribution :** Sunderban estuaries, Andhra coasts.

**Remarks :** The most abundant ribbon fish of the region comparising substantially to total fishry. It occurs almost in all season with greater abundance during monsoon months.

**Common name :** Gangetic ribbon fish.

#### 97. *Trichiurus lepturus* Linnaeus

1758. *Trichiurus lepturus* Linnaeus (partim), *Systema Naturae*, (ed 10) : 246 (type locality : South Carolina)

**Material examined :** (i) 1 ex, Swarpur, 20.xii.86, Coll. N.C. Nandi, (ii) 1 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan)

**Length range :** 235-260 mm.

**Colour :** Body silvery blue with metallic reflection.

**Salient features :** Body elongated, compressed, ribbon like, tapering gradually. Head small, 14-15% of total length. Mouth large with barbed fang like canine teeth, palatine teeth in 4 to 5 rows. Dorsal fin very long, from nape to tail end with three spines and 35 soft rays. Anal fins reduced and in the form of separate spines, numerous, buried. Pelvic and caudal fins absent. Post anal scutes not enlarged.

**Habitat :** Coastal waters and estuaries, mostly bottom living.

**Geographical distribution :** widespread in tropical and temperate waters.

**Remarks :** Not common in the region.

**Common name :** large head ribbon fish.

### Family STROMATEIDAE

Commonly known as pomfret, these are important food fishes of the region. They have, deep, greatly compressed, almost roundish body, as deep as long with small mouth, single dorsal fin with no spines, long pectoral fins and no pelvic fins. Two species of a single genus occur in the region.

#### 98. *Pampus argenteus* (Euphrasen)

1788. *Stromateus argenteus* Euphrasen, Kongl. Vetensk., Acad., Handl. Stockholm, 9 : 49 (type locality : "Castellum chinese Bocca Tigris dictum")

1984. *Pampus argenteus* : Talwar and Kacker, *Commercial sea Fishes of India* : 837.

**Material examined :** (i) 3 ex, Jambu island, 23.xii.83, Coll. N.C. Nandi, (ii) 1 ex, Haliday island, 1.ix.87, Coll. R.A. Khan.

**Length range :** 70-180 mm.

**Colour :** Back grey, belly and flank silvery white. Minute black dots on body.

**Salient features :** Body very deep and compressed, hard flesh. Adepse eyelids present; teeth small in single row in both jaws, laterally compressed. No palatine teeth. Gill membrane broadly united to isthmus, gill opening very narrow, vertical slit like on sides of body. Single dorsal fin, dorsal and anal fins fulcate, median fins preceded by 7-8 blade like spine. No pelvic fin, caudal fin deeply forked with longer lower lobe.

**Habitat :** Open seas, coastal waters and estuarine mouth.

**Geographical distribution :** Persian Gulf to Japan.

**Remarks :** The species mainly occurs in coastal waters and mouth of Hugly estuary. Caught abundantly during september-december period, but also occurs in other month. Of late the pomfrets have become craze of the people in this regions also escalating the market price wildly.

**Common name :** Silver pomfret.

**99. *Pampus chinensis* (Euphrasen)**

**1788.** *Stromateus chinensis* Euphrasen, Kongl. Vetensk. Acad. Handl. Stockholm, 9 : 53 (type locality : "Castellum Chinese Bocca Tigris dictum")

**1984.** *Pamous chinensis* : Talwar and Kacker, *Commercial sea Fishes of India* : 838.

**Material examined :** (i) 1 ex, Taltola, 17.ii.87, Coll. N.C. Nandi, (ii) 1 ex, Kalas Island, 10.iii.89, Coll. R.A. Khan

**Length range :** 85-100 mm.

**Colour :** Grey on back, silvery white belly.

**Salient features :** Body strongly deep and compressed with hard flesh. Eyes with adepose lid. Teeth in single row in both jaws, laterally compressed. No palatine teeth. Gill memberane broadly united to isthmus, gill opening narrow like vertical slits on side. Single dorsal fin, dorsal and anal fins not fulcate but gradually reducing in height posteriorly; no spines before the median fins; caudal fin slightly forked.

**Habitat :** Coastal waters and estuaries, prefers muddy bottom.

**Geographical distribution :** Pakistan, India and China.

**Remarks :** This species also occurs in abundance and contributes significantly during post monsoon fishing season. Generally caught by trawlers operating in the coastal waters adjoining mouth of the estuaries.

**Common name :** Chinese pomfret.

Order PLEURONECTIFORMES

Family BOTHIDAE

The lefteye flounders have flat and highly asymmetrical bodies with both eyes on left side. Fins without spine, long dorsal and anal fins. Only two species was recorded.

**100. *Pseudorhombus arsius* (Hamilton-Buchanan)**

**1922.** *Pleuronectes arsius* Hamilton-Buchanan, *Fishes of Ganges* : 128 (type locality : Ganges estuary below Calcutta)

**1877.** *Pseudorhombus arsius* : Day, *Fishes of India* : 423.

**Material examined :** 1 ex, Ajmalmari, 6.iii.89, Coll. R.A. Khan.

**Length :** 75 mm.

**Colour :** Brownish on ocular side with dusky blotches in anterior region of the straight part of lateral line and a small blotch halfway to caudal fin base.

**Salient features :** Body flat, almost oval; both eyes on left side, close together, separated by a narrow bony ridge. Maxilla tip reaching to posterior region of eye. Gill rakers

lanceolate, 12 on lower arm of first arch. Canine teeth on anterior part of lower jaw of blind side. Dorsal fin origin in front of upper eye. Scales on blind side cycloid, on ocular side ctenoid. Lateral line curved above pectoral fin, 2 branches in head.

*Habitat* : Shallow muddy and sandy bottom of coastal waters and estuaries.

*Remarks* : Occurs in small numbers in lower zone.

*Common name* : Large toothed flounder.

#### 101. *Pseudorhombus elevatus* Ogilby

1912. *Pseudorhombus elevatus* Ogilby, Mem. Queensland Mus., 1 : 45 (type locality : Queensland, Australia)

*Material examined* : (i) 1 ex, Sonakhali, 18.ii.87, Coll. N.C. Nandi, (ii) 1 ex, Ajmalmari, 10.iii.89, Coll. R.A. Khan, (iii) 1 ex, Kalas, 10.iii.89, Coll. R.A. Khan.

*Length range* : 62-92 mm.

*Colour* : Ocular side brown with faint blotches in 5 irregular rows along body and three large blotches along straight part of lateral line.

*Salient features* : Body almost oval and flat, depth nearly half of standard length. Dorsal profile of head slightly notched in front of eyes. Both eyes on left side. Maxilla extending below middle of lower jaw. Small teeth in both jaws, enlarged anteriorly, 28 teeth on blind side of lower jaw. Gill rakers lanceolate, 14 on lower arm of first arch. Dorsal fin very long covering the entire body, originating from above anterior nostrill of blind side. Lateral line equally developed on both side, curved anteriorly forming two branches on head. Scales ctenoid on eyed side and cycloid on blind side.

*Habitat* : Shallow muddy and sandy bottoms of estuaries and coastal waters.

*Geographical distribution* : The Red Sea, Persian Gulf, Pakistan, India, North-eastern coast of Australia.

*Remarks* : This flounder occurs in lower zone of the estuarine system in small numbers. Not liked much locally.

*Common name* : Deep flounder

#### Family CYNOGLOSSIDAE

These fishes also have asymmetrical bodies but elongated with a pointed tail and no ribs. Both eyes on left side, very small and close together. Dorsal caudal and anal fins united. The collections were represented by three species belonging to one genus.

#### 102. *Cynoglossus cynoglossus* (Hamilton-Buchanan)

1822. *Achirus cynoglossus* Hamilton-Buchanan, *Fishes of Ganges* : 132 (type locality : Ganga R. Mouth)

**1984.** *Cynoglossus cynoglossus* : Talwar and Kacker, *Commercial Sea Fishes of India* : 876.

**Material examined** : (i) 3 ex, Namkhana, 31.xii.83, Coll. N.C. Nandi, (ii) 3 ex, Janmbu island, 20.xii.83, Coll. N.C. Nandi, (iii) 1 ex, Gosaba, 30.x.85, Coll. J.K. De, (iv) 1 ex, Saimari, 23.viii.87, Coll. R.A. Khan, (v) 1 ex, Ajmalmari, 8.xi.83, Coll. R.A. Khan, (vi) 1 ex, Dhanchi, 10.iii.89, Coll. R.A. Khan.

**Length range** : 50-385 mm.

**Colour** : Ocular side brown, blind side whitish

**Salient features** : Elongated and flat body. Snout obtusely pointed and large, about one third of head length. Two nostrills on ocular side, anterior tubular, in front of lower eye. Rostral hook short, angle of mouth not reaching beyond lower eye, nearer to tip of snout than to gill opening. Dorsal and anal fins long, join together with caudal fin. Pectoral fin absent; small pelvic on blind side. Two lateral line on ocular side, midlateral line with 80-85 scales and 13-14 rows of scales between lateral lines. Scales ctenoid on both sides.

**Habitat** : Muddy and sandy bottoms of coastal waters and estuaries.

**Geographical distribution** : India, Bangla Desh, through the East Indies to Philippines.

**Remarks** : Occurs in small numbers in lower zones, of not much fishery value.

**Common name** : Gangetic tongue sole.

### 103. *Cynoglossus lingua* (Hamilton-Buchanan)

**1822.** *Cynoglossus lingua* Hamilton-Buchanan, *Fishes of Ganges* : 32 (type locality : Gangetic estuaries)

**Material examined** : (i) 1 ex, Hingulgunj, 25.vi.86, Coll. R.A. Khan, (ii) 1 ex, Nithidopani, 31.viii.87, Coll. R.A. Khan, (iii) 1 ex, Matla-Thakuran, 3.xi.88, Coll. R.A. Khan, (iv) 1 ex, Arbessi, 12.xi.88, (v) 1 ex. Kalas, 10.iii.89, Coll. R.A. Khan.

**Length range** : 113-290 mm.

**Colour** : Ocular side redish brown, a large black blotch on operculum.

**Salient features** : Elongated and flattened body. Two nostrills on ocular side, anterior tubular in front of lower eye, posterior in anterior half of interorbital space. Snout obtusely pointed. Short rostral hook, angle of mouth reaching beyond lower eye. Two lateral line on ocular side, midlateral with 95-100 scales, 12 row between lateral lines on ocular side. No lateral line on blind side. Scales ctenoid on ocular side but cycloid on head and lateral line, large cycloid on blind side. Long dorsal and anal fin; caudal fin with 10 rays.

**Habitat** : Coastal waters and estuaries, prefers muddy bottom.

**Geographical distribution** : West and east coasts of India, Indonesia and Philippines.

**Remarks** : Occurs in fair numbers in both muddy and sandy zones. Alongwith other soles, the species compares a moderate fishery but not of much market value.

**Common name** : Long tongue sole.

104. *Cynoglossus puncticeps* (Richardson)

1846. *Plagusia puncticeps* Richardson, Rept. Br. Assoc. Ad. Sci. : 280 (type locality : China)

1877. *Cynoglossus puncticeps* : Day, *Fishes of India* : 437.

*Material examined* : (i) 2 ex, Frassergunj, 20.xii.83, Coll. N.C. Nandi, (ii) 2 ex, Chimaguri, 10.ix.84, Coll. N.C. Nandi (iii) 2 ex, Choramayadwip, 4.xi.88, Coll. R.A. Khan.

*Length range* : 60-120 mm.

*Colour* : Occular side light brown or pale with several irregular dark brown blotches forming cross bars. Lower side whitish.

*Salient features* : Body elongated and flat, Two nostrils on occular side, anterior in from of lower eye, posterior in front of interorbital space. Snout rounded, rostral hook short; cleft of mouth not reaching beyond lower eye. Two lateral lines on ocular side, with 17-18 scales between them. Scales ctenoid on both sides. Long dorsal fin with nearly 100 rays.

*Habitat* : Muddy and sandy bottoms on the continental shelf and brackish waters.

*Geographical distribution* : Seas of India, through the East-indies, to the Philippines, Taiwan and southwards to the north-western coasts of Australia.

*Remarks* : Occurs in the coastal waters in small numbers, not of much commercial value.

*Common name* : Speckled tongue-sole.

Order TETRADONTIFORMES

Family TETRADONTIDAE

The puiffers have nacked body, small mouth, small gill opening and very strong united teeth forming a beak. Body covered with small platlets. These fishes are known to inflat their bodies with air and water. The muscle and viscera contain alkaloid poison.

105. *Chelondon fluviatilis* (Hamilton-Buchanan)

1822. *Tetradon fluviatilis* Hamilton-Buchanan, *Fishes of Ganges* : 362 (type locality : Ganges)

*Material examined* : (i) 1 ex, Kechuberia, 8.ii.79, Coll. A.K. Mondal, (ii) 1 ex, Kakdwip, 7.iv.84, coll. J.K. De, (iii) 4 ex Saimari, 23.viii.87 Coll. R.A. Khan.

*Length range* : 110-120 mm.

*Colour* : Body deep grey above, lighter on belly.

*Salient features* : Body short, back compressed into a ridge, with spines. Head oval;

**abdomen rounded; snout blunt; mouth terminal. Lips thick, fleshy. Two solid nasal tentacles on each side and an impervious nasal fosa present. Jaws equal, both with a median suture and cutting edges and covered with an ivory like substance. Dorsal fin inserted slightly ahead of anal fin. Pelvic fin absent. Body covered with fine dermal spines. Muscle and viscera poisonous.**

**Habitat :** Estuarine and marine, enters sometimes freshwater.

**Geographical distribution :** Seas and estuaries of India to Malay archipelago and beyond.

**Remarks :** Occurs, mainly in Hugly estuarine zone. Because of its poisonous muscle and viscera, the fishes caught in nets are thrown on shore by fishermen.

#### 106. *Chelondon patoca* (Hamilton-Buchanan)

1822. *Tetradon patoca* Hamilton-Buchanan, *Fishes of Ganges* : 363 (type locality : Ganges).

1992. *Chelondon patoca* : Talwar, *Fauna of West Bengal*, Part 2, Marine and estuarine fishes : 320.

**Material examined :** (i) 1 ex, Toshkhali, 11.xi.88, Coll. R.A. Khan, (ii) 1 ex, Haliday island, 10.xi.88, Coll. R.A. Khan.

**Length range :** 150-210 mm.

**Colour :** Body grey above light pale on belly

**Salient features :** Body short, skin coverings modified into small spines, in the form of beak having cutting edges and covered with a layer of ivory like substance. Head oval shaped; abdomen rounded; snout blunt. Lips thick and fleshy. Nostril around depression surrounded by a low rim, produced into a posterior and an anterior flap. Jaws equal with median sutures. Pelvic fin absent; dorsal fin inserted slightly ahead and above of anal fin. Two lateral lines, the upper joining the lower in the region above or behind the anal fin.

**Habitat :** Marine and estuarine, also enters freshwaters.

**Geographical distribution :** India, Bangla Desh, Burma.

**Remarks :** This poisonous fish is of no commercial value. Found on shore thrown by fishermen from their nets.

### B. FISHERY IN SUNDERBAN

The fish catches from entire Hugly Matla estuarine system during the 4 years period of intensive studies viz 1986-87, 87-88, 89-90 and 90-91, based on the statistics compiled by Central Inland capture Fisheries Research Institute, are shown in table 1. It may be seen that nearly 80% of the total catch was comprised of only 17 species which included *Hilsa (Tenulosa) ilisha*, *Pama pama*, *Setipinna* spp. (*S. phasa* and *S. taty*), Trichiurids, (*Trichiurus lepturus*, *Lepturacanthus Savala* and *L. pantului*), *Harpodon neherius*, *Arius jella*,

TABLE 1 : Total catches from Sunderban (Hugly-Matla) Estuarine System (based on CICFRI data)\*

| Species/Genera                 | 1990-1991       |         | 1989-90         |         | 1988-89         |         | 1987-88         |         | 4 yrsr<br>Mean |
|--------------------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|---------|----------------|
|                                | Quantity<br>mt. | Percent | Quantity<br>mt. | Percent | Quantity<br>mt. | Percent | Quantity<br>mt. | Percent |                |
| <i>Hilsa (tenulosa) ilisha</i> | 6256.5          | 16.31   | 1563.4          | 5.13    | 1720.09         | 4.42    | 1177.0          | 4.01    | 7.28           |
| <i>Pama pama</i>               | 5235.2          | 13.65   | 3978.2          | 13.10   | 6641.9          | 17.05   | 3514.8          | 11.97   | 13.69          |
| <i>Setpinna sp.</i>            | 3898.4          | 10.16   | 4379.4          | 14.37   | 6059.6          | 15.55   | 3852.5          | 13.12   | 12.85          |
| <i>Herpodon nehereus</i>       | 7065.7          | 18.42   | 4735.7          | 15.54   | 8000.2          | 20.54   | 5084.0          | 17.32   | 12.28          |
| <i>Arius jella</i>             | 1673.5          | 4.36    | 432.8           | 1.42    | 799.3           | 2.05    | 758.0           | 2.58    | 1.98           |
| <i>Pampus argenteus</i>        | 1871.9          | 4.88    | 160.1           | 0.52    | 896.9           | 2.30    | 682.2           | 2.32    | 2.46           |
| <i>Polynemus paradiseus</i>    | 174.6           | 0.45    | 98.2            | 0.32    | 313.4           | 0.80    | 179.4           | 0.61    | 11.92          |
| <i>Coilia sp.</i>              | 474.7           | 1.23    | 537.2           | 1.76    | 1347.5          | 3.46    | 1591.5          | 5.42    | 2.90           |
| <i>Hilsa elongata</i>          | 863.5           | 2.25    | 413.4           | 1.35    | 581.8           | 1.49    | 838.8           | 2.86    | 1.90           |
| <i>Otalithoides biauritus</i>  | 234.3           | 0.61    | 87.5            | 0.29    | 362.1           | 0.93    | 604.4           | 2.06    | 0.96           |
| <i>Polynemus indicus</i>       | 73.0            | 0.19    | 191.3           | 0.63    | 177.4           | 0.45    | 174.9           | 0.60    | 0.47           |
| <i>Chirocentrus dorab</i>      | 272.3           | 0.71    | 98.1            | 0.32    | 90.6            | 0.23    | —               | —       | —              |
| <i>Trichiurus sp.</i>          | 1834.6          | 4.78    | 3978.8          | 13.06   | 3792.2          | 9.74    | 2502.3          | 8.52    | 8.84           |
| <i>Others</i>                  | 8417.4          | 21.95   | 9815.7          | 32.22   | 8164.9          | 20.96   | 8399.7          | 28.61   | 25.44          |
| <b>TOTAL</b>                   | <b>38345.8</b>  |         | <b>30469.8</b>  |         | <b>38948.7</b>  |         | <b>29359.2</b>  | —       | —              |

\* Source : Annual Report CICFRI Barrackpore

**TABLE 2 : Total catches from Sunderban (Hugly-Matla) Estuarine System—Seasonal Variation (based on CICFRI data)\***

| Species/Genera                 | 1990-1991      |              |              | 1989-90        |              |              | 1988-89        |              |              | 1987-88        |              |              |
|--------------------------------|----------------|--------------|--------------|----------------|--------------|--------------|----------------|--------------|--------------|----------------|--------------|--------------|
|                                | Quantity<br>mt | Percent<br>1 | Percent<br>2 | Quantity<br>mt | Percent<br>1 | Percent<br>2 | Quantity<br>mt | Percent<br>1 | Percent<br>2 | Quantity<br>mt | Percent<br>1 | Percent<br>2 |
| <i>Hilsa (Tenulosa) ilisha</i> | 6256.5         | 0            | 100          | 1563.4         | 0            | 100          | 1720.9         | 0            | 100          | 1177.0         | 0            | 100          |
| <i>Pama pama</i>               | 5235.2         | 95.72        | 4.28         | 3978.2         | 90.6         | 9.4          | 6641.9         | 93.4         | 6.6          | 3514.8         | 6.2          | 93.8         |
| <i>Steipinna sp.</i>           | 3898.4         | 89.67        | 10.33        | 4379.4         | 92.6         | 7.4          | 6059.6         | 94.4         | 5.6          | 3852.5         | 90.8         | 9.2          |
| <i>H. Nehereus</i>             | 7065.7         | 12.48        | 89.52        | 9375.7         | 80.8         | 11.2         | 800.2          | 94.2         | 5.8          | 5084.0         | 93.8         | 6.2          |
| <i>Arius jella</i>             | 1673.5         | 9.19         | 80.01        | 432.8          | 5.6          | 94.4         | 799.3          | 75.6         | 44.4         | 758.0          | 54.0         | 46.0         |
| <i>Pampus argenteus</i>        | 1871.9         | 2.00         | 48.00        | 160.1          | 35.6         | 64.4         | 896.9          | 76.2         | 33.8         | 682.2          | 66.0         | 34.0         |
| <i>Pulunemus paradiseus</i>    | 174.6          | 81.40        | 18.60        | 98.2           | 20.4         | —            | 313.4          | 88.9         | 11.1         | 179.41         | 24.8         | 75.2         |
| <i>Coilia sp.</i>              | 474.7          | 84.0         | 15.20        | 537.2          | 43.8         | 56.2         | 1347.5         | 6.7          | 93.7         | 1591.5         | 88.0         | 12.0         |
| <i>Hilsa elongata</i>          | 863.5          | 64.38        | 30.70        | 413.4          | 75.5         | 24.5         | 581.8          | 80.3         | 19.7         | 838.8          | 78.9         | 21.1         |
| <i>Otolithoides biauritus</i>  | 234.3          | 0            | 100          | 84.5           | 31.0         | 69.0         | 362.1          | 81.5         | 185          | 684.4          | 96.6         | 3.4          |
| <i>Polynemus indicus</i>       | 73.0           | 0            | 100          | 191.3          | 0            | 100          | 177.4          | 0            | 100          | 174.9          | 15.7         | 4.3          |
| <i>Chirocentrus dorab</i>      | 272.3          | 60.03        | 39.17        | 98.1           | 95.2         | 9.8          | 3792.2         | 97.2         | 2.8          | —              | 94.4         | 5.6          |
| <i>Trichiurus sp.</i>          | 1834.6         | 60.03        | 39.17        | 3978.8         | 95.2         | 9.8          | 2792.2         | 97.2         | 2.8          | 2502.3         | 94.4         | 5.6          |
| <i>Others</i>                  | 8417.4         | 72.6         | 27.4         | 9815.7         | 74.06        | 25.94        | 8104.9         | 69.5         | 30.5         | 8399.7         | 72.3         | 27.7         |
| <b>TOTAL</b>                   | <b>38345.8</b> |              |              | <b>30469.8</b> |              |              | <b>38948.7</b> |              |              | <b>29359.2</b> |              |              |

1. Premonsoon (October-January)

2. Other seasons

\* Source : Annual Report CICFRI Barrackpore

*Pumpus argenteus*, *Polynemus paradiseus*, two species of *Coilia* (*C. raynoldi* and *C. ramcarati*), *Ilisha elongata*, *Otolithoides biauritus*, *Polydactylus indicus* and *Chirocentrus dorab*, in the descending order of abundance. There were wide fluctuations in the total catches of major species during different years. *Hilsa ilisha* constituted 16% during 1990-91 whereas its contribution during 1987-88 was only 4%. There was not much yearly fluctuation in the composition of *Pama pama*, which contributed at an average 13.0%. The mean contribution of anchovy (*Setipinna* sp.) over the period was also above 13%. There was wide year to year fluctuation in the catches of ribbon fishes which varied between 4.78% in 1990-91 and 13.06% in 1989-90. *Harpodon neheretus* was the most abundant species during all years comprising at an average 17.7% of the total fish landing from the estuarine system. The contribution of *Arius jella*, *Punipus argenteus*, *ilisha ellongata*, *Otolithoides biauritus* were around 2% each with wide year to year fluctuations. The total fish landings for the 4 years were 38345.8 mt in 1990-91, 30469.8 mt in 1989-90, 38948.7 mt in 1988-89, and 29359.2 mt during 1987-88. It is evident that total ctach did not fluctuate very much during different years.

The seasonal anaystis of catch data (Table 2) revealed that maximum catches came from winter fishery operations during post monsoon period. However, the abundance of different species varied considerably. *Hilsa ilisha* were caught during monsoon months, *Pania, pama*, *Setipinna* spp., *Trichiurus* spp. and *Harpodon nehereus* were mainly captured during post monsoon season. Similarly, the pomfrets (*pumpus argenteus*) were also caught mainly during post monsoon fishery operations. At an average post monsoon season contributed around 90% of the total catches. Table 3 gives the analysis of two years (1984-85 and 1985-86) zonewise. A general idea can be had from the figures. It is evident that at an average 90% of the catches came from lower zones of the estuarine system, during post monsoon fishery operations, which is the major fishing season.

**TABLE 3 : Contribution from lower zone of Hugly-Matla estuarine system in total Fish Catches during 1984-85 and 1985-86 (CICFRI data)\***

| Seasons         | 1984-85 | 1985-86 |
|-----------------|---------|---------|
| Post Monsoon-I  | 90.45   | 98.32   |
| Post Monsoon-II | 81.25   | 88.84   |
| Pre-monsoon-I   | 33.90   | 50.38   |
| Pre-monsoon-II  | 28.17   | 46.60   |
| Monsoon-I       | 67.15   | 89.40   |
| Monsoon-II      | 73.00   | 88.9    |

\* Source : Annual Reports CICFRI Barrackpore

### C. RELATIVE COMPOSITION BASED ON RANDOM SAMPLINGS.

Table 4 gives the results of random analysis of relative composition carried out during the collection of material for biological studies from few selected centres of the lower estuarine zone. Data for all zones were pooled yearwise. Although these figures are not based on systematic data collection from all zones of the estuarine system, like the catch records maintained by C.I.C.F.R.I. and are a gross estimation, it does give a general idea of the relative composition of different species. The Bombay duck was the most abundant species comprising about 27.32% during the four year period of study, followed by anchovys, *setipinna* spp and clupeid *Hilsa ilisha*. Ribbon fishes were also abundant during

**TABLE 4 : Approximate composition of different species in random collections during different years (pooled data of all zones)**

| Species                           | 1990-91 | 1989-90 | 1988-89 | 1987-88 | Mean |
|-----------------------------------|---------|---------|---------|---------|------|
| <i>Harpodon nehereus</i>          | 28.4    | 30.5    | 22.3    | 28.1    | 27.3 |
| <i>Hilsa</i> (T) <i>ilisha</i>    | 8.2     | 2.1     | 2.5     | 4.0     | 4.2  |
| <i>Setipinna taty</i>             | 6.7     | 6.8     | 8.5     | 7.3     | 7.3  |
| <i>Setipinna phasa</i>            | 3.5     | 4.3     | 3.2     | 3.6     | 3.6  |
| <i>Lepturacanthus savala</i>      | 2.3     | 3.0     | 3.2     | 2.2     | 2.5  |
| Other trichiurids                 | 3.8     | 5.2     | 4.5     | 4.5     | 5.0  |
| <i>Pama pama</i>                  | 3.7     | 3.2     | 1.3     | 2.9     | 2.8  |
| <i>Otolithus biauritus</i>        | 3.0     | 3.5     | 2.1     | 1.9     | 2.6  |
| <i>Arius</i> spp.                 | 3.7     | 3.8     | 1.3     | 2.9     | 2.8  |
| <i>Sillagonopsis panijus</i>      | 1.8     | 1.4     | 1.7     | 1.8     | 1.7  |
| <i>Coilia ramcarati</i>           | 1.7     | 2.6     | 5.2     | 5.3     | 3.4  |
| <i>Pellona ditchella</i>          | 2.0     | 1.7     | 1.8     | 1.5     | 1.8  |
| Other <i>Coilia</i> sp.           | 1.2     | 1.8     | 1.5     | 1.7     |      |
| <i>Ilisha elongata</i>            | 1.3     | 1.8     | 2.5     | 1.0     | 1.6  |
| <i>Polynemus paradiseus</i>       | 1.2     | 1.2     | 2.6     | 3.3     | 2.2  |
| <i>Eleuthronema tetradactylus</i> | 0.9     | 0.9     | 1.7     | 1.1     | 1.2  |
| <i>Pangasius pangasius</i>        | 2.6     | 0.8     | 1.5     | 2.8     | 1.9  |
| Others                            | 24.0    | 35.4    | 32.1    | 25.1    | 28.3 |

all years and contributed at an average 7.5%. Cat fishes belonging to genus *Arius* were next in order of abundance contributing nearly 3.57%. The contribution of *Pania pania* was considerably lesser during all years as compared to the records of C.I.C.F.R.I. It was probably due to the fact that this species constitutes major fishery in upper and middle zones of the estuary. Besides anchovys, the other species of Clupeids, like *Coilia* spp. (5.9%), *Ilisha elongata* and *Pellona ditchela* (2.75%) together were also important. Among polynemeids, *Eleutheronema tetradactylum* (1.2%), *Polynemus paradiseus* (1.33%) and *Polydactylus indicus* (1.1%) constituted the fishery of substance as these fetch high market price. The cat fish *Pangasius pangasius* was available almost throughout the year and contributed nearly 2.5%. The gangetic whiting *Sillaginopsis panijus* also contributed substantially to total catches (1.7%). Among other scienids, only *Otolithoides biauritus* was of importance which contributed nearly 2.6%. Since the random sampling was mainly from bag net capture, many of the larger scienids, like *Daysciana albidia* were not properly represented. Mugilids, mainly represented by *Liza persia* and *Liza tade* contributed comparatively lesser (1.6%) than some other highly esteemed fishes like polynomeids. The other species which contributed above 1% was pomfret, *Punipus argenteus* (1.9%). These came exclusively from Hugly zone and their availability in Matla zone was almost completely restricted. The other important species constituting individual fishery were *Raconda russeliana*, and *Chirocentrus dorab*, each contributing between 0.5 to 1.0%. Sizable percentage (around 21%) was contributed by a large number of species of lesser importance. These are generally termed as trash fishes.

#### D. FISHING METHODS

Major part of fish catches from Sunderban came from bag net fishery operations. Bag nets, which are locally known as behundi jal or been jal are of various sizes. Besides bag nets, some types of gill nets and cast nets are also used on smaller scales. Details of various types of nets employed in Sunderban have been described earlier by De (1910), Hornell (1932), Naidu (1938), Pillay and Ghosh (1962) and Dutta (1973). The last referred author grouped various fishing nets into following groups.

1. Fixed bag nets
2. Shore Scienes and boat scines
3. Gill nets
4. Set barrier nets
5. Trawl nets
6. Dip or lift nets
7. Cast nets
8. Clap or purse nets
9. Trap nets
10. Hooks and lines.

However, the maximum catches came from bag nets followed by hooks and lines and some from set gill nets. The bag nets are long tapering nets with mesh size decreasing towards cod end, which has minimum mesh size of 1.4 cm (Pillay and Ghosh, 1962). These nets are classified further into three broad categories based on number of meshes along the periphery and mesh sizes as 1) nets with upto 700 meshes, 2) with 800-1000 meshes and 3) with more than 1000 meshes. The nets are always operated in such a way as to cover the tides. The nets are set against the current at the beginning of tide after tying up the cod end by means of ropes. A boat with 2-3 men are required to operate the net. The net strains the tidal water passing through it and every thing that can be caught in the mesh of cod end, is retained. In deeper zones and creeks (Khals) these nets are set on wire ropes. Near the sea face, where depths are shallow, large bag nets are operated by tying these to bamboo stakes driven into the bottom. Gill nets are broadly divided into two groups, 1) Drift nets and 2) set nets. Drift nets can be a surface drift net, a column drift net or a bottom drift net. Among set nets, the bottom set gill nets are most commonly employed. There are various modifications of gill nets. Some important ones are 'Shele Jal' (for *Polydactylus indicus*, *Otolithoides biauritus*, *Pumpus* sp.) 'Barang Jal' (for *Lates calcarifer*, *Arius* sp. and *E. tetradactylum*) etc. Long lines with 100 to 150 hooks are used with baits of prawn or non commercial fishes. Such type of lines are used commonly in Matla region near Canning.

#### E. BIOLOGY OF SOME IMPORTANT SPECIES.

The detailed biology of 4 most important species viz Bombay duck, *Harpodon nehereus* (Hamilton-Buchanan), tapertail anchovy *Coilia ramcarati* (Hamilton-Buchanan), fourfinger threadfin *Eleutheronema teradactylum* (Shaw) and small-headed ribbon fish *Lepturacanthus savala* (Cuvier), have been worked out.

##### *Harpodon Nehereus* (Hamilton-Buchanan)

The Bombay duck, *Harpodon nehereus*, locally known as 'nehere' is the most abundant species in the catches from lower sunderban estuaries. The enormous quantities captured, mainly during winter (post monsoon) fishery operations, by bag nets, are genrally sun dried as fresh fishes are not in much demand locally and fetch a very low market price because of their soft and quickly parishable body. Elsewhere in the country, this species constitutes good fishery in West Coast where it occurs upto Ratnagiri along Konkan Coast and to Gulf of Cambay along Gujarat coast. In Bombay region also it is the dominant species and constitutes nearly 16% of the total catches.

The earlier studies on its biology include the works of Hora (1934) who described its occurrence and distribution in Bay of Bengal, particularly in relation to salinity, and Bapat *et al.* (1952) on length weight relationship, food and feeding habits and maturation from

Bombay waters. While several other estuarine species gained considerable attention of fishery scientists in the region, practically no work has been done on the biology of this dominant species.

### Occurrence and abundance

Although the species was available from all zones of the estuarine system almost throughout the year, it varied considerably between zones and seasons. As mentioned in Table 4, the random sampling revealed its share as 27.3% during the four years period, which varied between 22.3% during 1986-87 and 30.5% in 1990-91. Zone and season wise analysis revealed its highest abundance during post monsoon in Zone-2 (30.5%) followed by zone-1 (28.4%). Lowest availability was from Matla Zone (Zone-3) which was 25.3%. During other seasons its availability was very much restricted. The species was not collected from Zone-3 during late premonsoon (PRM-II).

### Length frequency Distribution

The length frequency distribution of the species are plotted separately for the year 1987-88 to 1990-91. The polymodal distribution curve revealed 3 clear modes during all years with slight variations (Fig 2). Mean modal lengths at the three modes ranged between 70 mm and 90 mm, 130 mm and 150 mm and 230 mm and 250 mm respectively during different year. Besides these three modes, a fourth very small and vague mode was also seen in some years at 290 mm. Mean length calculated from all years were 70 mm, 160 mm and 235 mm for 1st, 2nd and 3rd modes. These modes represented year classes as evident from seasonal length frequency distribution analysis (Fig. 3). It was noted that juveniles enter into the population around the size of 50 mm during early post monsoon period (POM-I, corresponding to calender months of Oct. & Nov.), resulting in the formation of first peak. No post larvae and fingerlings of below this size was available in the estuary indicating that spawning did not take place in the estuarine system. Beside this, 2nd and 3rd modes were also visible at 130 mm, and 230 mm. During next season (POM-II, Dec-Jan.), all the three modes shifted forward and formed the modes at 70 mm, 150 mm and 250 mm respectively for 1st, 2nd and 3rd modes. The progress continued at about same rate during next season (PRM-1, Feb-March). However during this season another batch of juveniles, resulting probably from second spawning, entered the population but it was considerably smaller because of restricted spawning during this period. However, the peak was clearly visible at 50 mm size group. During following season (Premonsoon-II, April-May), besides the new mode at 70 mm, the earlier modes were recorded at 110 mm, 210 mm, and 270 mm. The mode of largest size group appeared lost excepting few individuals of 290 mm-310 mm groups. At the end of the year in MON-II season (Aug-sept). modes were recorded at 110 mm for the new entrants of PRM-1 (8 months old), 150 mm for the old entrant of POM-1 (1 year period), at 250 mm for the second group, and at 290 for the third group. The mode of 4th group almost vanished from the population.

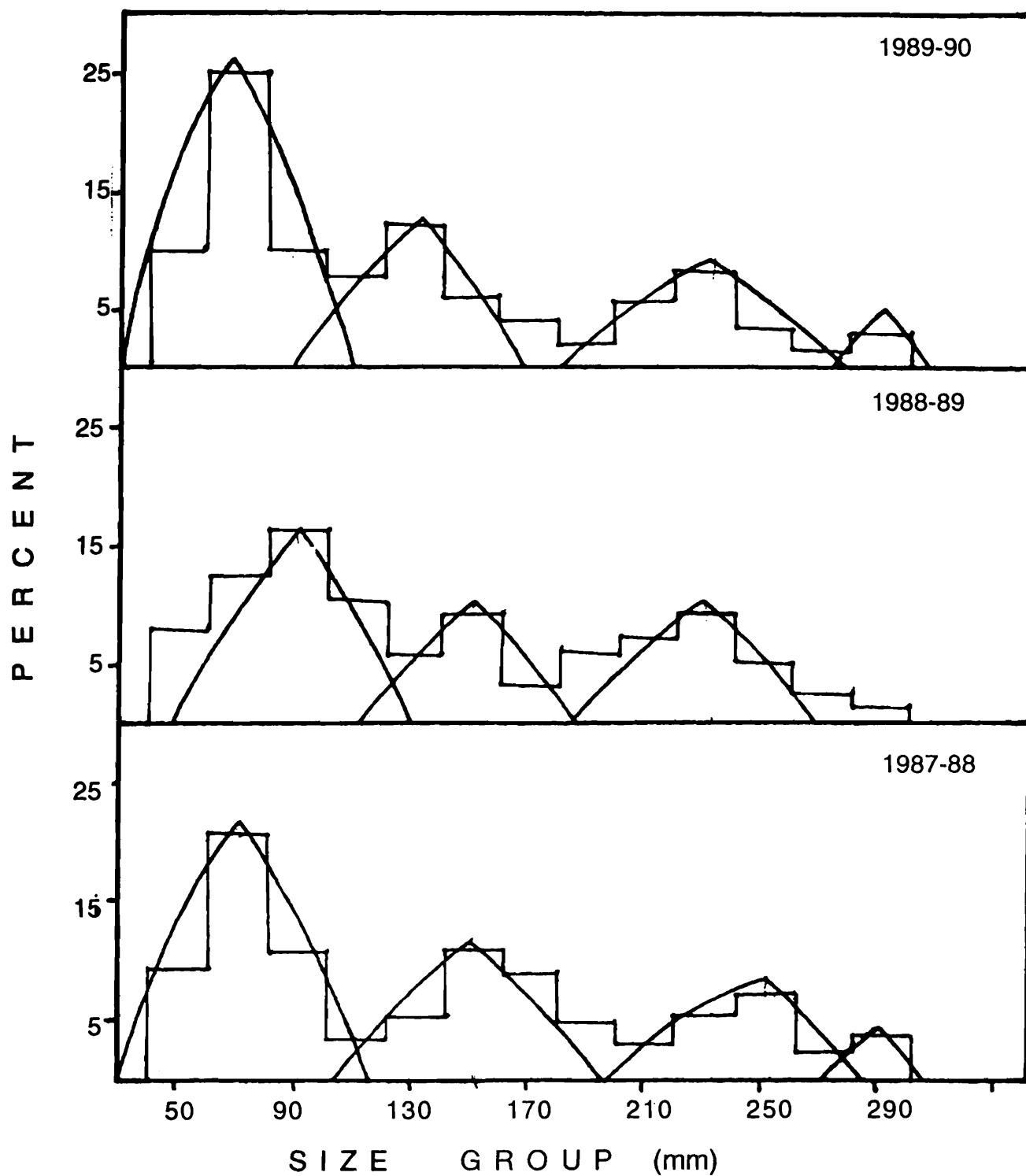


Fig. 2. Lenth frequency distribution of *H. nehereus*

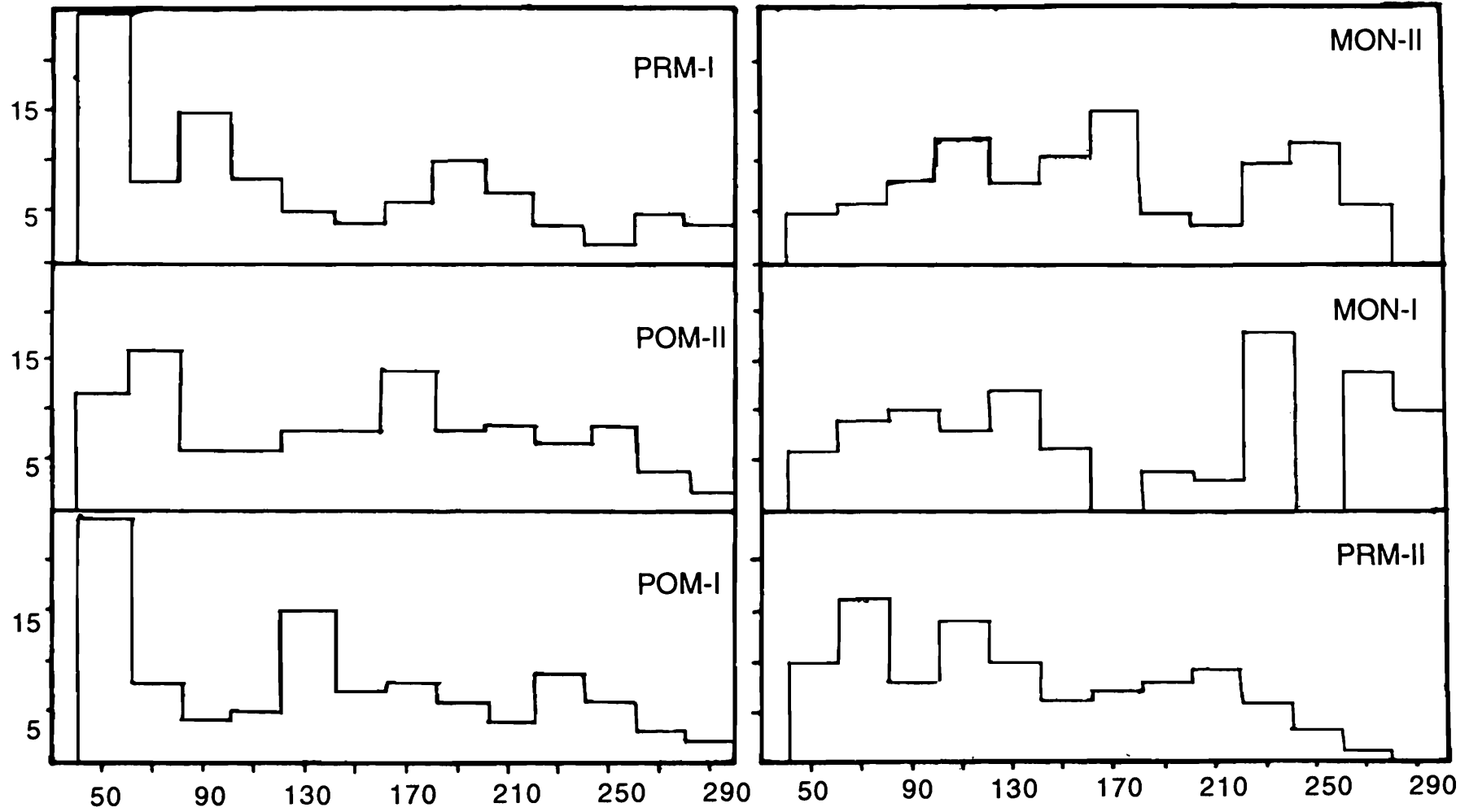


Fig. 3. Seasonal changes in length frequency distribution of *H. nehereus*.

### Age and length

From the seasonal length frequency distribution (Fig. 3), it was evident that there were three modes in the population at the end of year in MON-II (starting from the main season of new entrants, POM-I) at 100 mm, 170 mm and 250 mm. From the growth pattern analysis the differences between two succeeding modes were found to be annual. Therefore it may be concluded that mainly 3 year classes were available in the population at mean lengths of 100 mm, 170 mm, and 250 mm.

### Growth rate

On the basis of length frequency analysis of seasonal progression, it was estimated that the fish grew at the rate of 100 mm, 70 mm and 80 mm respectively during 1st, 2nd and 3rd year of life. The mean monthly rates computed varied between 8.33 mm during 1st year, 5.33 mm during 2nd year and 6.66 mm during 3rd year.

Von Bertalanffy growth equation was fitted to length at age data. The values of  $L_{\infty}$ ,  $K$  and  $t_0$  were estimated to be 390 mm, 0.420 and -0.33 respectively. The corresponding equation was (Figs 4 and 5) :

$$L_t = 390 (1 - e^{-0.420(t + 0.33)})$$

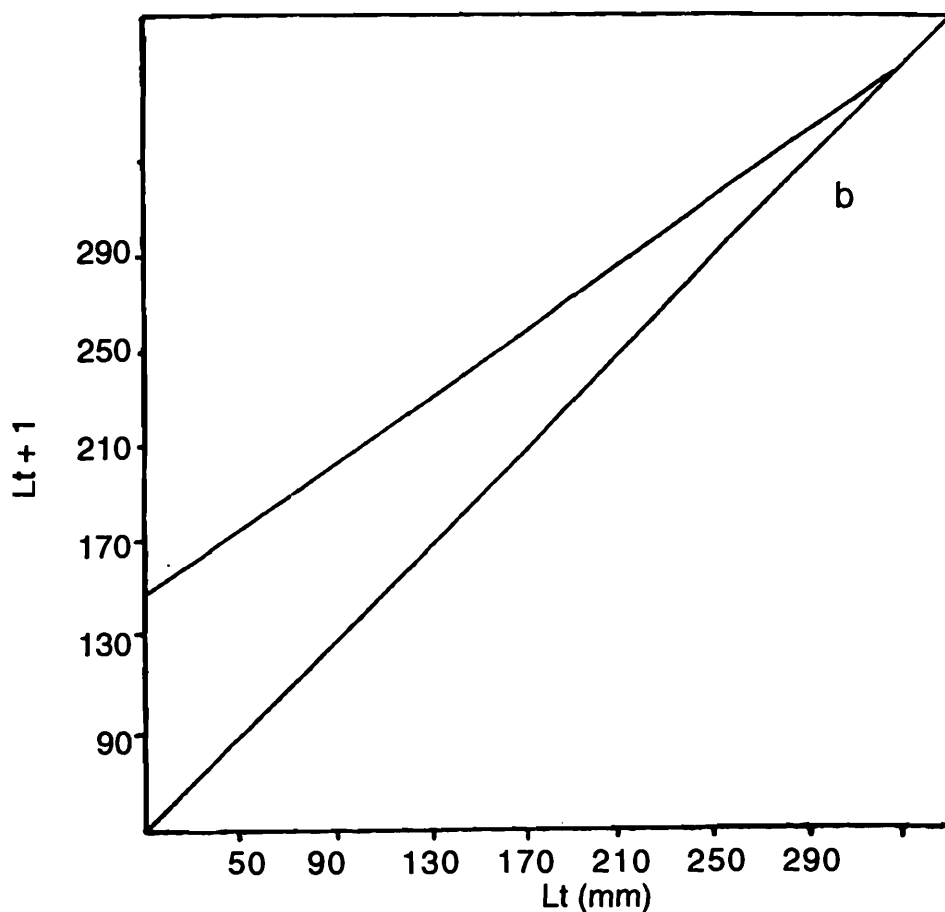


Fig. 4. Plot of  $L_t + 1$  against  $L_t$  (Ford-Walford) of *H. nehereus*.

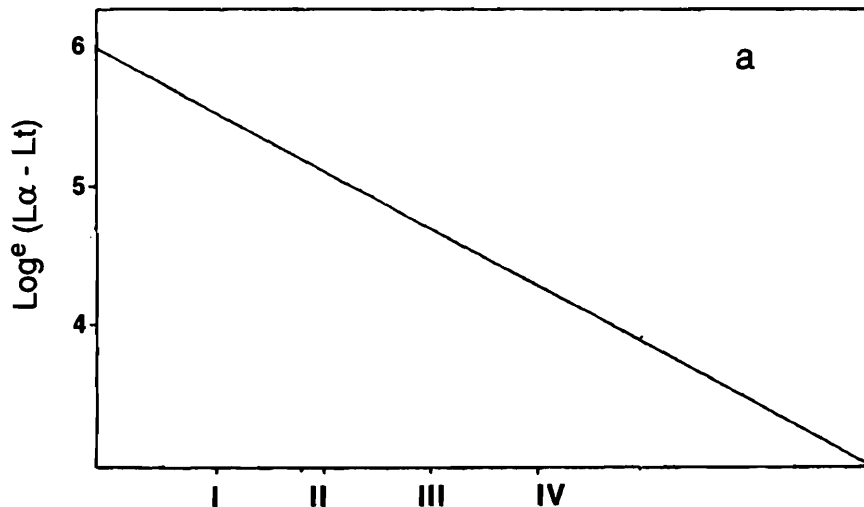


Fig. 5. Plot of  $\text{Log}_e (L_\infty - L_t)$  against age of *H. nehereus*.

### Length weight relationships

The length weight relationship of the fish was found to follow cube law with 'n' value of 3.0259. A straight line relationship was found with log-length and log-weight. The resulting equation was

$$\text{Log } W = -5.4082 + 3.0259 \text{ Log } L$$

$$\text{or } W = 3902 \times 10^{-5} L^{3.0259}.$$

Since the differences between sexes were not significant the data were pooled.

### Relative condition factor

The  $K_n$  values of the species varied considerably between seasons and at different size groups. It may be seen (Fig 6a) that the  $k_n$  values were always higher in juveniles as compared to adults. After the initial juvenile sizes, a sharp drop was noticed at 110 mm group which was followed by a rise forming peak at 150 mm group. This represented the onset of maturity and increase in  $K_n$  values due to maturation of gonades. Thereafter two more peaks at 250 and 290 mm were noticed representing the maturity of older year classes. Each peak of mature individuals was followed by sharp drop which represented spawning.

The seasonal variations in  $K_n$  values (Fig 6b) revealed two peak, major one during POM-I and other minor one, during PRM-I, representing two period of gonad maturation.

### Food and Feeding habits

The food of adult fishes was mainly comprised of Prawn and fishes. Among prawns *Sergestid*, *Acetis indicus*, was the dominant species comprising between 10.5% to 44.6%, highest during PRM-I and lowest during PRM-II. This was followed by Penaeid prawns (*Metapenaeus lysinissa*, *M. bravicornis*), which contributed between 15.0 to 28.8%. Paleomonid

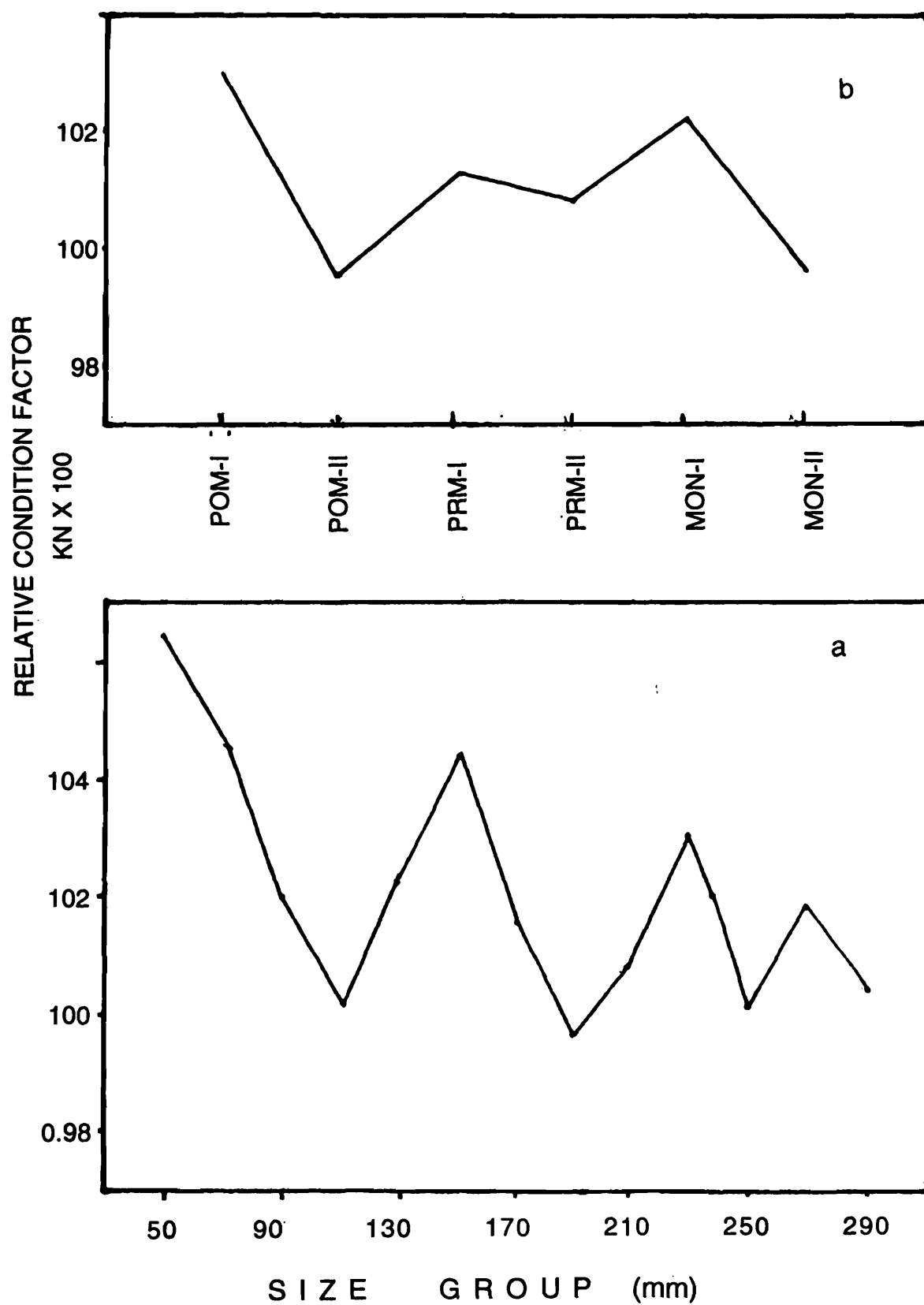


**Fig. 6.** Variations in relative condition factor (Kn) at different sizes (a) and during different seasons (b) of *H. nehereus*.

prawns comprising mainly *Neopaleomon styliferus* was next important item of food whose contribution varied between 8.2 to 31.5%, highest during monsoon (MON-I and MON-II). Among teleostean fishes, its own kind formed the major portion exhibiting the cannibalistic nature of the species. This was followed by several species of Clupeidae, Polynemidae and several other smaller fishes. At an average the contribution of fishes in the diet was to the extent of 33% Semidigested food or broken food were always available and contributed nearly 6.0%. (Fig. 7a).

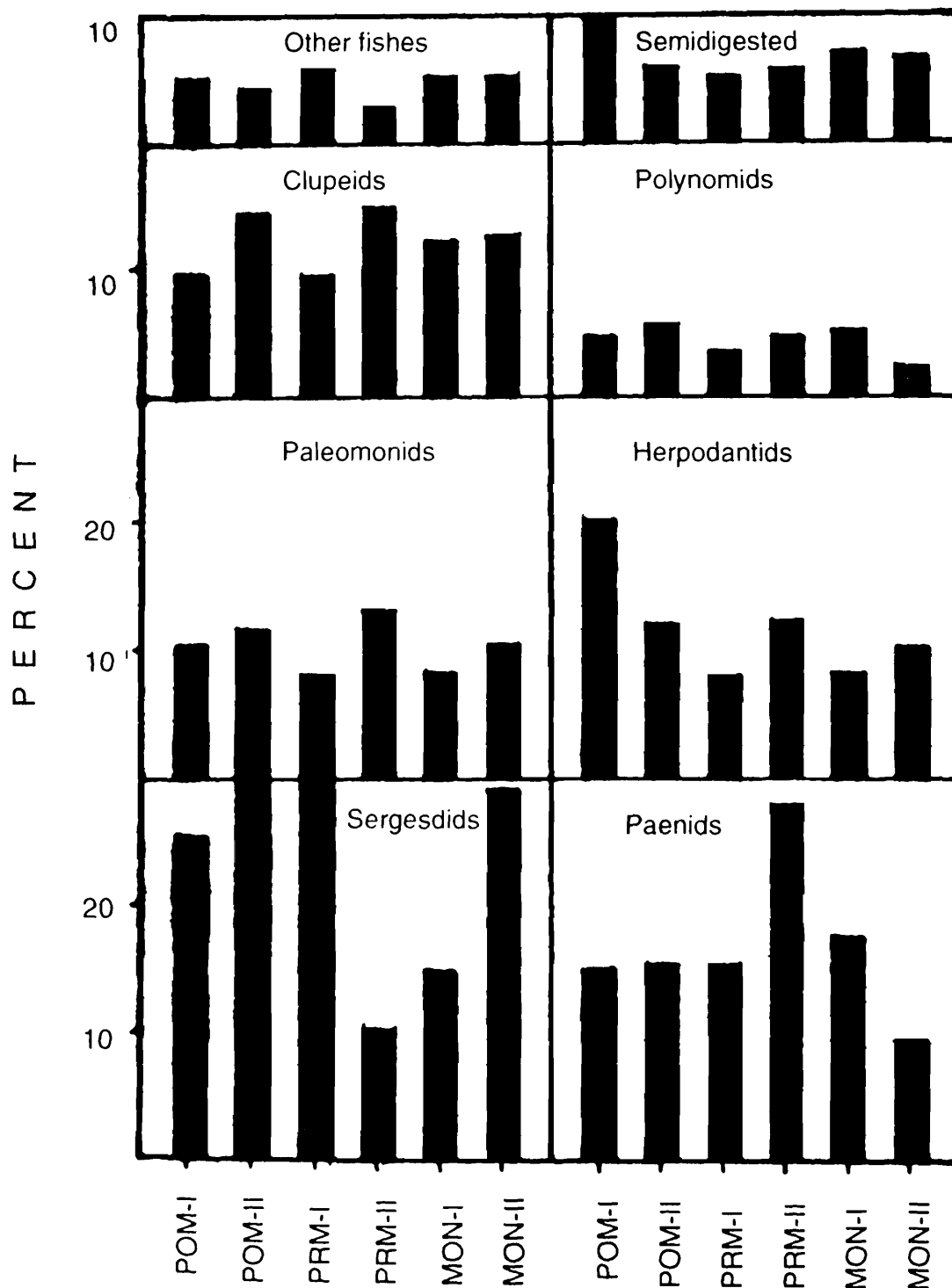


Fig. 7a. Relative occurrence of different food items in the guts of adults of *H. melherens*

The juveniles were found to feed differently from adults. While prawns continued to dominate the diet (54%), the fishes were almost entirely absent and were replaced by smaller crustaceans belonging to Amphipods, Stomatopods and crab larvae etc. The semidigested food and miscellaneous group comprised nearly 8.0% and 4.5% respectively (Fig. 7b).

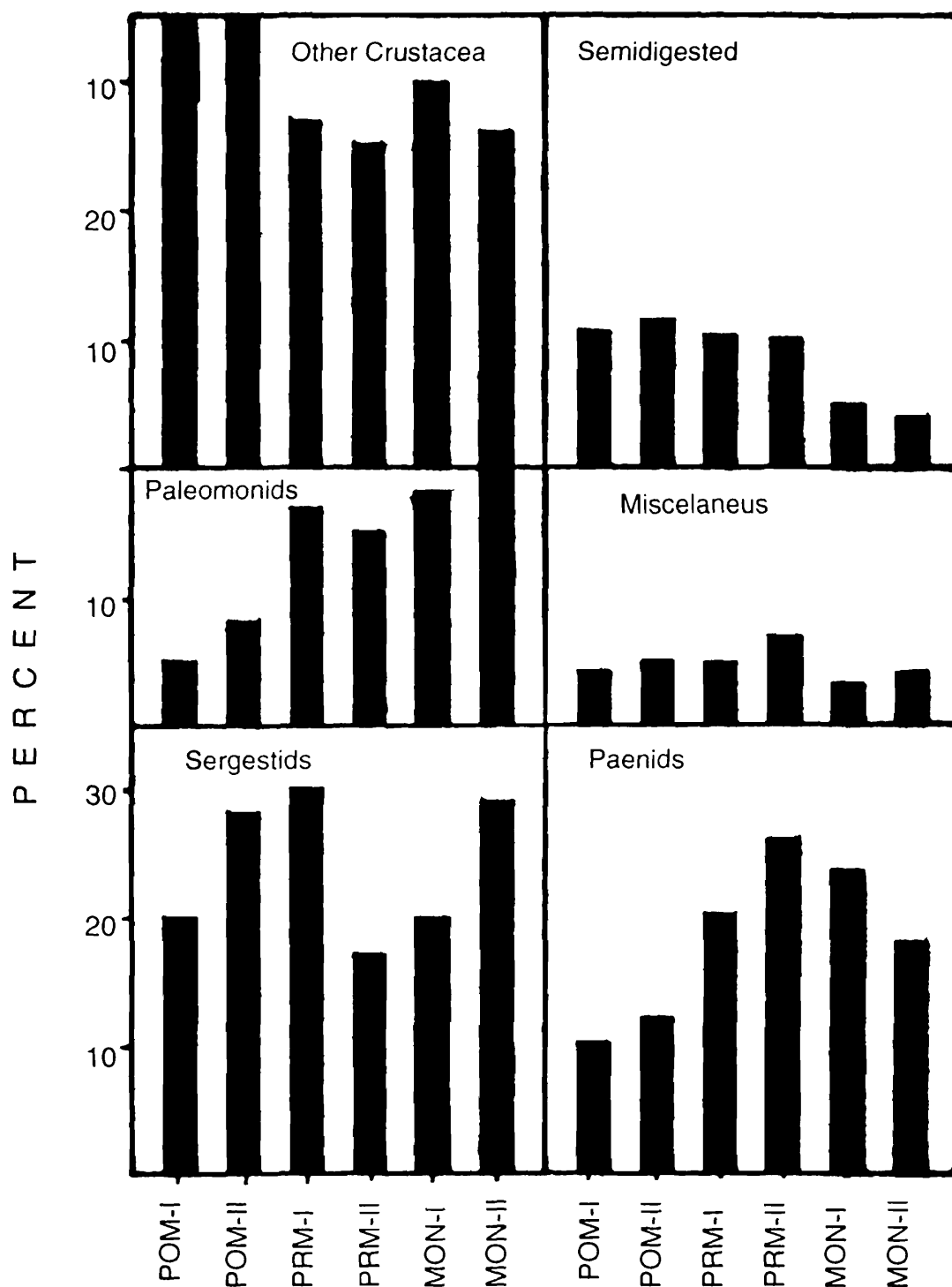


Fig. 7b. Relative occurrence of different food items in the guts of juveniles of *H. nehereus*.

**TABLE 5 : Seasonal variations in the intensity of feeding *H. nehereins***

| Seasons | Gorged | Full | 3/4 full | 1/2 full | 1/4 full | Traces | Empty guts | Feeding Condition |          |      |
|---------|--------|------|----------|----------|----------|--------|------------|-------------------|----------|------|
|         |        |      |          |          |          |        |            | Active            | Moderate | Poor |
|         |        |      |          | Adults   |          |        |            |                   |          |      |
| POM-I   |        | 35.2 | 19.6     | 15.2     | 11.5     | 8.3    | 10.2       | 54.2              | 26.7     | 18.5 |
| POM-II  |        | 20.2 | 15.5     | 10.5     | 25.2     | 10.4   | 18.2       | 35.7              | 35.7     | 28.6 |
| PRM-I   |        | 20.5 | 22.0     | 12.4     | 24.1     | 8.0    | 13.0       | 42.5              | 36.5     | 21.0 |
| PRM-II  |        | 10.0 | 16.4     | 22.2     | 17.5     | 9.5    | 24.4       | 26.4              | 39.7     | 33.9 |
| MON-I   |        | 20.3 | 20.0     | 17.4     | 16.0     | 10.3   | 16.0       | 40.3              | 33.4     | 26.3 |
| MON-II  |        | 8.0  | 1.8      | 15.2     | 20.0     | 19.5   | 22.5       | 19.8              | 35.2     | 45.0 |
|         |        |      |          | Juvenile |          |        |            |                   |          |      |
| POM-I   |        | 30.2 | 20.5     | 18.5     | 15.2     | 5.0    | 10.8       | 50.5              | 33.7     | 15.8 |
| POM-II  |        | 43.5 | 25.2     | 10.6     | 10.0     | 4.2    | 6.3        | 68.7              | 20.6     | 10.7 |
| PRM-I   |        | 25.0 | 20.0     | 15.5     | 16.0     | 9.5    | 14.0       | 45.0              | 31.5     | 23.5 |
| PRM-II  |        | 30.3 | 18.0     | 16.5     | 15.2     | 10.0   | 10.0       | 48.3              | 31.7     | 20.0 |
| MON-I   |        | 22.5 | 28.4     | 18.6     | 9.5      | 6.0    | 15.0       | 50.9              | 28.1     | 21.0 |
| MON-II  |        | 34.6 | 14.5     | 12.4     | 15.5     | 10.5   | 12.5       | 49.1              | 27.9     | 23.0 |

The intensity of feeding as determined by distension of guts have been shown in Table 5. In spite of almost similar rate of occurrence of empty guts in adults and juveniles, the feeding activity of juveniles was overall considerably higher than adults. The overall rate of active feeding was found as 52.3% in juveniles and 34.5% in adults, and poor feeding rates were 33% and 20% in adults and juveniles respectively. Marked variations in the intensity of feeding was recorded. In case of adults higher intensity was recorded during POM-I and PRM-I and lower during PRM-II. The poor feeding activity was due to maturation of gonads during the period. In case of juveniles no marked depression in feeding activity was noticed.

## Reproduction

### a) Sex ratio

Out of 235 adult fishes examined for the determination of sex ratio, 105 were males and 130 were females. Although there were seasonal variations in the sex ratio (Table 6), the overall sex ratio was found to be Male : Female as 1 : 1.238. A Chi square test of heterogeneity revealed significant differences at 5% level (Table 6) with observed  $\chi^2$  values of 17.83 at 5 degrees of freedom. This showed that the sex ratio of the species differed significantly with preponderance of females.

**TABLE 6 : Sex ratio and Chi ( $\chi^2$ ) square test of *H. nehereus***

| Seasons | Total | Male | Female | Male  | Female | Ratio     |
|---------|-------|------|--------|-------|--------|-----------|
| POM-I   | 39    | 17   | 22     | 43.50 | 50.50  | 1 : 1.249 |
| POM-II  | 31    | 13   | 18     | 41.93 | 58.07  | 1 : 1.384 |
| PRM-I   | 44    | 20   | 24     | 45.45 | 54.55  | 1 : 1.200 |
| PRM-II  | 41    | 17   | 24     | 41.46 | 58.54  | 1 : 1.410 |
| MON-I   | 46    | 23   | 23     | 50.00 | 50.00  | 1 : 1.000 |
| MON-II  | 31    | 15   | 19     | 44.12 | 55.80  | 1 : 1.260 |
|         | 235   | 105  | 130    | 44.40 | 55.60  | 1 : 1.238 |

#### Chi-square Test

observed  $\chi^2$  – 17.83  
5%, value – 11.07      Significant

### b) Size at first maturity

The size at first maturity was determined in case of fishes of 130 mm and above. The first mature female was recorded at 150 mm group (5%). Thereafter the ratio of maturity increased with the increasing sizes (Fig. 8a) and all females were mature at 250 mm group. The size at first maturity (Fig 8b) was estimated as the size at which 50% fishes were mature. It was found to be 210 mm. which correspond to 3rd year class.

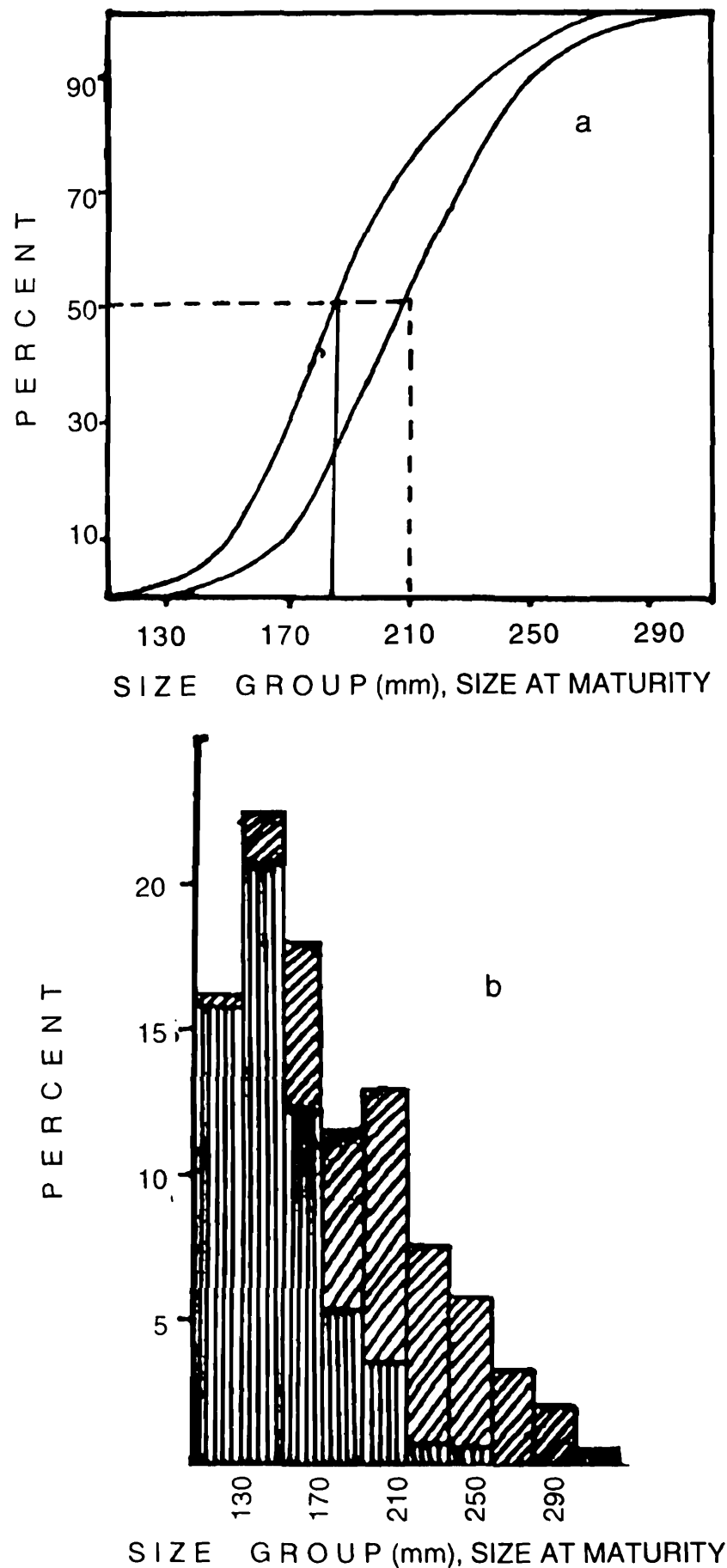


**Fig. 8.** Size at first maturity (a) and occurrence of mature and immature individuals at different sizes (b) *H. nehereus*.

### c) Seasonal distribution of maturity stages and spawning season

The frequency of occurrence of different maturity stages during different seasons are plotted in Fig. 9). It may be seen that females with ripe ovaries of Stage IV occurred almost throughout the year except for a brief period of PRM-II. Two peak periods of occurrence of ripe females were noticed, one during MON-II and other during POM-II revealing the increased maturation and spawning of the fish. This clearly indicated two spawning period of the fish almost at a gap of about 4 months resulting in prolonged spawning season.

### d) Maturation of intraovarian eggs and spawning season

Fig. 10 depicts the size frequency distribution of ova in the ovaries of adult females during different seasons. It was seen from the maturing ovaries that there were in general,

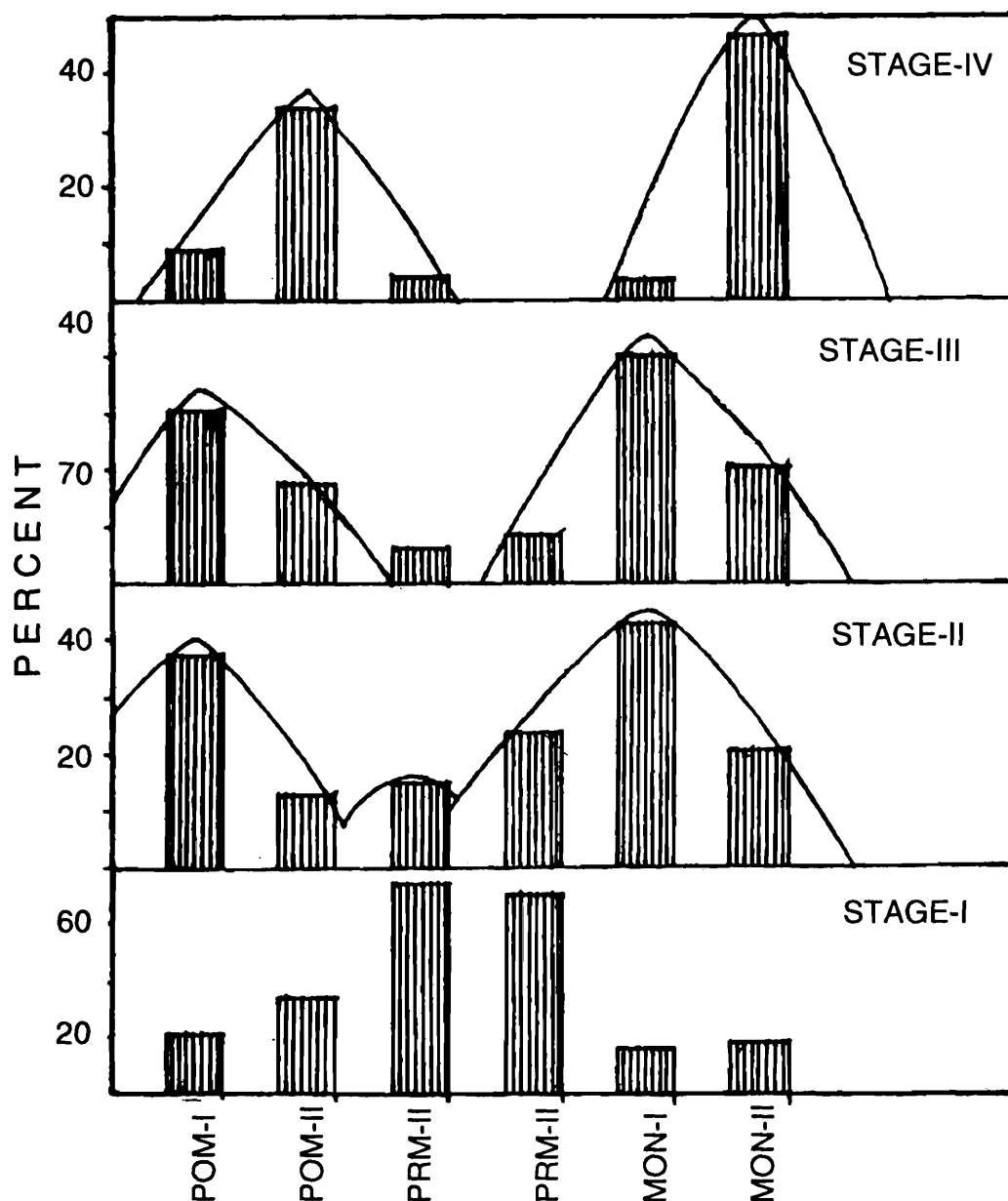


**Fig. 9.** Relative occurrence of individuals with different maturity stages during different seasons of *H. nehereus*.

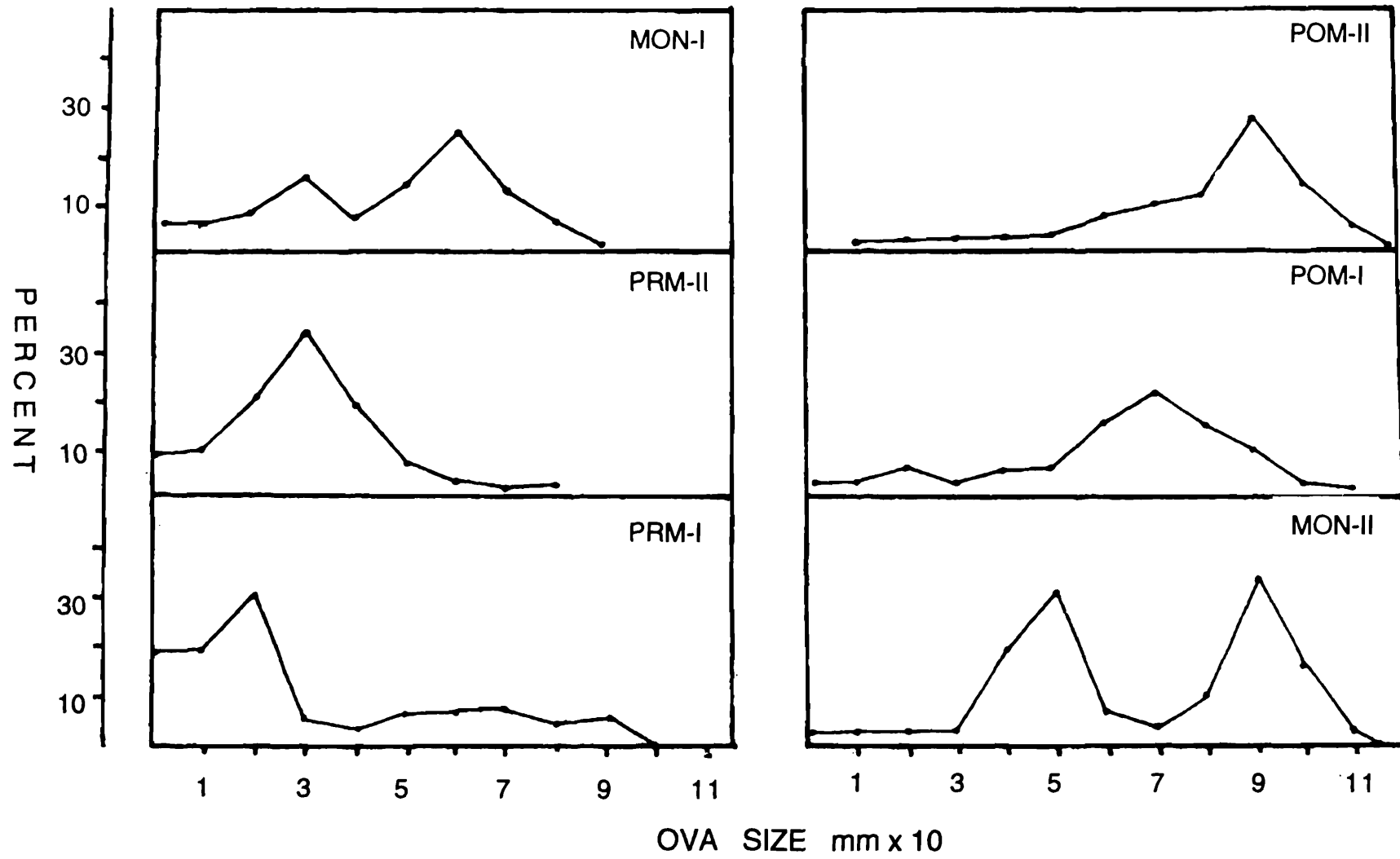


Fig. 10. Size frequency distribution of ova in a mature ovary during different seasons of *H. nehereus*.

two batches of maturing/mature over besides the mother stock. During PRM II, there were only a single batch of ova separated from mother stock at mean modal length of 0.3 mm. During next season (MON-I), this mode progressed further and formed peak at 0.6 mm size group. At this time a small batch of ova were again seen separating from mother stock. During Monsoon-II period, both the modes progressed. The older one formed peak at 0.9 mm size group and younger one at 0.5 mm group. During next season only the younger batch of ova was seen forming a mode at 6 mm size group. There was no trace of mode of older ova size group. It was supposed that these fully ripe ova in oozing mature females were spawned. However, immediately spawned spent fishes were not available in the population during this season and next season indicating that the fishes spawned somewhere else, probably in deeper waters. This was further confirmed by the non-availability of post larvae and juveniles below the size of 50 mm in the populations. The second batch of ova was found to form peak at 8 mm size interval during MON-II, indicating the second spawning during this period.

The food and feeding habits, length-weight relationships, growth rate, maturation and spawning of the fish in Sunderban region resembled closely to those of Bombay waters as studied by Bapat *et al.* (1952).

### *Coilia ramcarati* (Hamilton-Buchanan)

*Coilia ramcarati* (Hamilton-Buchanan) is one of the most important anchovys of Sunderban estuarine system. This is an endemic species of the estuaries of Ganga and constitutes substantial fishery alongwith two other species of *Coilia*. This is the largest rat-tailed anchovy of Indian Coasts and attains a length of 250 mm approx.

Several species of *Coilia*, specially *C. dussumeri*, have been the subject of study by several workers. Jones and Menon (1952) made observations on the development stages of fishes of the Genus *Coilia*. Palekar and Karandikar (1953), Bal and Joshi (1961) and Gadgil (1967) studied various aspects of the biology of *C. dussumeri*, from Bombay region. From Hugly Matla estuarine system, Verghese (1971, 1973) made observations on some aspects of the biology of *C. ramcarati*, based on data collected during early sixties. No other work is available on the biology of this endemic species of Sunderban.

### Occurrence and abundance

Random sampling revealed the contribution of this species to total fish landing as 1.7%, 2.6%, 4.2% and 5.3% during the years 1987-88, 1988-89, 1989-90 and 1990-91, with a mean of 3.4% (Table 4). These were comparatively abundant in zone 1 (40%) as compared to zones 2 and 3 (30% each). About 70% of the total catch was obtained during post monsoon fishery operations.

### Length frequency distributions

Fig. 11 shows the frequency of occurrence of different length groups in the population during the years 1987-88, 1988-89 and 1989-90 separately. Five size class modes are

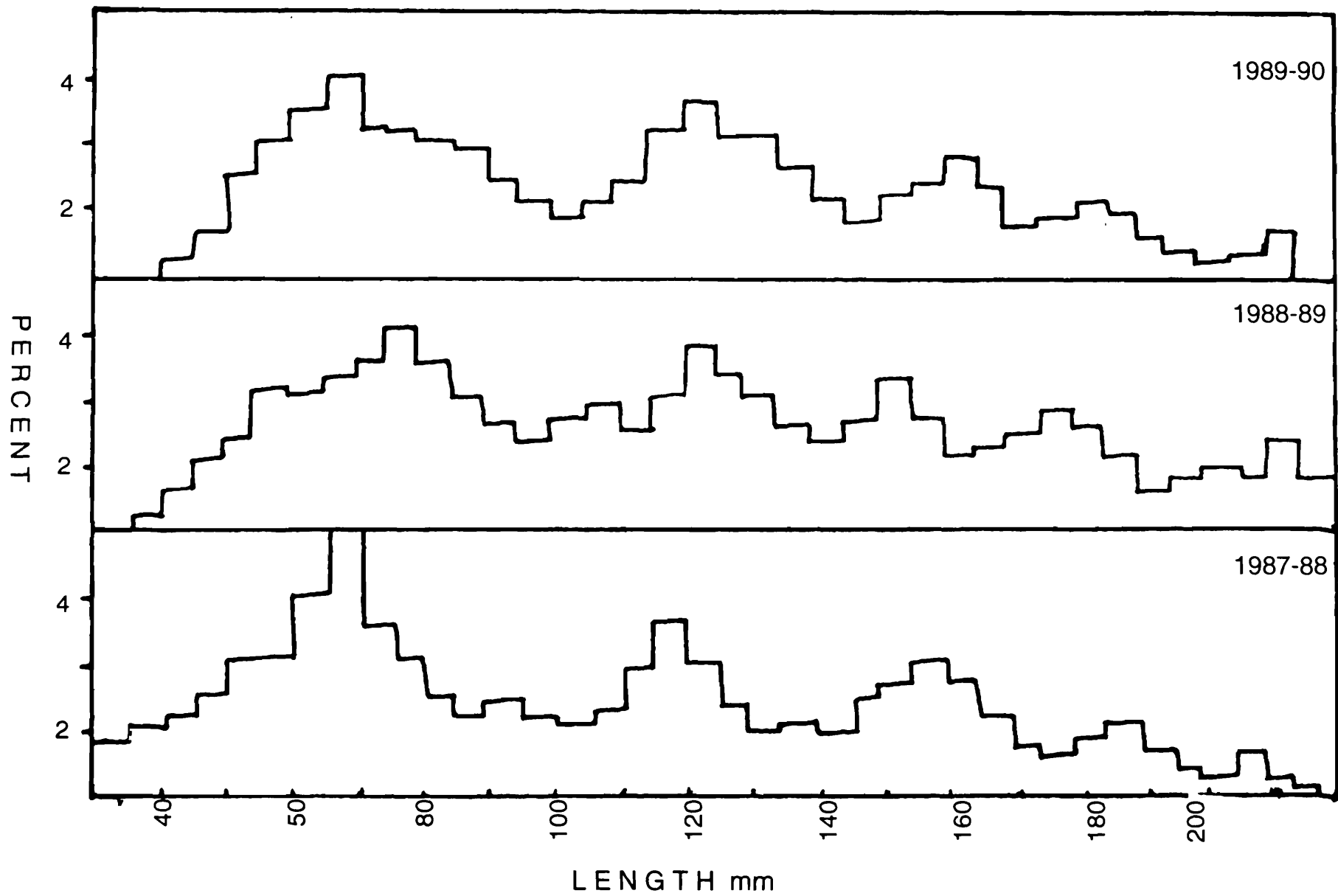


Fig. 11. Length frequency distribution of *C. ramcarati*

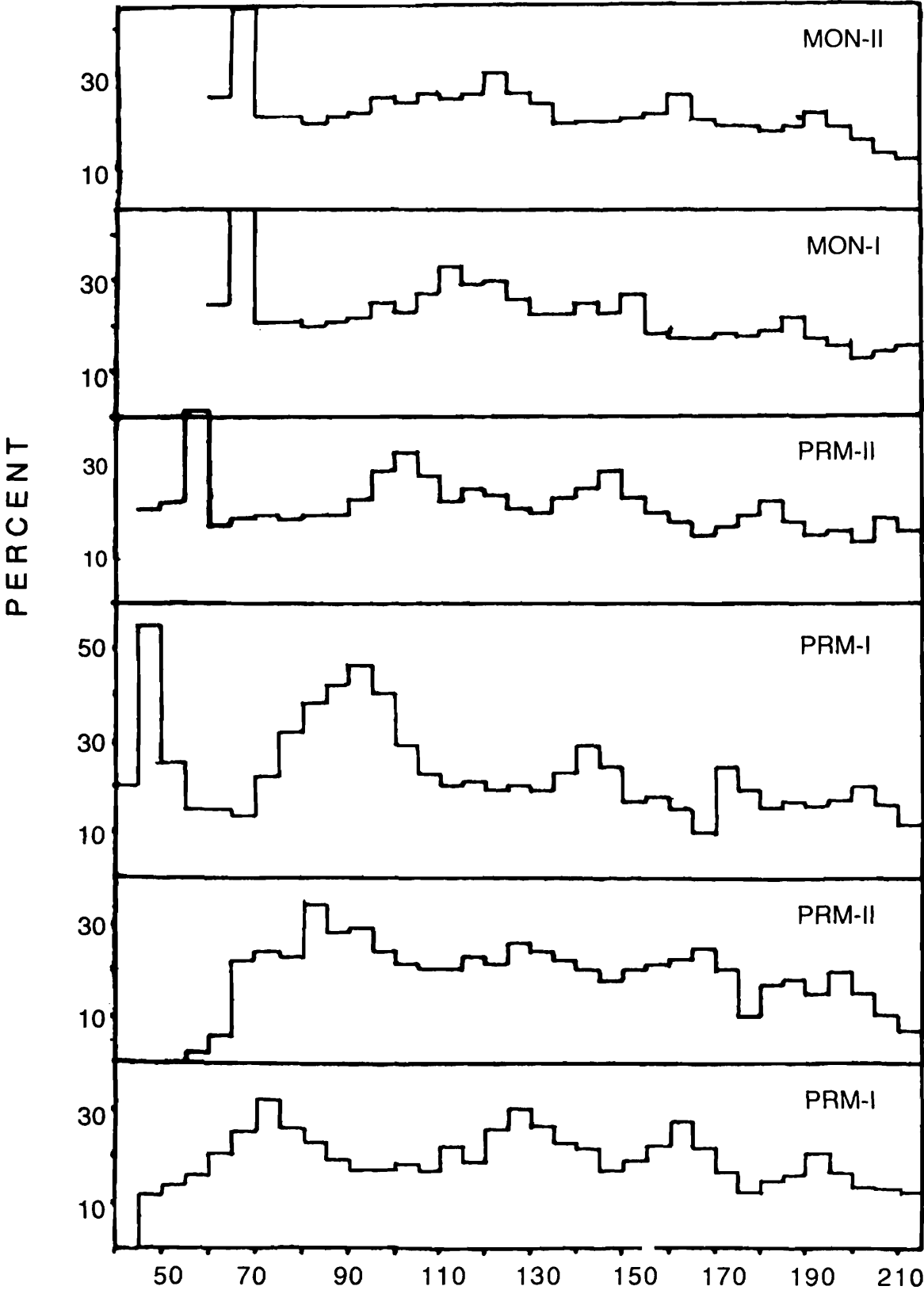


Fig. 12. Seasonal changes in length frequency distribution of *C. ramcarati*

distinctly visible in each year with modal lengths at 70-80 mm, 120-125 mm, 155-160 mm, 185-190 mm and 200-210 mm. Excepting minor variations the pattern was almost similar during different years. The maximum size observed was 220 mm. These five groups represented five year classes as revealed by seasonal shifting of modes. Fig. 12 depicts the seasonal analysis of length frequency distribution for 1989-90. During POM-I, there was an abundance of post larvae in the plankton and fry net collections indicating the spawning. In the seasonal length frequency graph (Fig. 12) of this season (PRM), the first clear mode was seen at 70 mm size class which appeared to belong to earlier generation. The second, third, fourth and fifth modes were at 125 mm, 160 mm, 185 mm and 210 mm size groups. During following (POM-II) season, all modes progressed further forming peaks at 80 mm, 130 mm, 165 mm, and 195 mm sizes. The 5th group was not very clear. The modes continued to shift during next season. However, during PRM-I, a new mode was formed at 45 mm interval which represented the individuals produced during POM-I season. During this 4 month period, these had grown to the size of 45 mm. The other modes were at 140 mm, 170 and 200 mm. During next (PRM-II) season, the modes were at 55 mm, 100 mm, 145 mm, 175 mm and 205 mm respectively. At the end of year (PRM-II), these modes were at 70 mm, 120 mm, 160 mm, 190 mm and 210 mm, which were almost similar to size classes analysed from yearwise frequency graph. Therefore, each mode appeared to represent a year class. The impact of second group of entrants could not be detected on the polygraph, which was probably due to comparatively small number of entrants, arising from slower spawning rate during second phase.

### Age and length

As stated above, there were five year classes available in the population having mean lengths of 70, 120, 160, 190 and 210 mm at the ages of 1, 2, 3, 4, and 5 years.

### Growth rate

When growth rate was analysed from annual data it was noted that fishes grew at the rate of 73.7 mm, 50 mm, 35 mm, 26.7 mm and 18.0 mm. during first, second, third, fourth and fifth years of life. The growth rate decreased progressively from age 1 to age 5. The mean monthly growth rate varied between 5.83 mm and 1.66 mm.

### Von Bertalanffy growth equation

When the length at age data were fitted into Von Bertalanffy growth equation, a significant equation was obtained. The values of asymptotic length ( $\alpha$ ),  $k$  and  $t_0$  were 276.7497, 0.2469 and -0.0059 respectively. The resultant equation was :

$$Lt \ 276.7469 (1 - e^{-0.2469 (t+0.0059)})$$

These have been graphically represented in figs 13a and 13b.

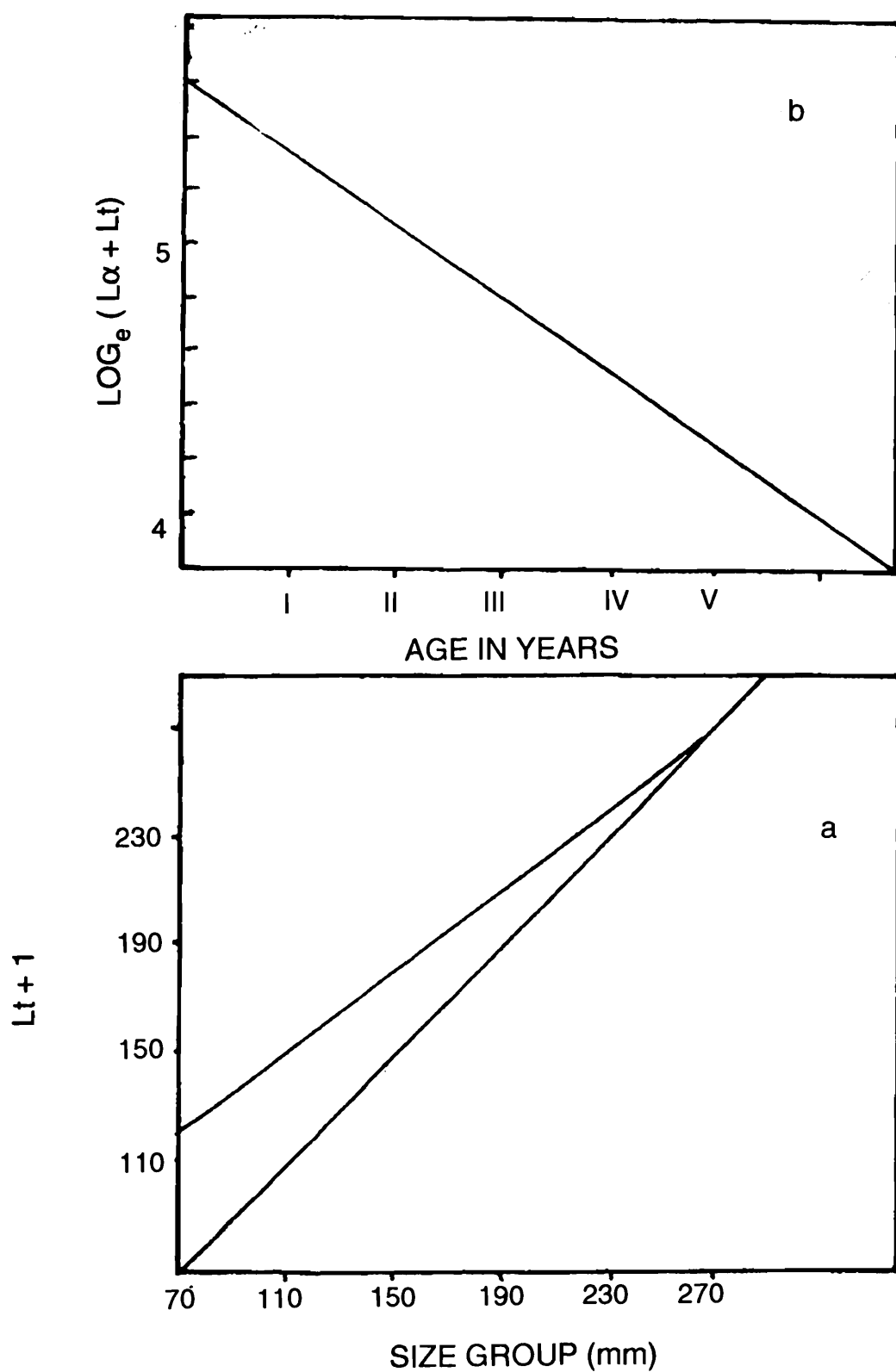


**Fig. 13.** (a) Plot of  $L_t + 1$  against  $L_t$  (Ford Walford) of *C. ramcarati*.; (b) Plot of  $\text{Log}_e (L_\alpha - L_t)$  against age of *C. ramcarati*.

### Length-Weight relationship

The length weight relationship of *C. ramcarati* was found to be significantly different between adults and juveniles. Therefore equations were computed separately which are as

Juveniles :  $\text{Log } W = -4.3211 + 2.5960 \text{ Log } L$

$$W = 4774 \times 10^{-4} L^{2.5960}$$

Adults :  $\text{Log } W = -5.3198 + 3.0095 \text{ Log } L$

$$W = 4788 \times 10^{-5} L^{3.0095}$$

Fig. 14 exhibits the graphical relationship of weight to length.

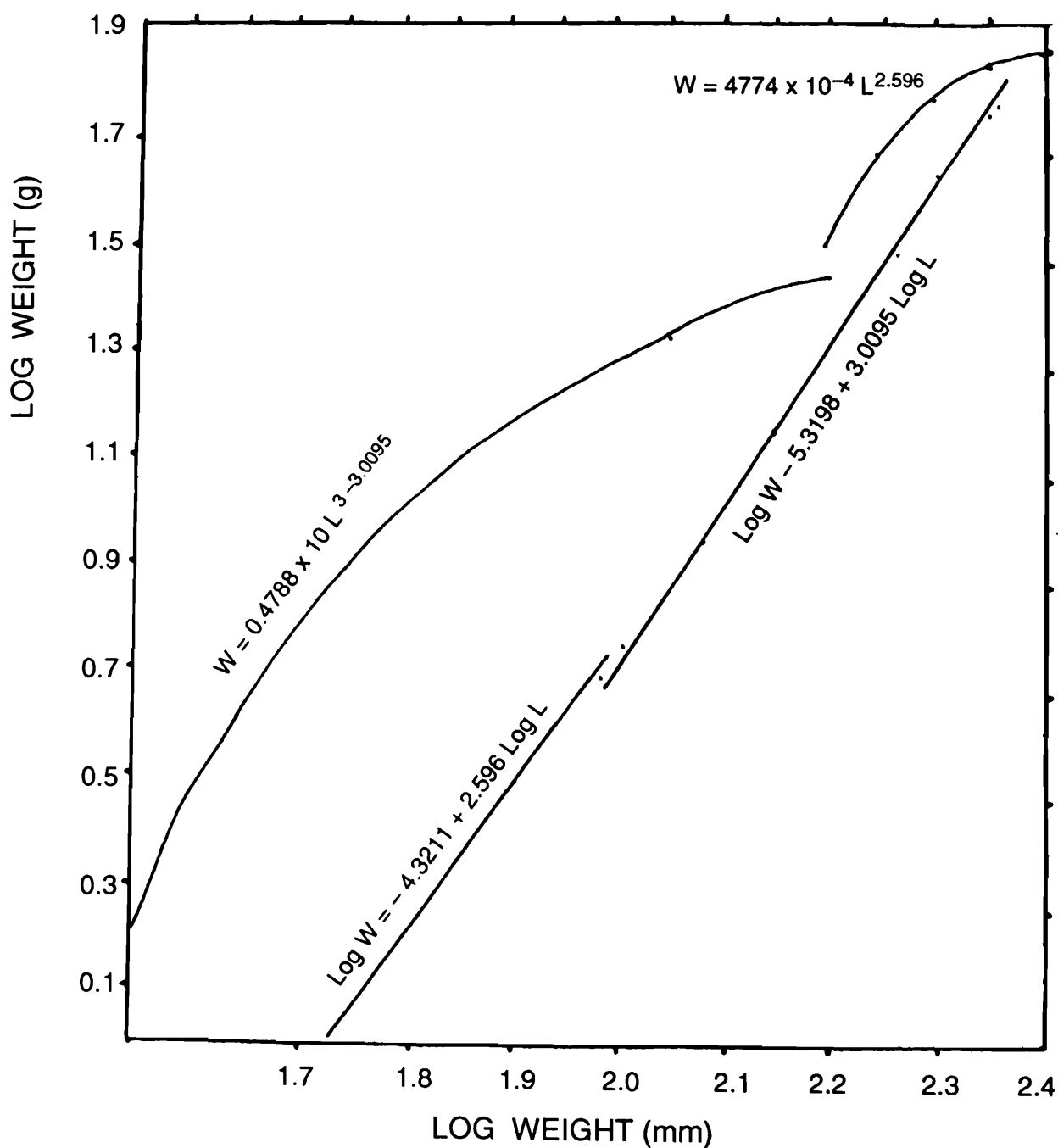


Fig. 14. Length weight relationship of *C. ramcarati*.

### Relative condition factor

The  $K_n$  values of *C. ranicarati* at different size groups (Fig. 15a) exhibited higher values upto the size of 60 mm, followed by a sharp decrease. The values started increasing from the size of 100 mm onwards due to maturation of gonads. A sharp drop was noticed immediately after indicating spawning. Thereafter several ridges and furrows are seen representing maturation and spawning of different year class individuals. Seasonal  $K_n$  curve (Fig 15b) revealed a major peak during MON-II and a minor during PRM-I. Lower values were noticed during POM-I and PRM-II. As already known, these periods represent maturation of gonades and consequent spawning.

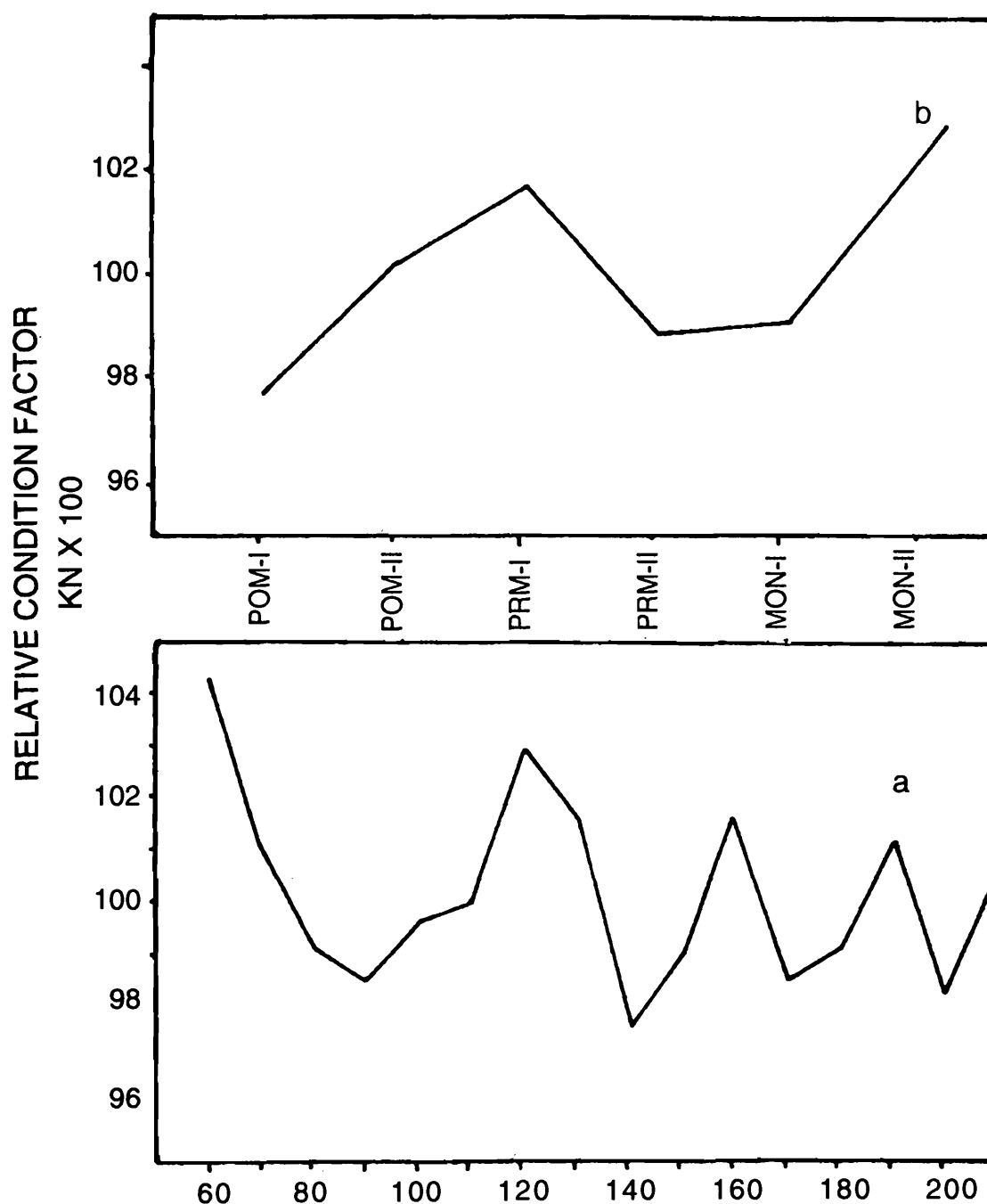


**Fig. 15.** Variations in relative condition factor ( $K_n$ ) at different sizes (a) and during different seasons (b) of *C. ranicarati*.

### Food and Feeding habits

The food of the adults of *C. ramcarati* (Fig. 16) was chiefly consisted of copepods (20.2%), Prawn and shrimp (29.13%), Other crustaceans including stomatopods, isopods and mysids etc (10.7%), Miscellaneous food items including polychaetes and chaetognaths (6.8%) and semidigested food (30.2%). In Juveniles, copepods were the most abundant group (42.2%) followed by other crustaceans (18.0%), Prawns and shrimps and Miscellaneous items (about 8% each). The Semidigested food comprised nearly 22.6%.

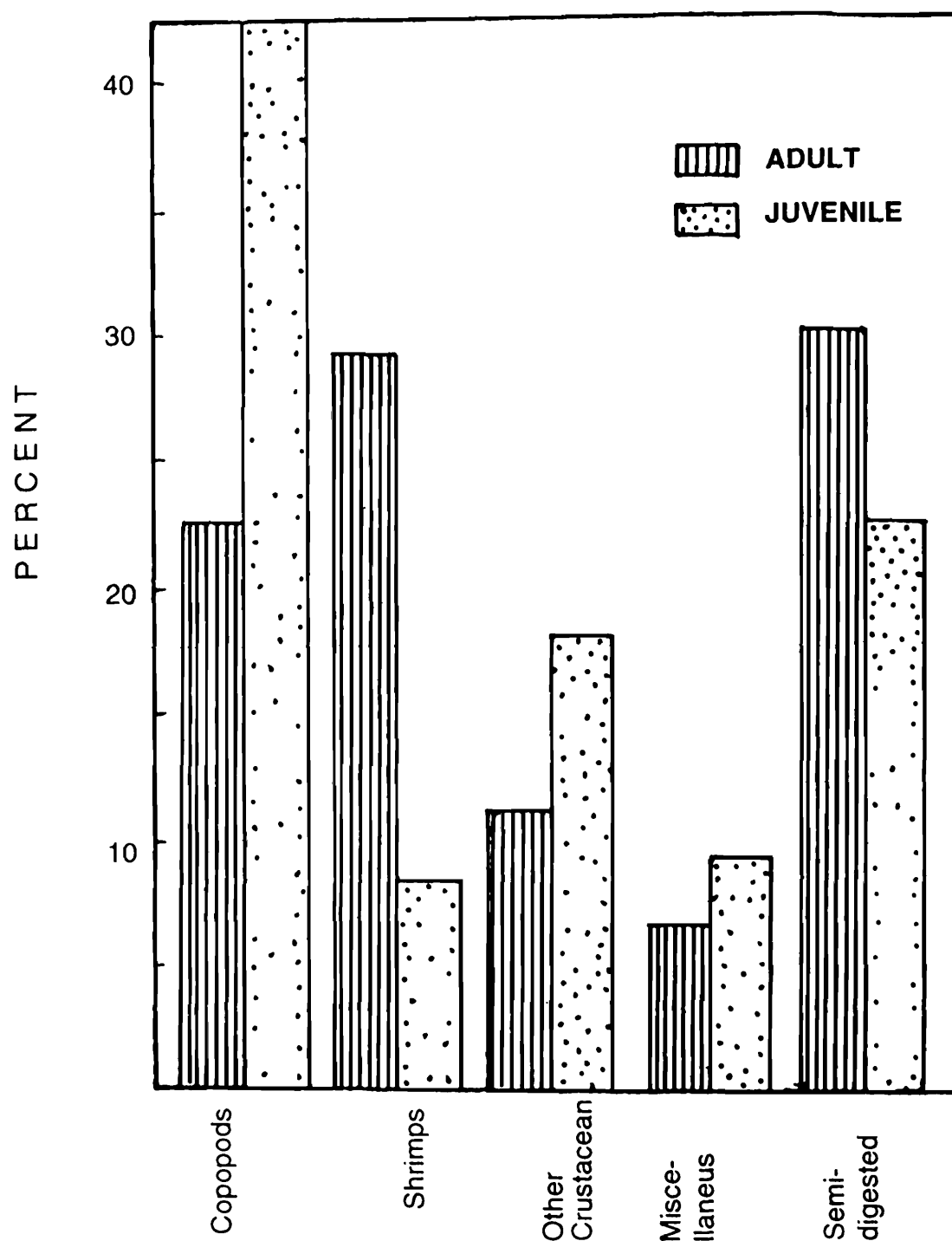


Fig. 16. Relative occurrence of different food items in the guts of adults and juveniles of *C. ramcarati*.

**TABLE 7 : Seasonal variations in the intensity of feeding of *C. ramcarti***

| Seasons | Gorged | Full | 3/4 full | 1/2 full | 1/4 full | Traces | Empty guts | Feeding Condition |          |      |
|---------|--------|------|----------|----------|----------|--------|------------|-------------------|----------|------|
|         |        |      |          |          |          |        |            | Active            | Moderate | Poor |
|         |        |      |          | Adults   |          |        |            |                   |          |      |
| POM-I   |        | 7.2  | 15.3     | 35.5     | 24.4     | 8.2    | 10.4       | 22.5              | 58.9     | 18.6 |
| POM-II  |        | 6.0  | 10.2     | 24.2     | 19.0     | 18.2   | 22.9       | 16.2              | 43.2     | 40.6 |
| PRM-I   |        | 9.0  | 11.5     | 21.3     | 28.2     | 11.8   | 18.2       | 20.5              | 49.5     | 30.0 |
| PRM-II  |        | 4.2  | 6.4      | 19.3     | 32.4     | 15.5   | 23.2       | 10.6              | 51.7     | 38.7 |
| MON-I   |        | 9.5  | 9.0      | 30.5     | 28.4     | 10.6   | 12.0       | 18.5              | 58.9     | 22.6 |
| MON-II  |        | —    | 8.2      | 15.2     | 20.2     | 15.4   | 41.0       | 8.2               | 35.4     | 56.4 |
|         |        |      |          | Juvenile |          |        |            |                   |          |      |
| POM-I   |        | 22.2 | 28.5     | 20.3     | 12.3     | 14.2   | 12.5       | 40.7              | 32.6     | 26.7 |
| POM-II  |        | 15.5 | 23.2     | 30.2     | 11.2     | 10.5   | 9.4        | 38.7              | 41.4     | 19.9 |
| PRM-I   |        | 10.2 | 13.4     | 18.5     | 28.3     | 13.4   | 16.2       | 23.6              | 46.8     | 29.6 |
| PRM-II  |        | 14.3 | 17.4     | 11.5     | 20.0     | 22.3   | 14.5       | 31.7              | 31.5     | 36.8 |
| MON-I   |        | 8.2  | 19.2     | 23.2     | 24.0     | 8.4    | 18.0       | 26.4              | 47.2     | 26.4 |
| MON-II  |        | 38.0 | 20.2     | 14.2     | 24.1     | 13.2   | 10.5       | 38.2              | 38.3     | 23.5 |

## Intensity of feeding

The occurrence of empty gut in the population was comparatively moderate in *C. ramcarti*. In case of adults, active feeding was recorded in only 16.08% cases. The rates of moderate and poor feedings were 40.6 and 34.48% respectively. In juveniles, active feeding was recorded in case of 33.55% individuals followed by 39.3% moderately fed individuals and 27.15% poorly fed individuals. Feeding intensity was lowest in adults during gonad maturation period like other fishes. (Table 7).

## Reproduction

### a) Sex ratio

Sex ratio of the species did not differ much from hypothetical 1:1 ratio. It was 1 : 1.1358 for male : female. A Chi square test of heterogeneity did not reveal significant differences at 5% level.

### b) Size at first maturity

Size at first maturity (size at which 50 individuals are mature) was determined by plotting the occurrence of mature individuals at different sizes (Fig. 17). All females below 90 mm were immature and the earliest mature individual recorded was of 100 mm length. The 50% maturity size was worked out to be 230 mm.

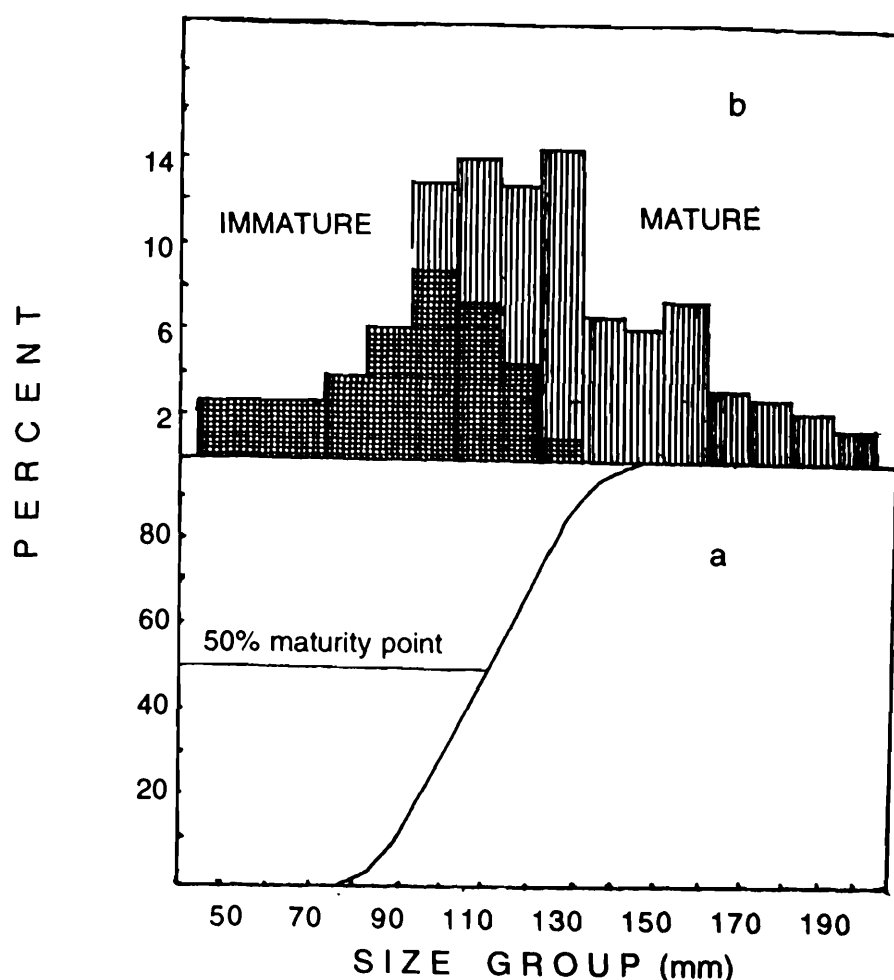


Fig. 17. Size at first maturity (a) and occurrence of mature and immature individuals at different sizes (b) of *C. ramcarati*

### c) Frequency of occurrence of maturity stages and spawning season

Fig 18 depicts the occurrence of different maturity stages in the population during different seasons. Stage IV ripe individuals were available during PRM-I and MON-II. The ripe individuals were altogether absent during POM-I and II seasons. The figure exhibited two clearly separated modes representing two spawning periods of the fish.

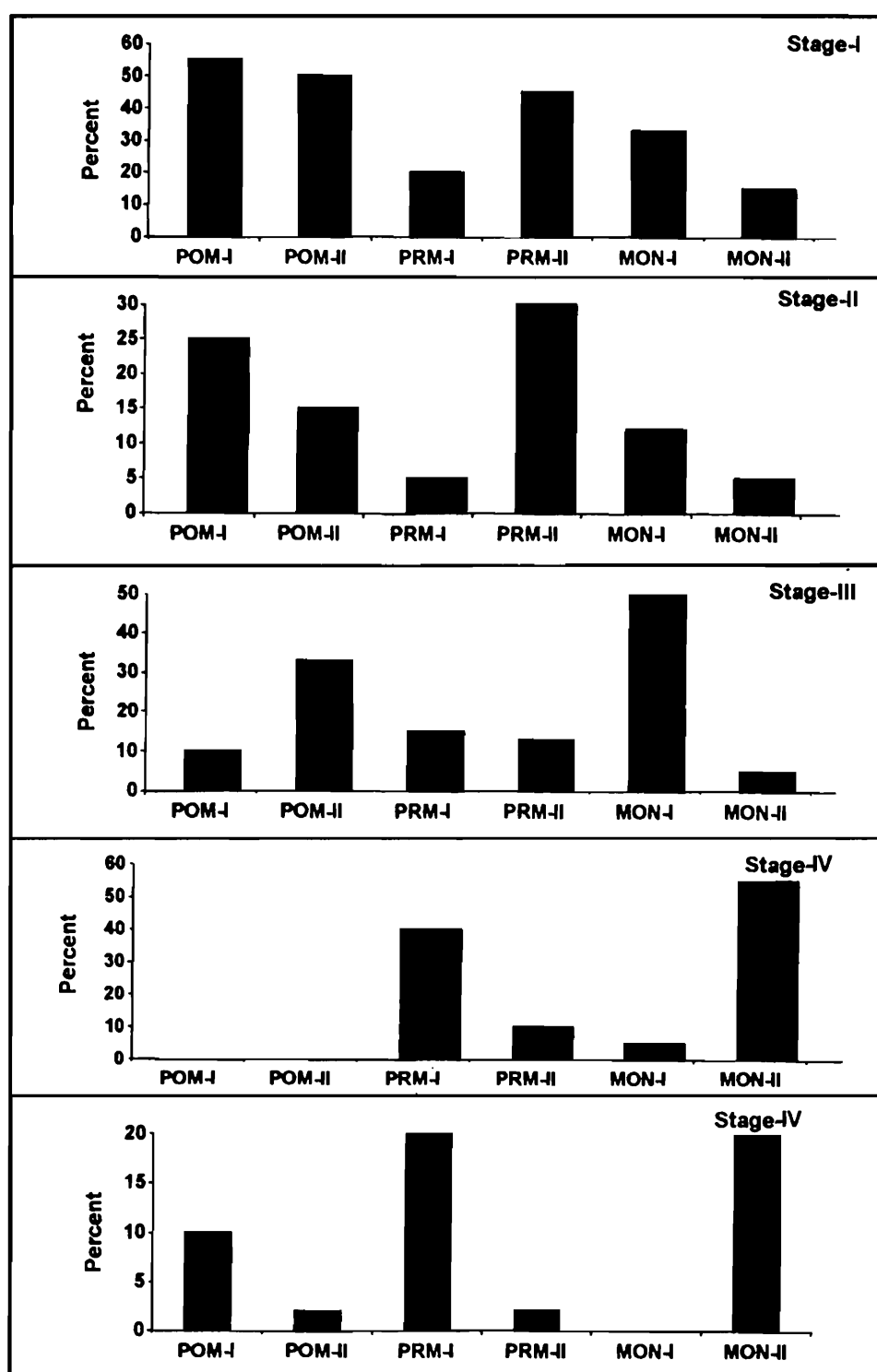


**Fig. 18.** Relative occurrence of individuals with different maturity stages during different seasons of *C. ramcarati*.

#### d) Size frequency distribution of ova and spawning season

The analysis of size frequency distribution of ova in a mature/maturing ovary revealed two widely separated batches (Fig 19). In a ripe ovary the main peak was recorded at the size group of 0.810 mm which comprised fully mature ova. The second peak was close to mother stock forming mode at 0.5 mm. This again suggested an extended spawning season of the fish.

In spite of small variation in different aspects of the biology of species, the observations support the finding of Verghese (1973).

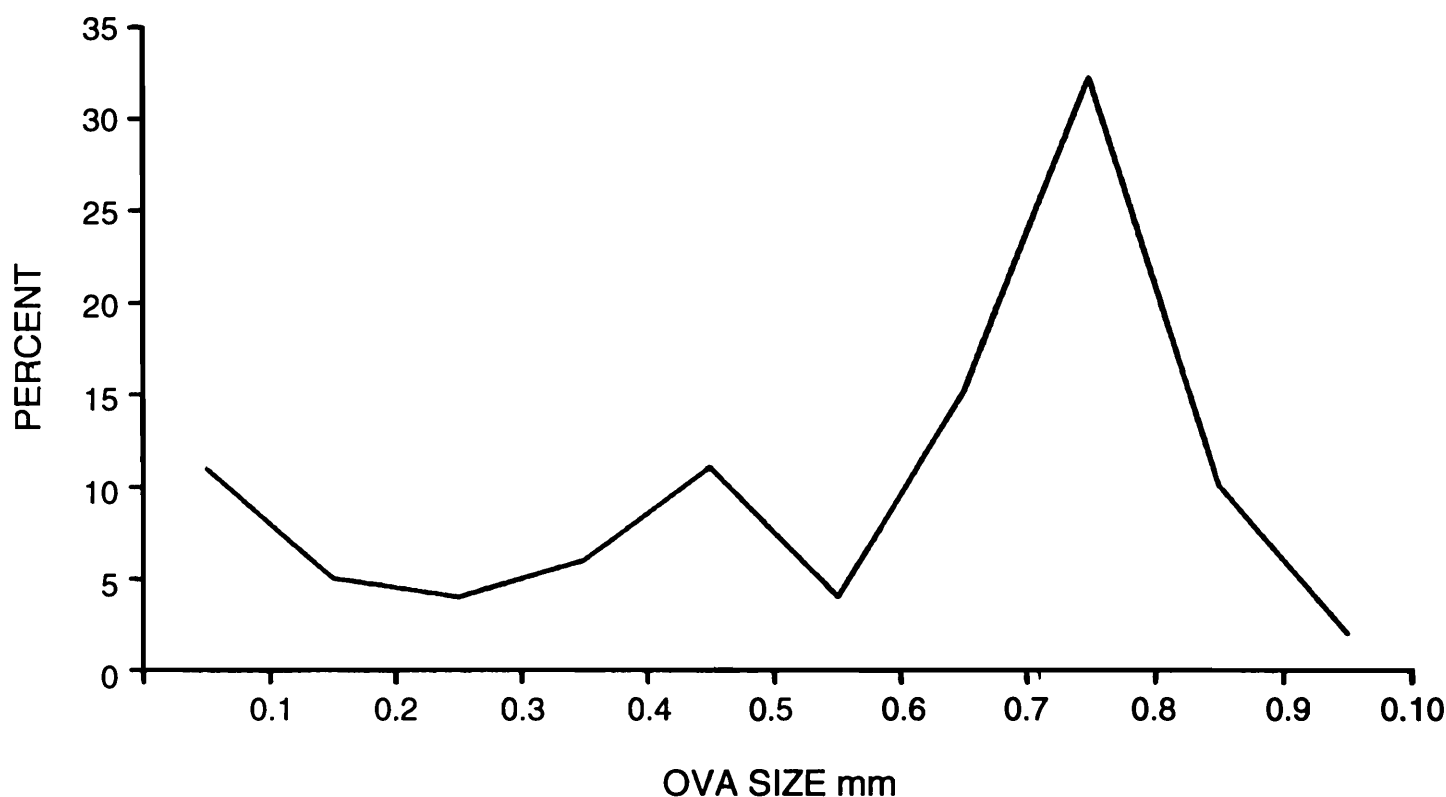


Fig. 19. Size frequency distribution of ova in a mature of ovary *C. ramcarati*.

#### *Eleutheronema tetradactylum* (Shaw)

The polynemid threadfin, *Eleutheronema tetradactylum* (Shaw) is one of those commercially important species, which command a very high market price, not only in this region of the country but everywhere they occur. In Calcutta, apart from the catches of Hugly-Matla estuarine system, fishes from Chilka are also brought. These fishes are available in the estuary almost throughout the year. It spawns in the estuary as post larvae and fry were collected in abundance during spawning season.

In spite of its economic importance and regular availability in sunderban estuaries, not much work has been done on its biology. In early fifties, Sarojni and Malhotra (1952) studied its larval development, followed by the study of food and feeding habits by

**Malhotra (1953).** Pillay and Ghosh (1962) recorded its occurrence in bag net fishery and **Chandra (1962)** studied the distribution and abundance of larvae. The studies from other regions include the works of Karandikar and Palekar (1950) on its ovarian development and spawning habits and Bapat and Bal (1952) on food and feeding habits from Bombay waters. Patnaik (1970) studied various aspects of its biology from Chilka lake.

### **Occurrence and abundance**

The species occurred during all seasons of the year in all zones of the estuary. Its relative composition varied between 0.95 and 1.2% during 4 years of study (Table 4) with a mean of 1.2% Catch comprised of chiefly young class individuals. These were almost uniformly distributed in all zones of the estuary.

### **Length frequency distribution**

The length frequency distribution of the species for three years, 1987-88, 1988-89 and 1989-90 combined has been analysed. The post larvae and fry of the species were present during major part of the year as revealed by plankton and fry collections. However, 2 peak period of abundance, one during POM-I and other during MON-I, indicated their main spawning periods, placed about 6 months apart. These larvae below 50 mm were shown in length frequency polygraph as A (abundant), M (moderate) and L (low), since plankton collections could not be expressed quantitatively on the polygraph (Fig. 20). The pooled data revealed the occurrence of several modes. Following the twice a year spawning of almost same intensity, two clear modes in each years were visible. In PRM-I, the abundance of post larvae was followed by modes at 125, 275 350, 425, 500, 550 and 575-600 mm size groups. These modes are designated as a, b, c, d, e, f and g respectively. All the modes progressed during next (PRM-II) season and formed modes at 175, 300, 375, 450, 500, 550 and 600 size groups. Besides these, a new mode appeared at 75 mm group representing the new entrants in the population of those born during PRM-I period. This mode was designated as O2, representing early brood. During MON-I, the shift was further noticed, except the last mode which was overlapping. During MON-II, there was no major entry of new recruits in the population and modes shifted gradually. During following season (POM-I) again a new batch of recruits entered and formed peak at 75 mm group. This batch was designated as O1 and represented the late brood. There were successive shifts in the modes and at the end of year, the modes of O2 was at 250 mm and O1 at 170 mm, representing the growth of one year and half year respectively. The other modes were at 350, 400, 475, 525 and 575 mm size classes.

### **Age and length**

When progression of modes and growth attained were analysed, it was found that O2 represented the growth of one full year at the end of POM-II attaining a size of 250 mm and O1, attaining a size of 100 mm, represented half year's growth. Following this, modes a and b were included in 2nd year class, c and d in third year class and e and f in fourth

year class. The pattern of mode g was not very clear. This gives the approximate length at different ages as 250 mm, 400 mm, 525 mm and 575-600 mm for ages 1, 2, 3, and 4 respectively.

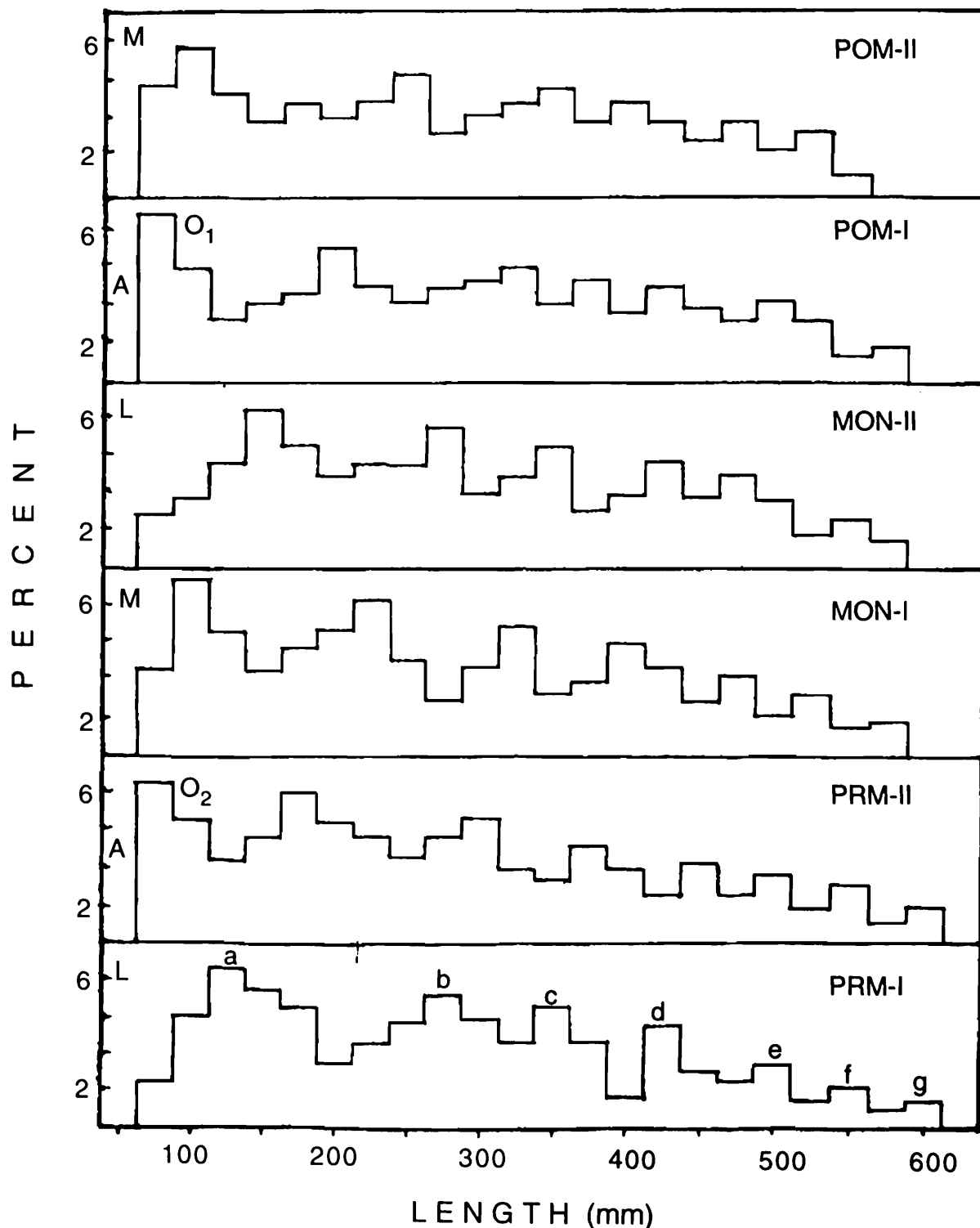


Fig. 20. Seasonal changes in length frequency distribution of *E. tetradactylum*  
Abundance of post larvae is shown as A-abundant, M-moderate and L-Low,  $O_2$  = early brood,  $O_1$  = Late brood, a-g = modes

### Growth Rate

Progression of modes in LF curve revealed the annual growth increment in length as 250 mm, 150 mm, 125 mm, and 75 mm during 1st, 2nd, 3rd and 4th year, giving mean monthly rate of 20.8 mm, 12.5 mm, 10.4 mm and 6.25 mm respectively.

### Von Bartalanfey growth equation

The length at age date were fitted and following growth equation was obtained (Figs. 21, 22).

$$L_t = 864.1666 (1 - e^{-0.3062(t + 0.041)})$$

The equation described well the growth rate of the species.

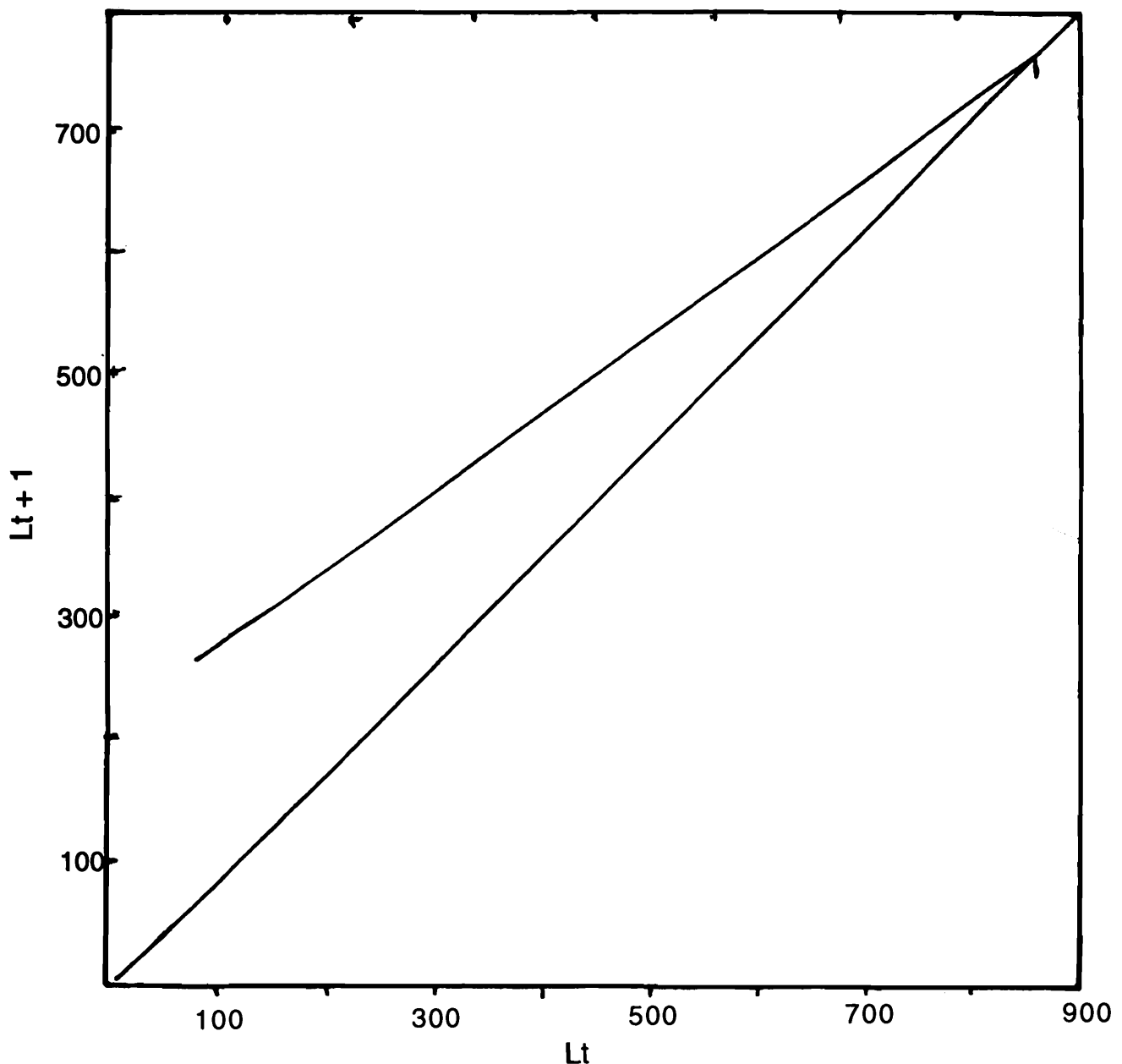


Fig. 21. Plot of  $L_t + 1$  against  $L_t$  (Ford- Walford) of *E. tetradactylum*

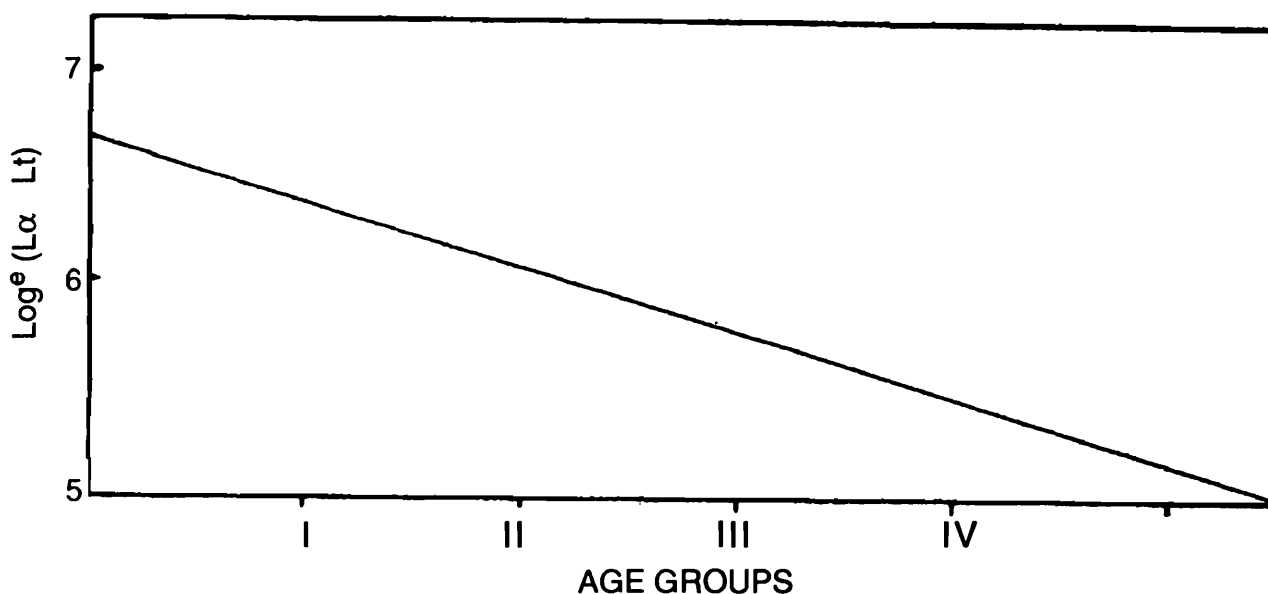


Fig. 22. Plot of  $\text{Log}_e (L\alpha \text{ } Lt)$  against age of *E. tetradactylum*

### Length weight relationship

Length weight relationship of juveniles did not reveal satisfactory results because of reasons unknown. Analysis of variance did not reveal significant differences between sexes and therefore data were pooled and combined equation was obtained.

$$\text{Log } W = -5.17012 + 3.0180 \text{ Log } L$$

$$W = 3040 \times 10^{-5} L^{3.0180}$$

The length weight relationships are expressed graphically in fig. 23.

### Relative condition factor

Like other fishes, the values were always high in smaller fishes. A sharp drop was noted at 125 mm, after which the values fluctuated around 1, till the size of 325-350 mm when a sudden increase was noticed (Fig, 24a), which was due to onset of maturity. Thereafter several peaks appeared in quick succession one after other representing maturation and spawning of different age class individuals. The seasonal curve also fluctuated considerably but clearly followed maturation of gonad and spawning period (Fig 24b).

### Food and Feeding Habits

The food of adults comprised mainly of fishes (29.38%), which included Clupeidae (*Coila* sp, *Setipinna* sp), Harpodontidae, Sciaenidae and few other groups. The fishes were followed by decapod crustaceans (prawns) which comprised nearly 42% and were represented by all three groups, viz Sergestidae, Penaeidae and Palaemonidae. Beside these, the other food items were Other crustacea including stomatopods, isopods and mysids (7.06%) and Miscellaneous item consisting of polychaetes etc (7.06%). The semidigested food comprised about 18.45% (Fig. 25). In juvenile's diet, fishes did not play

any significant role. The bulk of diet was comprised of Decapod crustaceans (43.75%), followed by other crustaceans (30.8%) and miscellaneous items (9.4%).

### Feeding intensity

In case of adults , at an average, 21.15% individuals were found actively fed, 42.13%, moderately fed and 34.63% poorly fed. In case of Juveniles the ratio of actively fed individuals was considerably high (33.53%) followed by moderately fed (39.66%) and poorly fed (26.48%). (Table 8).

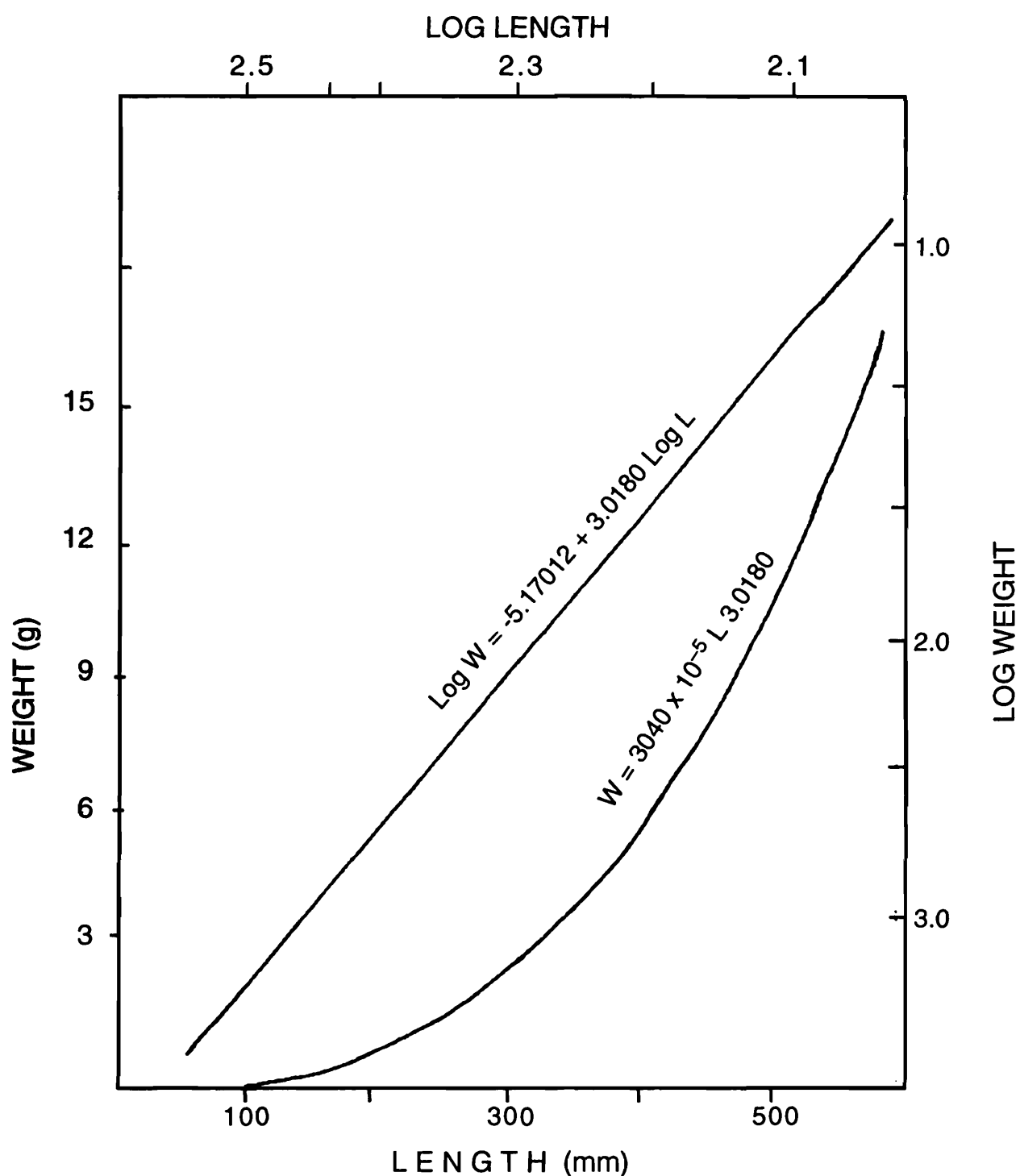


Fig. 23. Length weight relationship of *e. tetradactylum*

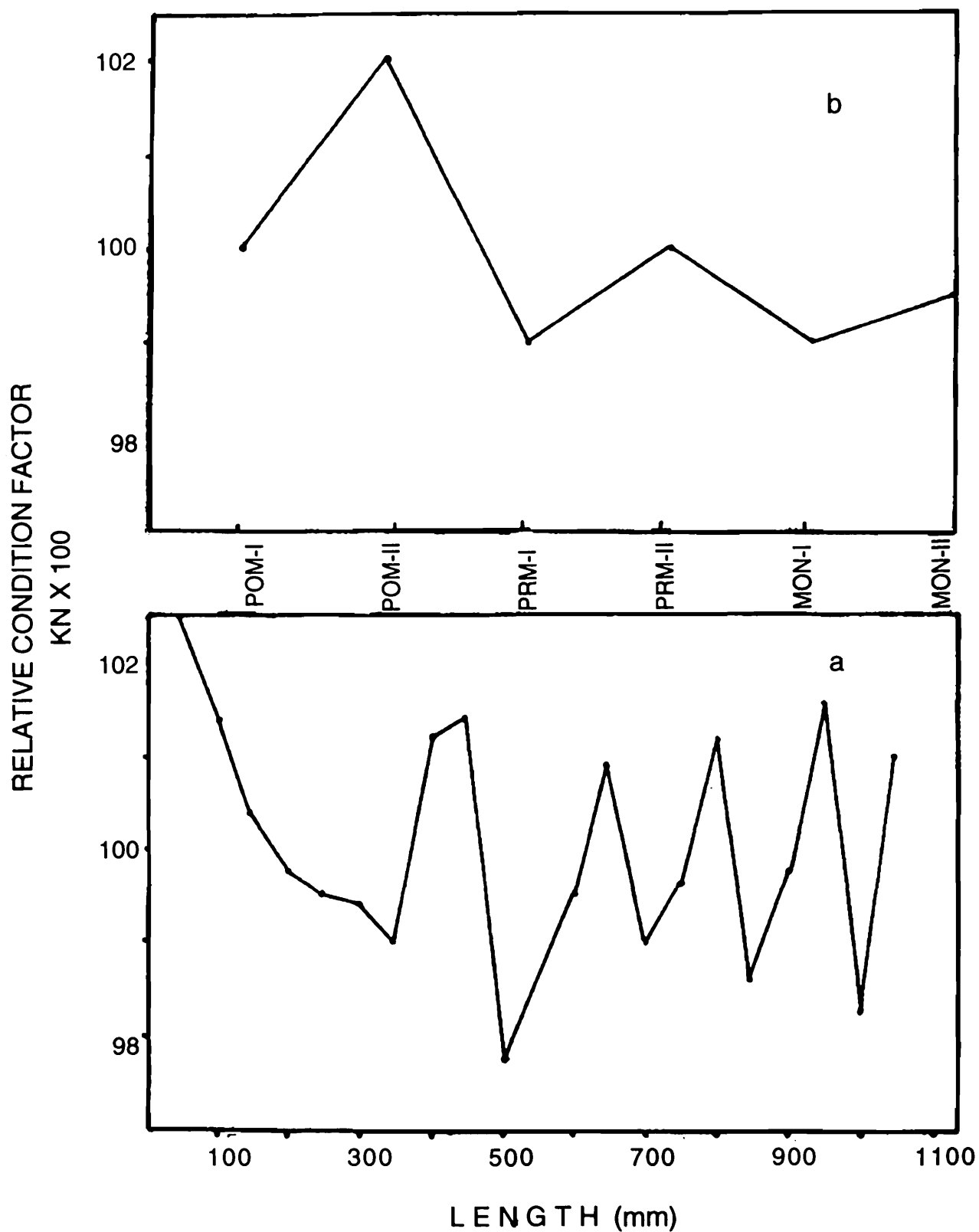


Fig. 24. Variations in relative condition factor (Kn) at different sizes (a) and during different seasons (b) of *E. tetradactylum*.

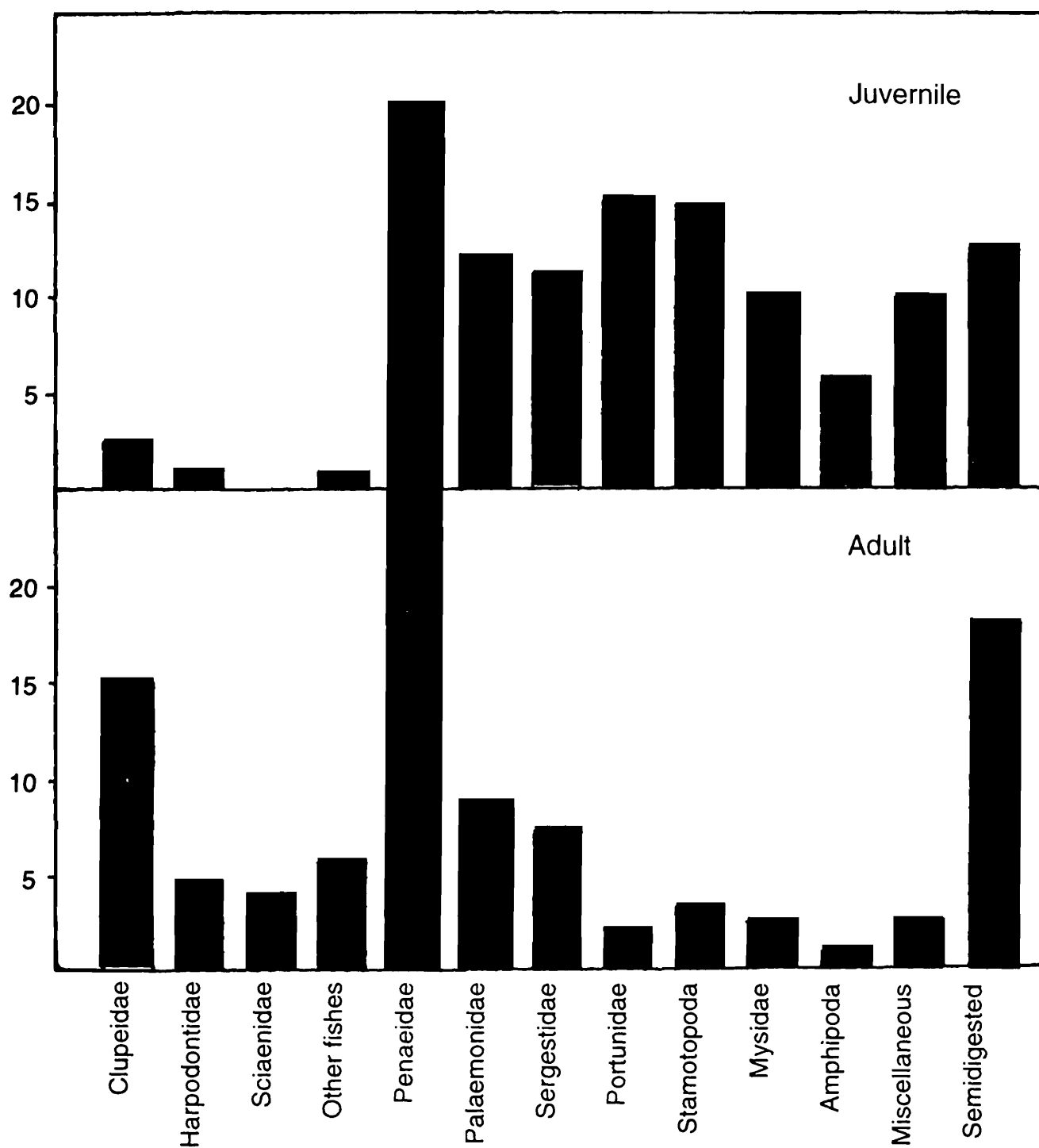


**Fig. 25.** Relative occurrence of different food items in the guts of adults (a) and juveniles (b) of *E. tetradactylum*.

**TABLE 8 : Seasonal variations in the intensity of feeding of *E. tetradactylum***

| Seasons | Gorged | Full  | 3/4 full | 1/2 full | 1/4 full | Traces | Empty guts | Feeding Condition |          |       |
|---------|--------|-------|----------|----------|----------|--------|------------|-------------------|----------|-------|
|         |        |       |          |          |          |        |            | Active            | Moderate | Poor  |
|         |        |       |          | Adults   |          |        |            |                   |          |       |
| POM-I   |        | 6.8   | 10.0     | 10.0     | 10.5     | 42.3   | 20.4       | 16.8              | 20.5     | 62.7  |
| POM-II  |        | 12.5  | 15.0     | 14.5     | 16.0     | 21.2   | 21.8       | 27.5              | 30.5     | 42.0  |
| PRM-I   |        | 7.0   | 9.5      | 9.0      | 9.6      | 40.6   | 24.3       | 16.5              | 18.6     | 64.9  |
| PRM-II  |        | 8.5   | 14.0     | 13.5     | 9.7      | 34.2   | 20.1       | 22.5              | 23.2     | 54.3  |
| MON-I   |        | 10.0  | 7.4      | 14.0     | 7.5      | 32.8   | 27.3       | 17.4              | 21.5     | 61.1  |
| MON-II  |        | 10.0  | 18.0     | 8.5      | 10.0     | 26.8   | 16.9       | 28.0              | 18.5     | 43.5  |
| MEAN    |        | 9.13  | 12.30    | 13.25    | 10.55    | 33.0   | 21.76      | 21.45             | 23.8     | 54.75 |
|         |        |       |          | Juvenile |          |        |            |                   |          |       |
| POM-I   |        | 12.2  | 6.8      | 30.0     | 21.2     | 19.3   | 9.3        | 19.0              | 51.2     | 28.6  |
| POM-II  |        | 13.0  | 13.4     | 27.5     | 24.1     | 13.6   | 8.9        | 26.4              | 51.1     | 22.5  |
| PRM-I   |        | 14.5  | 21.0     | 20.2     | 22.0     | 10.4   | 11.9       | 35.5              | 42.2     | 22.3  |
| PRM-II  |        | 8.5   | 12.5     | 26.5     | 16.4     | 16.1   | 20.0       | 21.0              | 42.9     | 36.1  |
| MON-I   |        | 14.6  | 22.2     | 18.6     | 22.0     | 11.8   | 10.8       | 36.8              | 40.6     | 22.6  |
| MON-II  |        | 13.2  | 20.4     | 19.8     | 20.0     | 12.8   | 13.5       | 33.6              | 39.8     | 26.3  |
| MEAN    |        | 12.66 | 16.05    | 23.76    | 20.95    | 14.0   | 12.40      | 28.92             | 44.63    | 26.40 |

## Reproduction

### a) Sex ratio

Out of 650 specimens examined 300 were males and 350 females giving a male female ratio of 1 : 1.166. A Chi square test of heterogeneity revealed no significant differences at 5% level (Table 9).

**TABLE 9 : Sex ratio and CHI square test of *E. tetradactylum***

| Seasons | Total | Male | Female | Male  | Female | Ratio-M.F. |
|---------|-------|------|--------|-------|--------|------------|
| POM-I   | 95    | 70   | 25     | 73.68 | 26.32  | 1 : 2.8    |
| POM-II  | 120   | 25   | 95     | 20.83 | 79.17  | 1 : 3.8    |
| PRM-I   | 45    | —    | 45     | 0     | 100.00 | 0 : 100    |
| PRM-II  | 55    | 5    | 50     | 9.09  | 90.91  | 1 : 10.0   |
| MON-I   | 20    | 15   | 5      | 75.0  | 25.00  | 1 : 0.33   |
| MON-II  | 15    | 2    | 13     | 13.33 | 84.66  | 1 : 6.5    |
|         | 350   | 117  | 233    | 33.42 | 66.68  | 1 : 1.99   |

#### Chi-square Test

observed  $X^2 = 65.20$  Significant  
5%, value = 17.83

### b) Size at first maturity

The smallest mature female observed was of 342 mm. The size at which 50% fishes were mature was worked out to be 380 mm. (Fig. 26). All fishes above 450 mm were mature. High ratio of mature females was observed in PRM-I and MON-II, indicating two spawning seasons (Fig. 27).

### c) Size frequency distribution of ova and spawning season

During PRM-I, beside mother stock there were two sharp modes at 0.4 mm and 0.8 mm size group. The latter peak was comprised of fully mature ova ready for shedding, as during following seasons (PRM II), almost all ova of this size were spawned. The smaller mode of PRM-I progressed during PRM-II and formed peak at 0.6 mm group. During next season (MON-I) the peak further progressed to 0.8 mm group formed by fully mature ova. There was no other noticeable peak. Like previous batch of fully mature

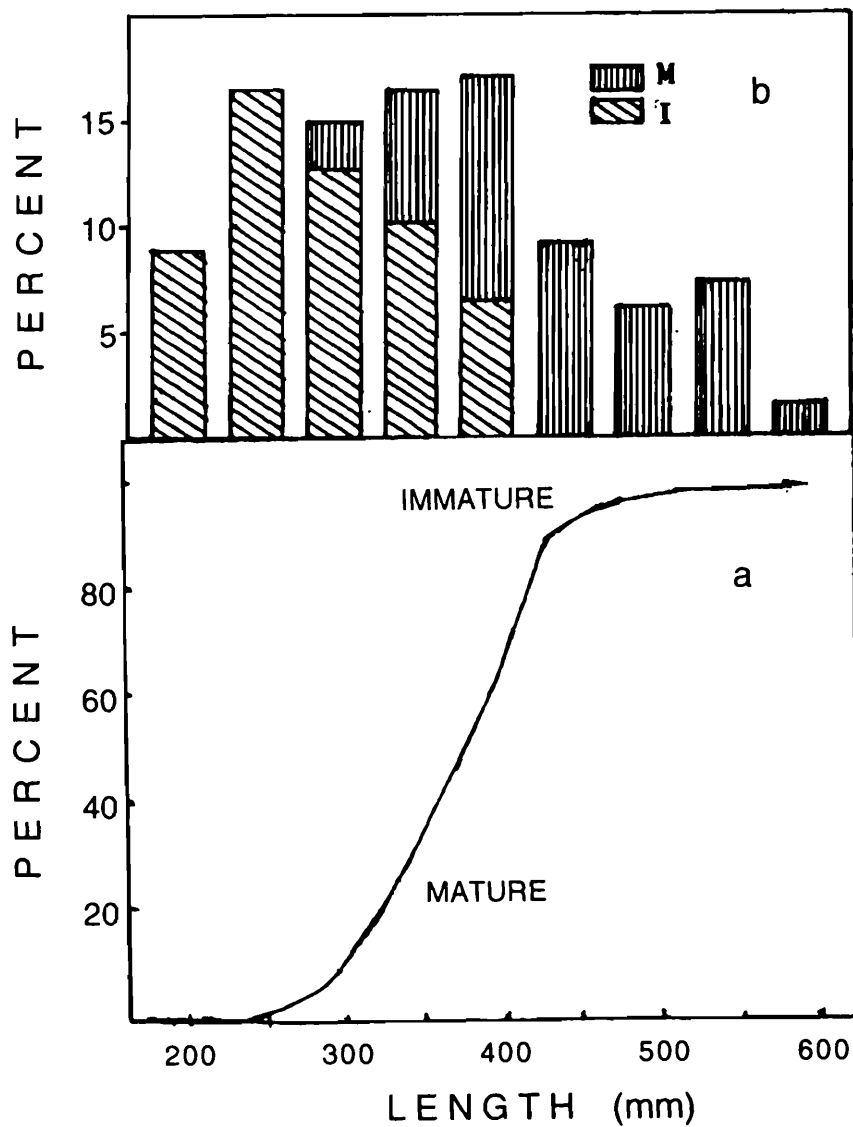


Fig. 26. Size at maturity (a) and occurrence of mature and immature individuals (b) at different sizes of *E. tetradactylum*. M = Mature, I = Immature

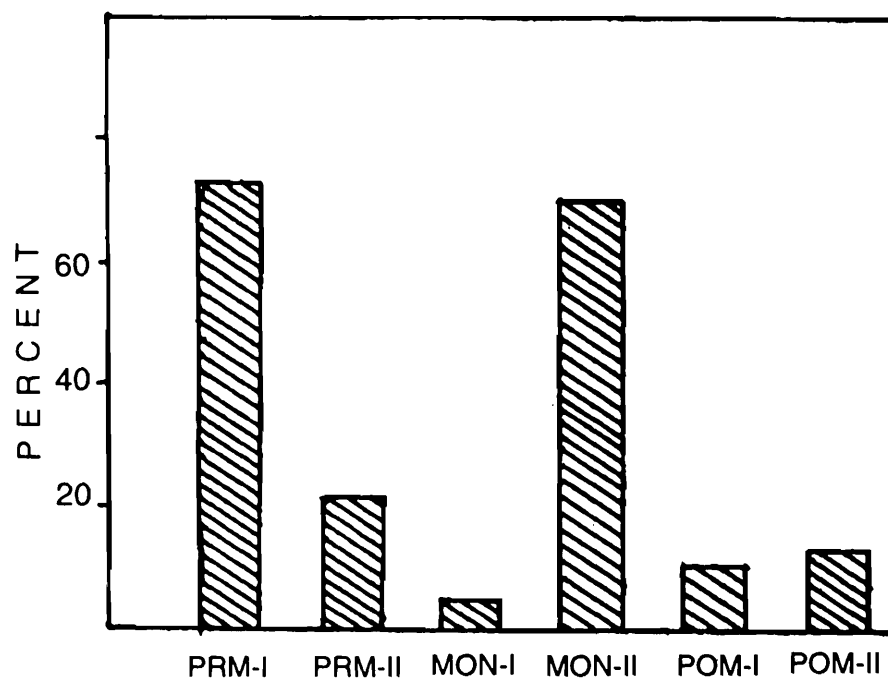


Fig. 27. Relative occurrence of mature individuals of *E. tetradactylum*

ova, this batch was also spawned during next season (MON II). There was no noticeable development of ova during next season. Next batch of ova started development from POM-II which will mature during following PRM-I season, like the previous one. This also indicate the two spawning season of the fish (Fig. 28).

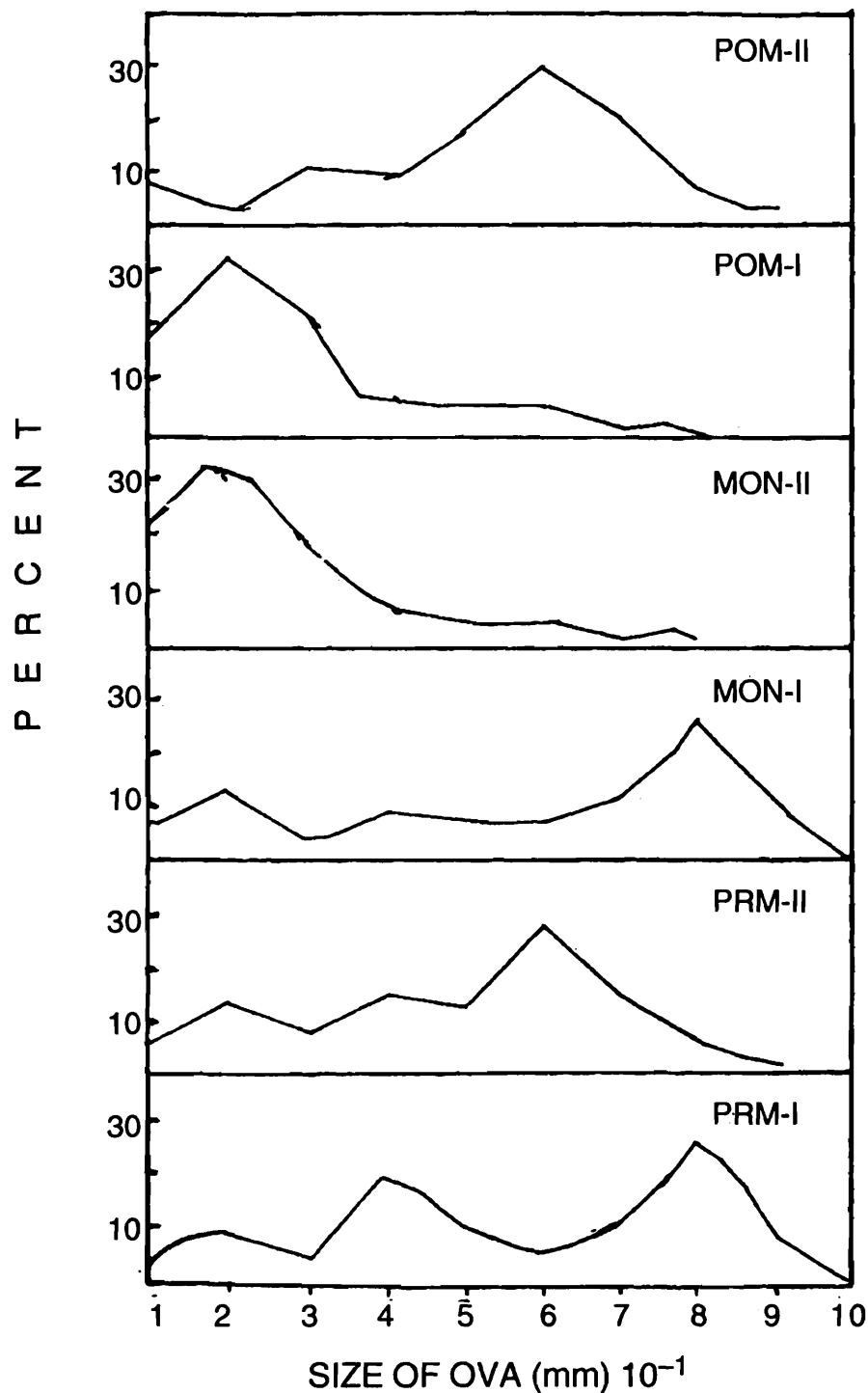


**Fig. 28.** Size frequency distribution of ova in the ovaries of *E. tetradactylum* during different seasons.

### *Lepturacantus savala* (Cuvier)

*lepturacanthus savala* (Cuvier), known earlier as *Trichiurus savala* (Cuvier), is one of the most important fishes of Hugly-Matla estuarine system and alongwith the two other trichurids, *Trichiurus lepturus* (Linnaeus) and *Lepturacanthus pantului* (Gupta), constitute a very good ribbon fishery, specially during post monsoon fishing season. Its contribution was about 2.5% of the total fish catches. This was nearly one third of total ribbon fishery.

The species occurs abundantly in the lower zones of estuarine system and adjoining coastal waters. These fishes are not consumed much in fresh condition and bulk of catches like Bombay duck are sun dried.

Inspite of its abundance in the estuarine system and coastal regions of Bay of Bengal, very few studies have been carried out in the past on its biology. Notable contribution is that of Gupta (1967a & b) who worked out its growth and feeding in the estuarine system. Elsewhere the species has been studied by Venkataraman (1944) and Vijayraghvan (1951) for its food and feeding habits and by Jacob (1946) for its bionomics. The important contribution on the biology of allied species are those of Prabhu (1955), Tampi *et. al.* (1971) and Narsimham (1972 a and b) on *T. lepturus* and of Narsimham (1974) on *Eupleurogrammus muticus*. James (1967) dealt with general trichiurid fishes.

Ribbon fishes contribute significantly to total catches in other parts of the country too. Their average contribution was about 5-17% in the states of Kerala, Karnataka, Goa Maharashtra and Gujrat (West Coasts) during 1984-88.

#### Occurrence and abundance

From Table 1, it can be seen that during the four years period (1987-88, 1988-89, 1989-90 and 1990-91), the period during which the present studies were carried out, it contributed nearly 7.5% of total catches and bulk of the catches (89-94%) was obtained during post monsoon fishing season (Table 2). In terms of weight, its quantity was 35148, 1641, 3998 and 1836 tons during the above cited four years.

Table 4 Shows the rough estimate of the composition of total trichiurids in Sunderban estuarine zone. The mean composition varied between 6.7% in 1990-91 to 8.2% during 1989-90. Not much year to year fluctuation could be recorded. It is also clear that maximum catches came from Zone-1 (45.5%), followed by zone-2 (38.8%). The contribution from Zone 3 was only 17.7%. The seasonwise analysis revealed that 80% of the catches were from post monsoon season and during other seasons their occurrence was very limited.

The random estimation analysis revealed that *L. Savala* nearly contributed 32.5% to 29.5% of total ribbon fishes during various years. Its individual contribution in total fish catches of sunderban was 2.63%, 2.93%, 2.46% and 1.97% during the four years.

### Length-frequency distribution

The standard length frequency polygraph of *L. Savala* for all years combined are shown in Fig. 29a. Six modes were visible at 381 mm, 492 mm, 660 mm, 828 mm, 968 mm and 1004 mm size groups, each representing a year class. In order to establish yearly nature of these modes, seasonal length frequency polygraph for a particular size range (500-600 mm) group was traced (Fig. 29b). It was noticed that during POM-I, the individuals within this size range formed peak at 560 mm size group. This mode was shifted to 600 mm during the following POM-II season. During next two seasons, PRM-I and PRM-II, the modes progressed further and formed peaks at 620 and 660 mm respectively. The size progression continued further to next two seasons, MON-I and MON-II when modes were observed at 680 and 700 mm respectively. This gave a length increment of about

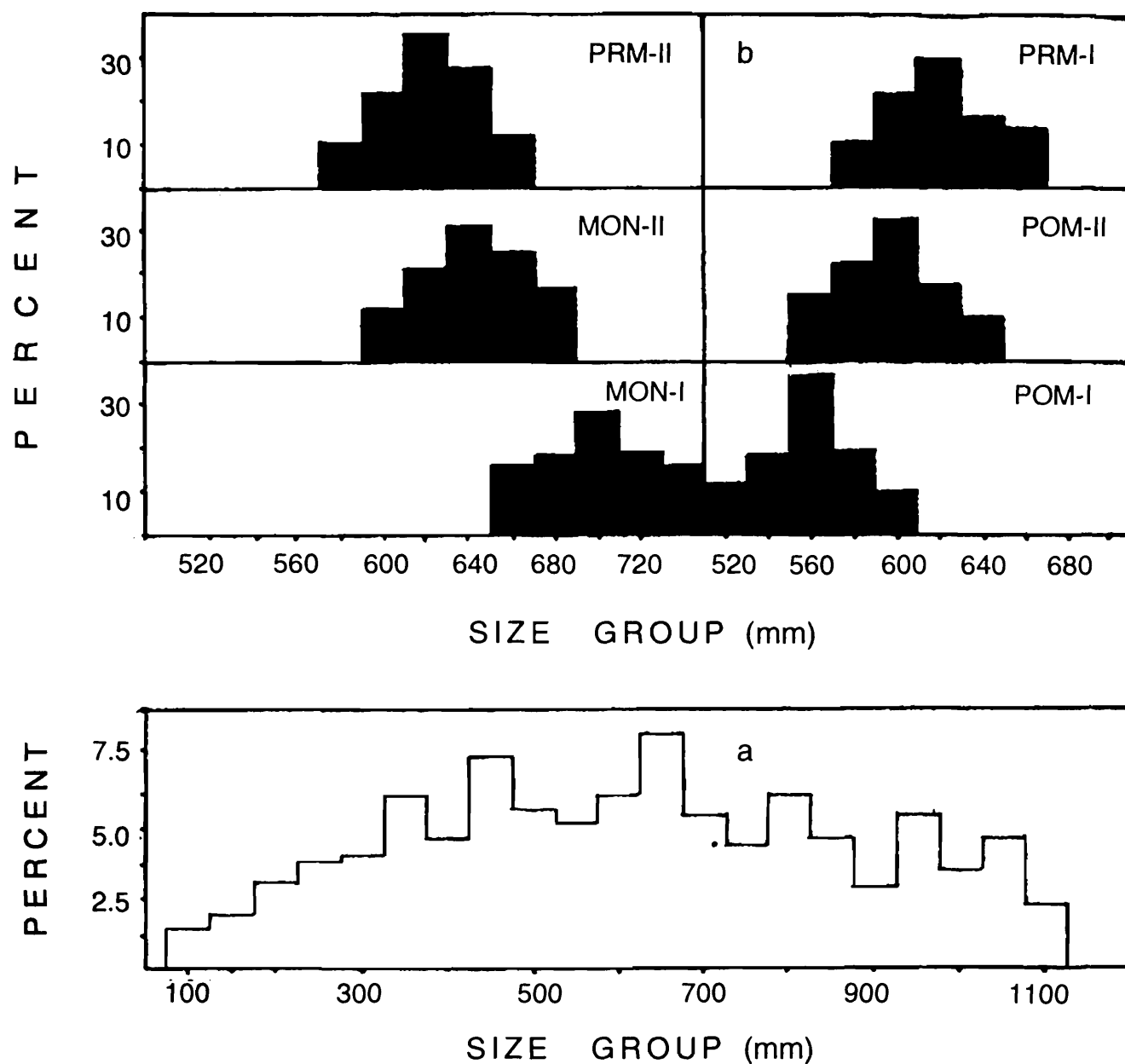


**Fig. 29.** Length frequency distribution of combined *L. savala* at different size groups (a) and seasonal changes (b).

140 mm over a period of one year. This corresponded well to the length increment of corresponding size group in annual frequency graph. It may be noticed from these figures, that the length increment during two subsequent modes of age group II (mean mode length 492 mm) and age group III (mean mode length, 660 mm) was 168 mm. This was very close to mean annual length derived, which was 140 mm.

### Age and growth

The mean growth increments, as derived from LF polygraph were 381 mm, 111 mm, 168 mm, 168 mm and 158 mm during 1st, 2nd, 3rd, 4th and 5th years of life. The growth increment of last mode was not clear because of insufficient sample size.

### Von Bertalanffy growth equation

The values of different parameters of von Bertalanffy growth equation are plotted in Figs. 30 and 31). The resultant equation was

$$L_t = 1230 (1 - e^{-0.1362 (t - 0.0117)})$$

The equation described well the growth rate of the fish.

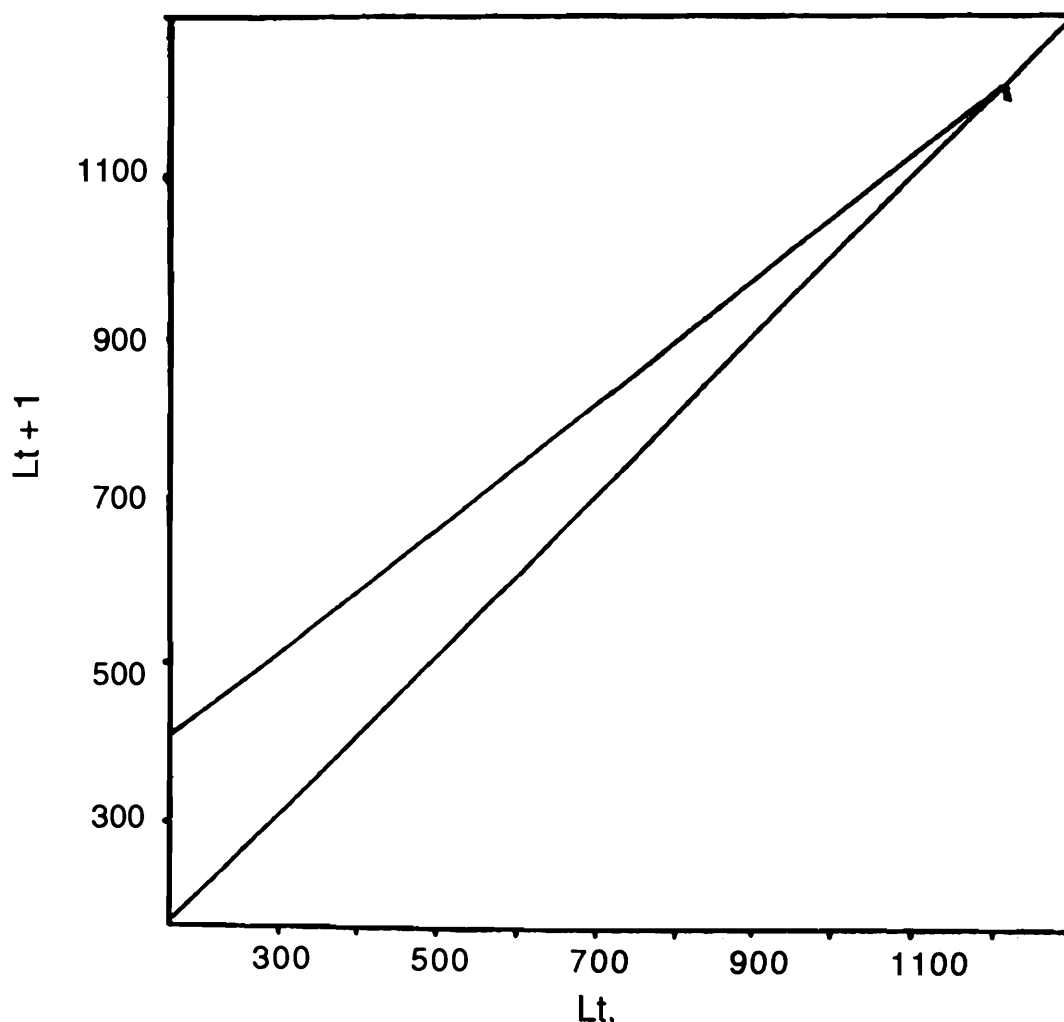


Fig. 30. Plot of  $L_t + 1$  against  $L_t$  (Ford Walford) of *L. savala*

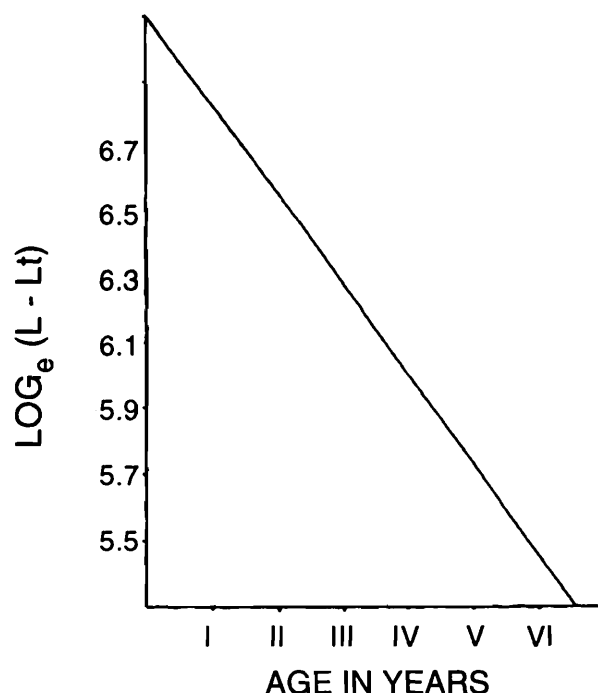


Fig. 31. Plot of Log<sub>e</sub> (L - Lt) against age of *L. savala*

### Length weight relationships

The length weight relationship of males and female did not differ significantly and therefore combined equation was worked out as

$$\text{Log } W = -8.2130 + 3.8012 \text{ Log } L$$

$$W = 7870 \times 10^{-8} L^{3.8012}.$$

The length-weight relationship curve and straight line log values are plotted in Fig. 32.

### Relative Condition factor (Kn)

The Kn values at different size groups fluctuated considerably and 6 modes were clearly visible (Fig. 33a). Seasonal variations in Kn values (Fig. 33b) showed two peaks, one in POM-II and other PRM-II coinciding with two spawning periods.

### Food and feeding habits

The food of adults consisted mainly of prawns (63.1%) which included Sergestids (28.33%), Penaeids (29.3%) and Palaemonids (5.51%). This was followed by fishes (27.1%) which was chiefly constituted by Clupeidae, Harpodontidae, Mugilidae and some other fishes. Semidigested food was about 7.5%. The food of juveniles consisted of prawns (41.4%), fishes (15.76%), other crustaceans (28.83%) and semidigested food (13%). (Fig. 34)

### intensity of feeding

Intensity of feeding of the species was mostly very poor which ranged between 40 to 66% with an average of 56%. The percentage of empty guts alone was considerably high forming at an average 46.6%. The conditions in Juveniles was not much different from adults (Table 10).

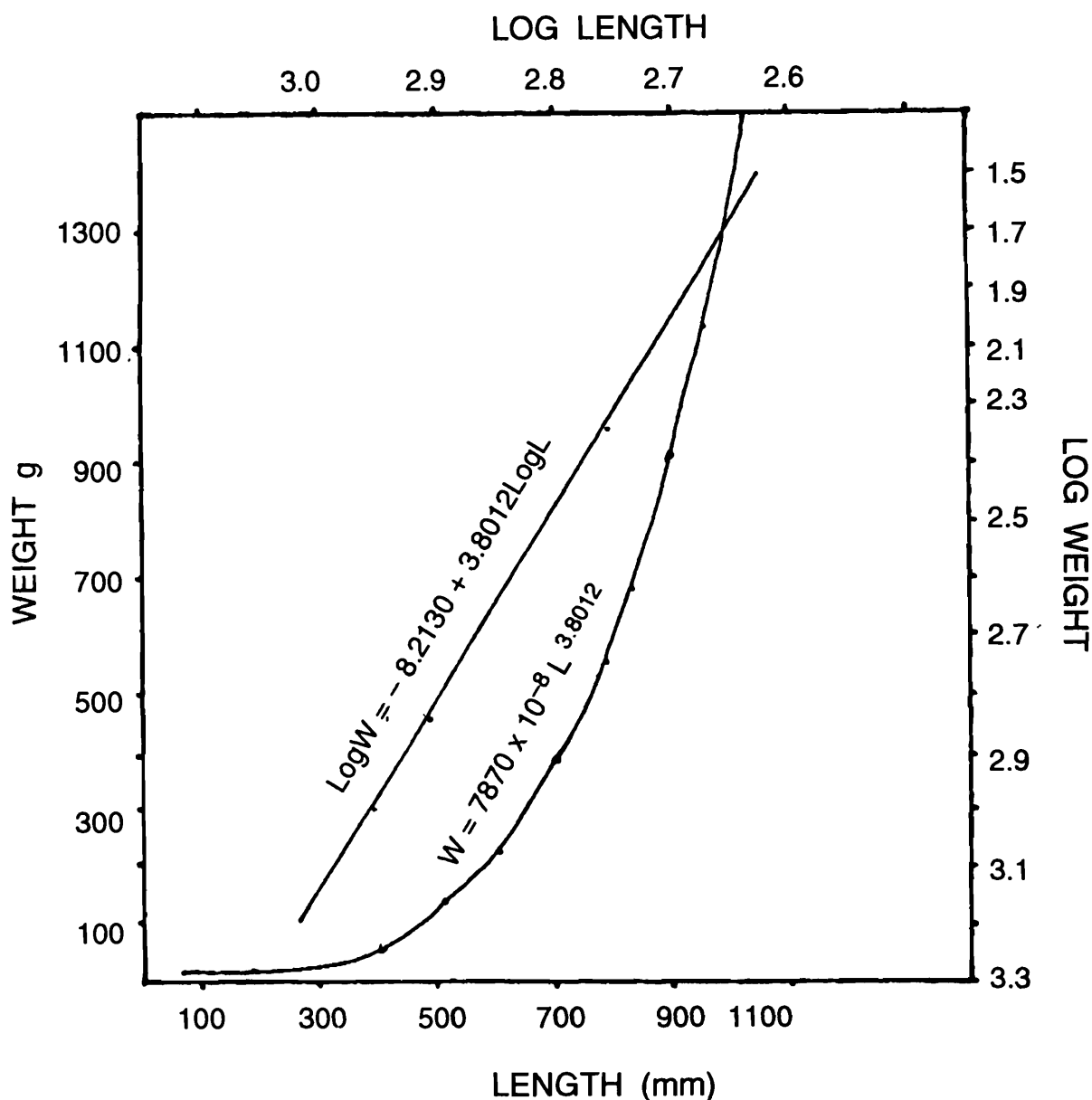


Fig. 32. Length weight relationship of *L. savala*

## Reproduction

### a) Sex ratio

The sex ratio of the species did not differ significantly from 1 : 1 ratio as the values were 1 : 1.107 which indicated a slight preponderance of females over males (Table 11).

### b) Size at Marturity, distribution of maturity stages and spawning season.

Smallest mature female observed was at 360 mm and mean size of fishes at 50% maturity point was worked out to be 560 mm (Fig. 35a). Fig. 35b exhibits the relative occurrence of individuals with different maturity stages during different seasons. It may be seen that highest ratio of stage-IV (ripe) individuals was recorded during POM-II and PRM-II. This depicted the two spawning period the species.

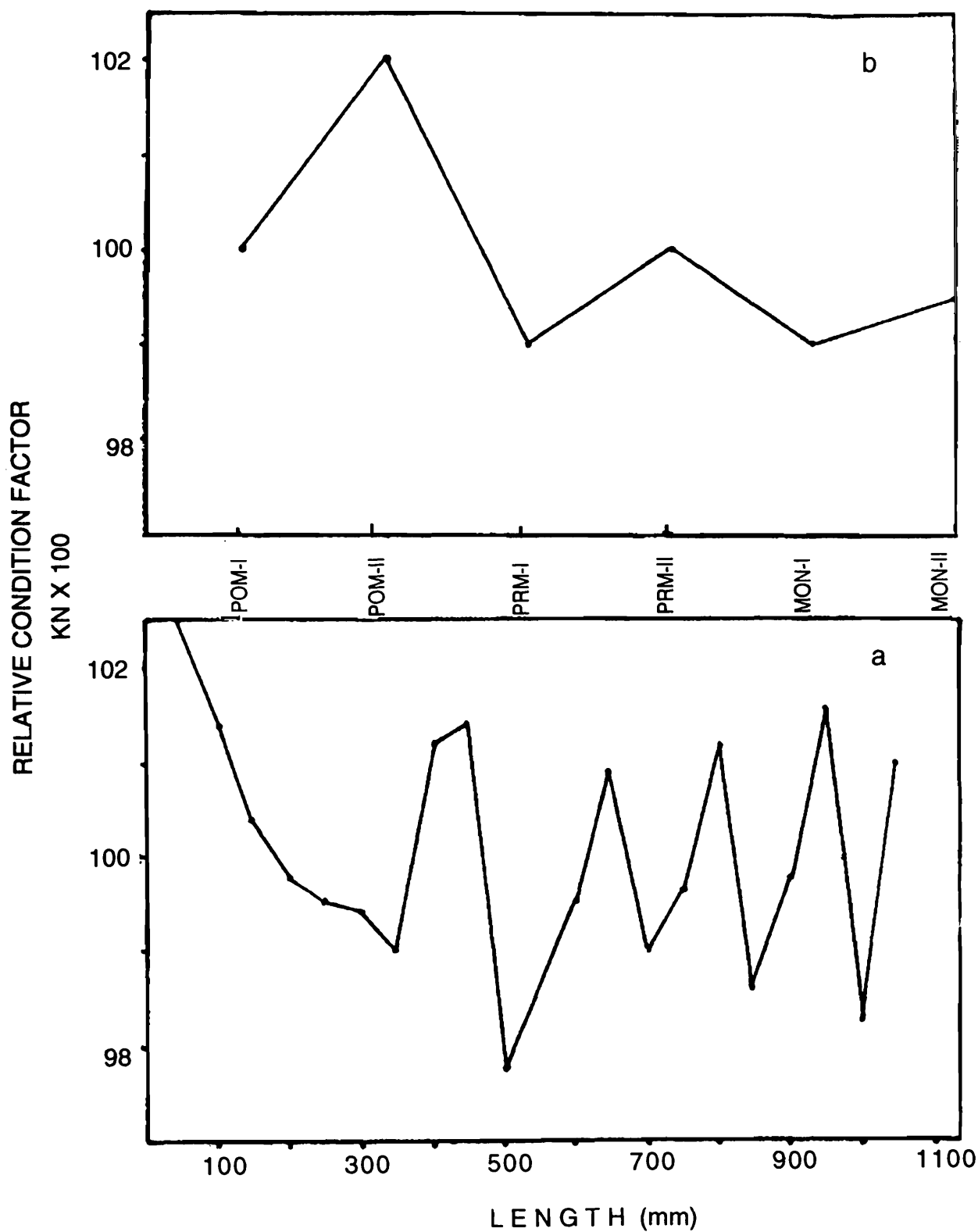


**Fig. 33.** Variations in relative condition factor (Kn) at different sizes (a) and during different seasons (b) of *L. savala*

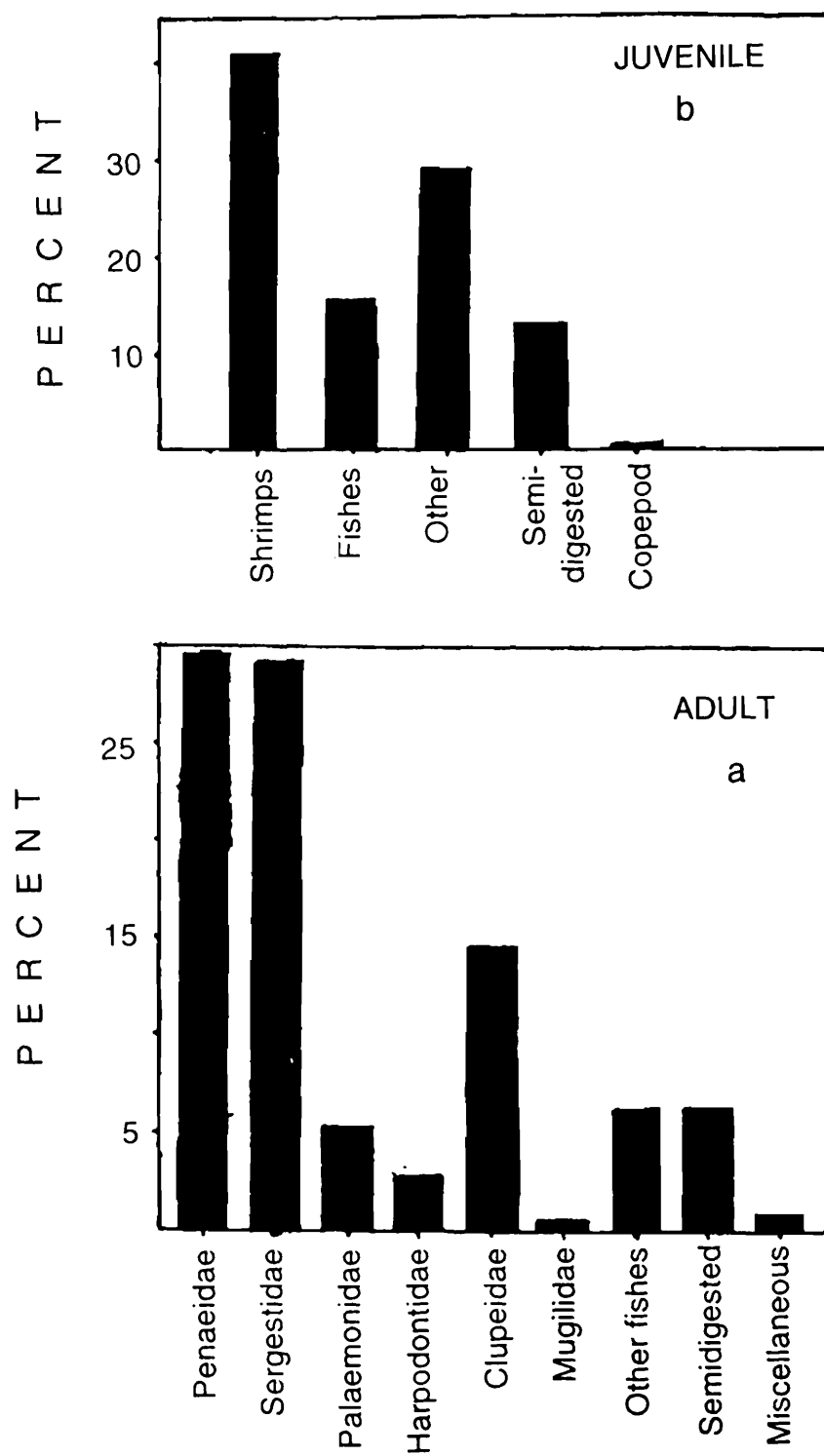


Fig. 34. Relative occurrence of different food items in the guts of adults (a) and juveniles (b) of *L. savala*.

TABLE 10 : Seasonal variations in the intensity of feeding of *L. Savala*

| Seasons | Gorged | Full | 3/4 full | 1/2 full | 1/4 full | Traces | Empty guts | Feeding Condition |          |       |
|---------|--------|------|----------|----------|----------|--------|------------|-------------------|----------|-------|
|         |        |      |          |          |          |        |            | Active            | Moderate | Poor  |
|         |        |      |          | Adults   |          |        |            |                   |          |       |
| POM-I   |        | 2.0  | 6.0      | 16.0     | 16.0     | 12.0   | 48.0       | 8.0               | 32.0     | 60    |
| POM-II  |        | 6.0  | 9.0      | 8.0      | 12.0     | 10.0   | 55.0       | 15.0              | 28.0     | 65    |
| PRM-I   |        | 4.0  | 6.0      | 20.0     | 10.0     | 8.0    | 52.0       | 10.0              | 30.0     | 60    |
| PRM-II  |        |      | 8.0      | 16.0     | 10.0     | 6.0    | 60.0       | 8.0               | 26.0     | 66    |
| MON-I   |        | 9.0  | 16.0     | 15.0     | 12.0     | 13.0   | 35.0       | 25.0              | 27.0     | 48    |
| MON-II  |        | 11.0 | 10.0     | 20.0     | 19.0     | 10.0   | 30.0       | 21.0              | 29.0     | 40    |
| MEAN    |        | 5.33 | 9.16     | 15.83    | 13.16    | 9.83   | 46.66      | 14.50             | 30.33    | 56.55 |

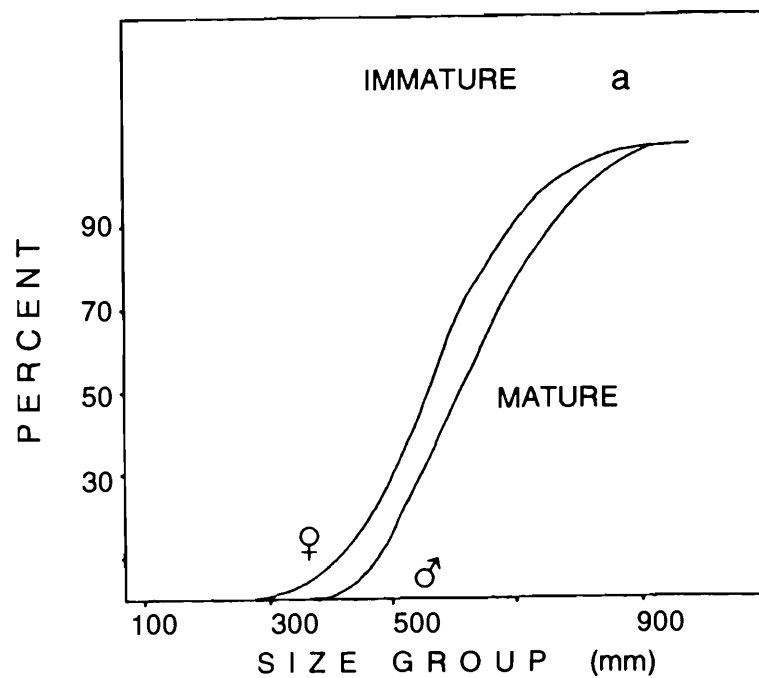


Fig. 35a. Size at maturity of *L. savala*

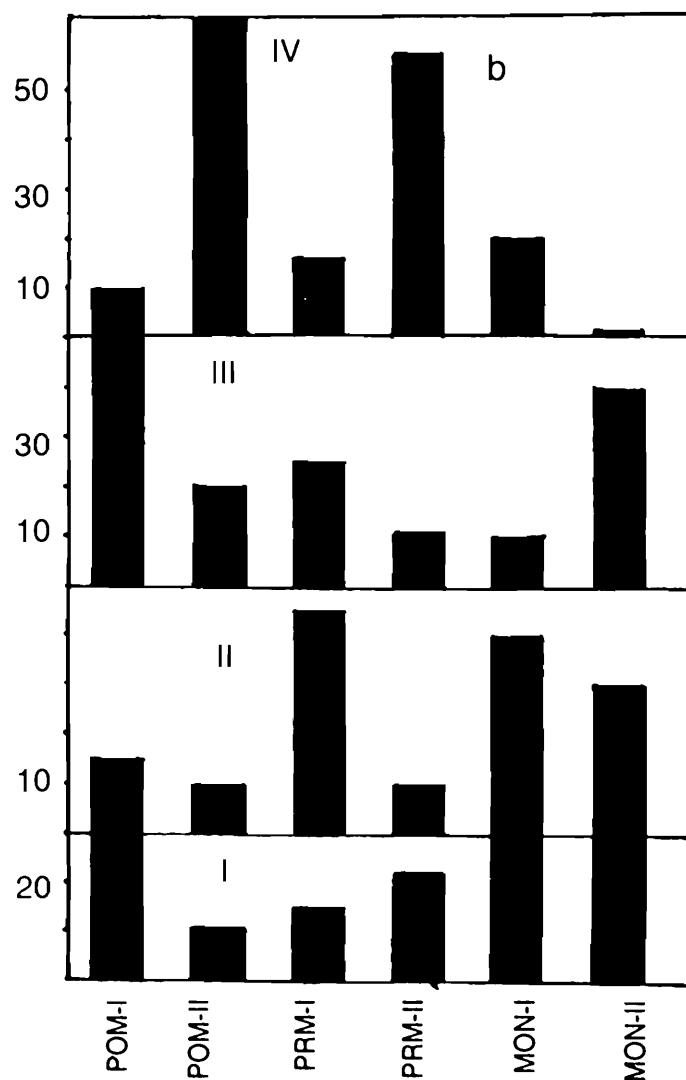
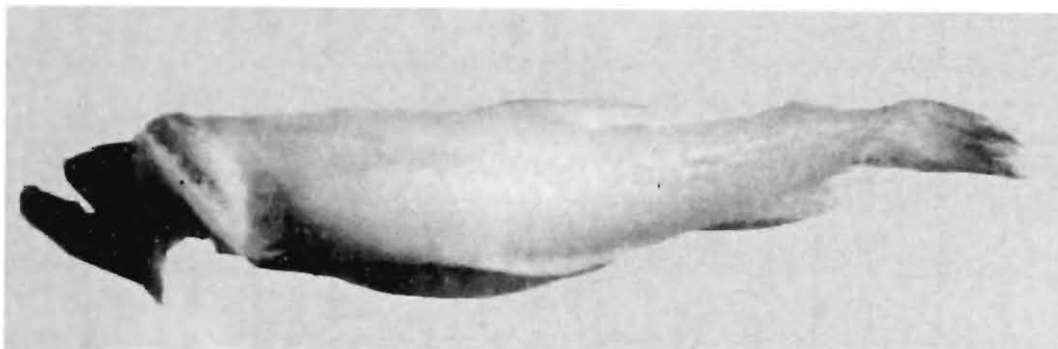
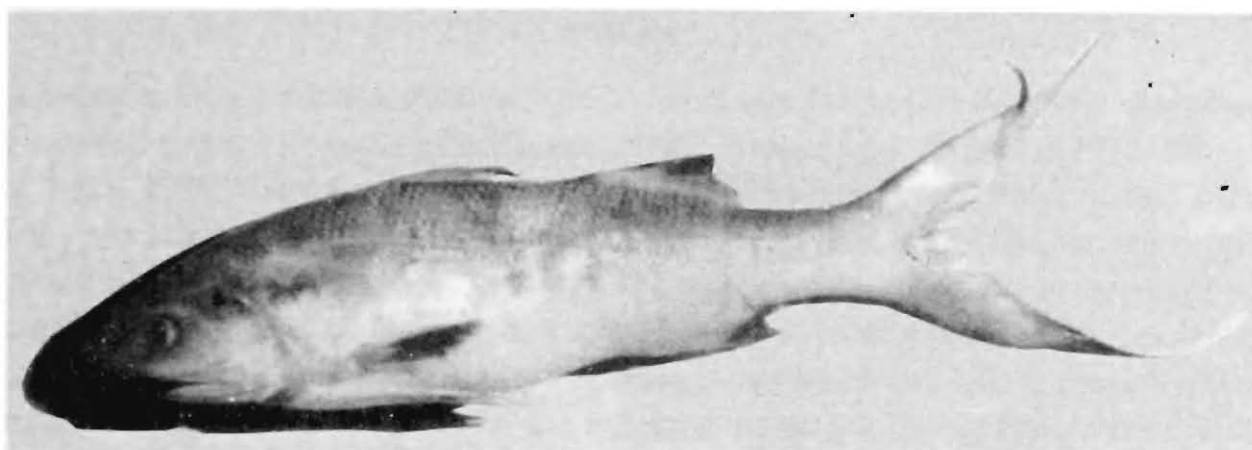


Fig. 35b. Relative occurrence of individuals with different maturity stages during different seasons— *L. savala*

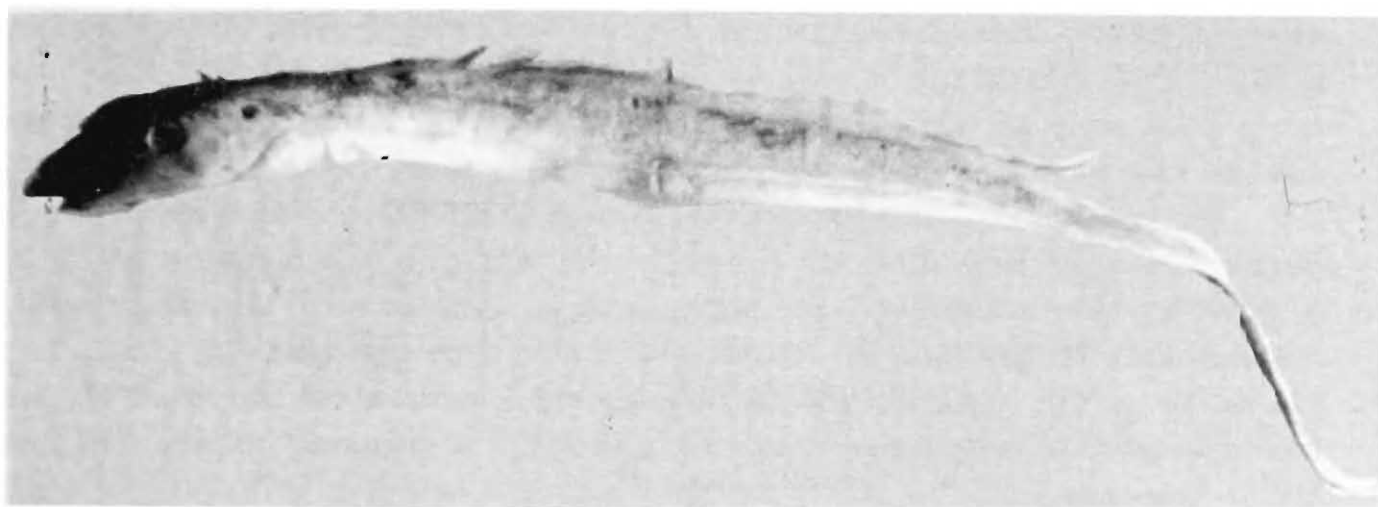
**PLATE-I**



*Harpodon nehereus* (Hamilton-Buchanan)



*Eleutheronema tetradactylum* (Shaw)



*Lepturacanthus savala* (Cuvier)

**TABLE 11 : Sex ratio and CHI square test of *L. Savala***

| Seasons | Total | Male | Female | Male  | Female | Ratio– M : F |
|---------|-------|------|--------|-------|--------|--------------|
| POM-I   | 93    | 42   | 51     | 45.16 | 54.84  | 1 : 2.1      |
| POM-II  | 99    | 45   | 54     | 45.45 | 55.44  | 1 : 1.2      |
| PRM-I   | 35    | 20   | 15     | 57.10 | 42.90  | 1 : 0.75     |
| PRM-II  | 15    | 9    | 6      | 6.00  | 40.00  | 1 : 0.36     |
| MON-I   | 11    | 5    | 6      | 45.40 | 54.60  | 1 : 0.20     |
| MON-II  | 48    | 20   | 28     | 41.6  | 59.40  | 1 : 1.42     |
|         | 300   | 140  | 160    |       |        | 1 : 1.07     |

**Chi-square Test**observed  $\chi^2$  – 052 Not Significant**DISCUSSION**

The fish fauna of Hugly Matla estuarine system in Sunderban region has been described by several earlier workers (Hamilton-Buchanan, 1822; Annandale, 1907 and 1992; Kemp, 1917; Hora, 1933, 1934, 1943; Sewell, 1934 and David, 1954). Jhingran (1982) lists a total of 172 species recorded from the estuary, which includes 73 species of freshwater origin and 99 species of marine/higher salinity origin. Compared to this list, the number of species recorded during present investigations (107) is considerably lesser. This is mainly due to the fact that many of the freshwater species, which can not tolerate even slight increase in the salinity and occur only in the extreme upper zones of Hugly river, have not been taken into consideration. Similarly, Talwar (1991) enlisted a large number of species reported from the estuaries of Ganga (Appendix-1). However, the current occurrence of many of the species in the estuarine system needs to be ascertained through detailed investigations.

It is clear from the foregoing account that fish fauna of Sunderban estuarine system comprised of a large number of species of both marine and freshwater origin, with a dominance of marine element. These fishes visit and stay in the estuaries for a given period of time and then return to their respective places. The period of stay of each species varies considerable and even some may stay permanently. This phenomenon has resulted in the availability of only few year classes in the population of many species, which may not be true representation of all stages of life. This limitation might result in slight variations, specially age and growth estimations, nevertheless, the information available are sufficient for a broad generalisation of their biology. In spite of several variations in biological parameters, the general patterns were similar to those observed by Bapat *et al.* (1952) for *Harpodon nehereus*; Varghese (1973) for *Coilia ramcarati*; Gupta (1967 a & b) for *Lepturacanthus savala* and Patnaik (1970) for *Eleutheronema tetradactylum*.

The fish fauna of the estuarine system has been classified by Pantulu and Bhimachar (1964) into resident and transients or migrants. The resident species is the one, which is represented by some or all the size groups during all the months of the year as occurring in one or other zone of the estuary. The transients are migratory fishes, which enter and remain in the estuary for a short period only. A large number of species have almost made the estuaries their permanent abode and therefore have been classified as resident species. These include *Mugil persia*, *M. tade*, *Polynemus paradiseus*, *Polydactylus indicus*, *Otolithoides biauritus*, *Lates calcarifer*, *Lepturacanthus savala*, *Hilsa toli*, *Arius jella*, *Plotosus canius*, *Harpodon nehereus*, *Setipinna taty*, *Ilisha elongata*, *Setipinna phasa*, *Coilia ramcarati*, *Polynemus paradiseus*, *Pama pama* and *Sillaginopsis panijus*.

Further, the estuaries of Sunderban serve as nurseries for migrant species, providing spawning grounds for many which show anadromus or catadromus types of migrations. These species can be broadly divided into three categories (Jhingran, 1982).

i) Marine forms that migrate upstream and spawn in freshwater areas of the estuary : *Hilsa ilisha*, *Polynemus paradiseus*, *Sillaginopsis panijus* and *Pama pama*.

ii) Freshwater species, which spawn in saline area of the estuary, are : *Pangasius pangasius*.

iii) Marine species that spawn in less saline area of the estuary : *Arius jella*, *Osteogeneiosus militaris* and *Polydactylus indicus*.

The young ones remain in the estuary for a certain period of time before returning to sea. The period varies considerably from species to species. Further, the young ones of many marine species such as some sciaenids, ribbon fishes etc. migrate for feeding into the lower zone of estuary during the winter and summer months and return to the sea, when the salinity of the estuary goes down with the onset of monsoon.

The fisheries of the Sunderban has been reported earlier by several workers (De, 1910; Naidu, 1952; Jhingran and Gopalakrishnan, 1971; Datta *et. al*, 1971). Jhingran (1982) analysed the landings and catch composition between the period 1964-65 to 1975-76. There were wide fluctuations in the annual landings from Sunderban estuaries. During the period 1964-65 and 1972-73 the mean annual landing was 2797.5 ton and during 1973-74 and 1975-76 it was 6315.8 ton only. As compared to these figures, the landing during recent years has increased tremendously. The mean annual landing during the period of present study (1987-88 to 1990-91) was 34280 mt. (Table 12). This shows an increase of nearly six folds from 1975-76. Regarding species composition, the figures quoted by Jhingran (1982) do not include the data for *Hilsa ilisha* separately, though he mentioned the increased availability of the species during latter years. However, six species/groups, namely *Harpodon nehereus*, *Setipinna* spp. *Pama pama*, *Trichiurus* spp. *Hilsa ilisha* and *Otolithoides biauritus* continued to contribute significantly to total catches. Their combined share for the three periods (1964-65 to 1972-73, 1973-74 to 1975-76 and 1987-88 to 1990-91) was

78.22%, 83.11% and 62.64% respectively (Table 12). The enormous increase in the annual landings may be attributed to i) increased availability of certain species like *Hilsa ilisha* and *Pama pama*, ii) improved gears and crafts and iii) increased efforts.

**TABLE 12 : Mean annual landings and percentage composition of important fish species from Sunderban estuarine system during 1964-65 to 1975-76 and 1987-88 to 1990-91.**

| Mean Annual landings*    |                          |                          |                               | Percentage composition   |                          |                          |
|--------------------------|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|--------------------------|
| 1964-65<br>to<br>1972-72 | 1973-74<br>to<br>1975-76 | 1987-88<br>to<br>1990-91 |                               | 1964-65<br>to<br>1972-72 | 1973-74<br>to<br>1975-76 | 1987-88<br>to<br>1990-91 |
| (Jhingran, 1982)         |                          | Present<br>studies       |                               | (Jhingran, 1982)         |                          | Present<br>studies       |
| –                        | –                        | 2679.45                  |                               | –                        | –                        | 7.46                     |
| 1242.2                   | 2579.8                   | 4842.52                  | <i>Hilsa ilisha</i>           | 47.37                    | 44.69                    | 13.94                    |
| 73.                      | 320.1                    | 4547.47                  | <i>Pama pama</i>              | 0.27                     | 5.54                     | 13.3                     |
| 422.1                    | 780.6                    | 6221.4                   | <i>Setipinna</i> spp.         | 16.08                    | 13.52                    | 17.95                    |
| 5.3                      | 23.3                     | 915.9                    | <i>Arius jells</i>            | 0.2                      | 0.4                      | 2.6                      |
| 5.7                      | 9.8                      | 902.77                   | <i>Pumpus</i> spp.            | 0.21                     | 0.17                     | 2.5                      |
| 3.6                      | 21.8                     | 191.4                    | <i>polynennus paradiseus</i>  | 0.13                     | 0.38                     | 0.54                     |
| 1.3                      | 2.3                      | 987.72                   | <i>coilia</i> spp.            | 0.05                     | 0.04                     | 2.96                     |
| 26.9                     | 102.2                    | 674.3                    | <i>Ilisha elongata</i>        | 1.02                     | 1.77                     | 1.98                     |
| 103.8                    | 156.8                    | 322.07                   | <i>Otolithoides biauritus</i> | 3.95                     | 2.71                     | 0.97                     |
| 0.6                      | 3                        | 154.15                   | <i>Polydactylus indicus</i>   | 0.03                     | 0.05                     | 0.46                     |
| –                        | –                        | 115.15                   | <i>Polydactylus indicus</i>   | –                        | –                        | 0.31                     |
| 246.5                    | 806.4                    | 3026.97                  | <i>Trichiurus</i> sp.         | 9.4                      | 13.97                    | 9.02                     |
| 5.3                      | 44.7                     | –                        | <i>O. militaris</i>           | 0.2                      | 0.77                     | –                        |
| 551.6                    | 921.8                    | 8699.42                  | <i>Others</i>                 | 21.03                    | 15.96                    | 25.92                    |
| 2622.2                   | 5772.6                   | 34280.88                 | TOTAL                         |                          |                          |                          |

\* in tons for the data of Jhingram (1982) and in mt for present studies

The results obtained during present investigations, while update the existing knowledge on the status of the fishes of Sunderban may also provide baseline information needed for further studies, both on biodiversity as well as on fisheries.

## SUMMARY

The fish resources of the Sunderban estuarine system were explored based on extensive fieldwork carried out during four consecutive year (1987-88, 1988-89, 1989-90 and 1990-91). The entire Sunderban area was divided into three zones, viz. Zone-1, Hugly estuarine region, Zone-2, Thakuran estuarine region and Zone-3, Matla-Raimangal estuarine region. For seasonal studies, the seasons were divided into premonsoon, PRM (March-June), Monsoon, MON (July-October) and Post Monsoon, POM (November-February). Each season was further divides into an early (I) and a late (II) part.

A total of 106 species belonging to 82 genera and 42 families were recorded. These were represented by both, marine and fresheater elements, with predominance of the former. These fishes visit and stay in the estuaries for a given period of time and then return to their respective places. The period of stay of each species varies considerably and even some may stay permanently. The estuarine fishes have been classified into three categories viz. i. Marine species that migrate upstream and spawn in freshwater areas of estuary, ii) Freshwater species which spawn in saline areas of the estuary and iii) Marine species that spawn in less saline areas of the estuary. Several species such as *Mugil persia*, *M. tade*, *Polynemus paradiseus*, *Polydactylus indicus*, *Otolithoides biauritus*, *Lates calcarifer*, *Lepturacanthus savala*, *Hilsa toli*, *Arius jella*, *Plotosus canius*, *Harpodon nehereus*, *Setipinna taty*, *S. phasa*, *Ilisha ellongata*, *Coilia ramcarati*, *Pama pama* and *Sillaginopsis panujus* pass almost their entire life in the estuarine system and are termed as resident species.

Out of these, only few species are numerically abundant and formed the bulk of the fishery. These were *Hilsa ilisha*, *Harpodon nehereus*, *Pama pama*, *Trichiurus* sp. *Setipinna* spp., *Arius jella*, *pumpus* spp. *polynemus paradiseus*, *coilia* spp. *Ilisha elongata*, *Otolithoides biauritus*, *Polydactylus indicus* and *Chirocenrtus dorab*. Six species/groups viz. *Harpodon nehereus*, *Setipinna* spp. *Pama pama*, *Trichiurus* spp. *Hilsa ilisha* and *Otolithoides biaruritus* constituted the bulk (nearly 62.6%) of fishery of the estuarine region. The total fish landing from the region increased several folds during recent years which was related to i) increased availability of some important species like, *Hilsa ilisha*, and *Pama pama*, ii) improved gears and crafts and iii) increased efforts.

Various aspects of the biology like length frequency distribution, age and growth, length-weight relationship, relative condition factor, food and feeding habits, sex ratio, size at maturity, development of ova, maturation and spawning etc of four important species viz. Bombay duck, *Harpodon nehereus* (Hamilton-Buchanan), Rat-tailed anchovy, *Coilia ramcarati* (Hamiton Buchanan), Threadfin, *Eleutheronema tetradactylum* (Shaw) and Ribbon fish, *Lepturacanthus savala* (Cuvier) were also studied.

*Harpodon nehereus*, which was one of the few most abundant species occurring in all zones throughout the year, constituted approximately 27% of the total fish landing in random samples. Its highest abundance was recorded from Zone-1 and lowest from Zone-3. Highest availability was in post monsoon. The fish is not much in demand and is

mostly sun dried. The polymodal length frequency curve revealed three clear modes with a vague fourth one. The mean length at different modes were 70.0 mm, 150.0 mm and 250.0 mm for 1st, 2nd and 3rd modes respectively. These modes represented year classes as evident from the progression of modes during different seasons. Growth rate calculated on the basis of length frequency analysis was 100.0 mm, 70.0 mm and 80.0 mm respectively for 1st, 2nd and 3rd years. The length weight relationship equation for the two sexes combined was  $W = 3902 \times 10^{-5} L^{3.0259}$ . Two peaks in relative condition factor (Kn), first major one during POM-I and second minor one during PRM-I were recorded. The food comprised mainly of sergestid, penaeid and paleomonid shrimps followed by fishes (clupeids, polynemids) and also of its own kind. There were significant differences, both in the dietary composition and intensity of feeding of adults and juveniles. The size at first maturity (50% maturity point) was estimated to be around 250.0 mm group. Sex ratio differed significantly with the preponderance of females. The females with ripe ovaries occurred almost throughout the year except for a brief period of PRM-II, with two peak periods, during POM-II and MON-II.

*Coilia ramcarati*, an endemic anchovy of Sunderban estuaries, also constituted an important fishery with a gross composition of 3.4% in random samples. They were comparatively abundant in Zone-1. Five modes were distinctly visible in length frequency graph at 70-80 mm, 120-125 mm, 155-160 mm, 185-190 mm and 200-210 mm size groups, which represented 5 year classes as evident from the progressive shifting of modes during different seasons. The growth rate calculated was 73.7 mm, 50.0 mm, 35.0 mm, 26.7 mm and 18.0 mm during 1st, 2nd, 3rd, 4th and 5th years of life. The length weight relationship of the adults of the two sexes combined was  $W = 4788 \times 10^{-5} L^{3.0095}$ . Seasonal Kn curve revealed a major peak in MON-II and a minor during PRM-I. Food of the species chiefly comprised of copepods, small shrimps, other crustacean and polychaetes. The food composition and intensity of feeding differed considerably between adults and juveniles. Active feeding was recorded in only 16% cases in adults while it was 33% in juveniles. Sex ratio did not differ significantly. The size at first maturity was estimated to be around 230 mm size group. State IV ripe individuals were available during PRM-I and MON-II, exhibiting two clearly separated spawning period.

The polynemid threadfin, *Eleutheronema tetradactylum* was another commercially important species, which commands a very high market price. The species occurred during all seasons in all zones. Its approximate share in random samples was nearly 1%. Post larvae and fry were available during major part of the year, with two peaks of abundance, one in POM-I and other during MON-I, which was probably due to two spawning seasons of almost equal intensity. Two clear modes in each year class were visible. The approximate calculated lengths at different ages were 250.0 mm, 400.0 mm, 525.0 mm and 575.0-600.0 mm for 1st, 2nd, 3rd and 4th year classes respectively. The annual growth increments calculated were 250.0 mm, 150.0 mm, 125.0 mm and 75.0 mm during 1st, 2nd, 3rd and 4th years of life. The combined length-weight relationship equation

was  $W = 3040 \times 10^{-5} L^{3.0180}$ . The relative condition factor closely followed maturation of gonads and spawning. The food of adults mainly comprised of shrimps (42%) followed by fishes (clupeids, *Harpodon nehereus* and sciaenids), with a share of 29%. In juvenile's diet, fish did not play any significant role and the bulk was comprised of crustaceans. The ratio of actively fed individuals was 21.0% in adults and 33.0% in juveniles. No significant differences in the sex ratio were observed. The size at first maturity was worked out to be 380.0 mm. Individuals with ripe ovaries were recorded in abundance during POM-I and MON-I, which represented the spawning season.

The ribbon fish *Lepturacanthus savala* is another very important fish of the Sunderban estuaries and along with two other trichurids, it constitutes very good fishery, particularly during post monsoon fishing season. It occurs in lower zone of the estuarine system and adjoining coastal waters. The fish is not much in demand and is mostly sun dried. Its approximate contribution in random samples was nearly 2.5%. Six modes were visible in length frequency graph at 381.0 mm, 492.0 mm, 660.0 mm, 829.0 mm, 968.0 mm and 1004.0 mm size groups. These represented year classes as assessed by seasonal progression of modes. The mean growth increments derived from LF polygraph were 381.0 mm, 111.0 mm, 168.0 mm, 168.0 mm and 158.0 mm during 1st, 2nd, 3rd, 4th and 5th years of life. The length weight relationship equation for the two sexes combined was  $W = 7870 \times 10^{-8} L^{3.8012}$ . Two peaks in Kn values, one in POM-II and other in PRM-II were observed. The food of adults was mainly consisted of shrimps (63.1%), followed by fishes (27.1%), which included clupeids, mullets and some other species. The intensity of feeding was mostly poor. The sex ratio did not differ significantly. The size at first maturity was worked out to be 560.0 mm. Highest ratio of stage IV ripe individuals was recorded during POM-II and PRM-II, which depicted two spawning season.

The results obtained, while update the existing knowledge on the status of the fishes of Sunderban, my also provide baseline information needed for further studies, both on biodiversity as well as on fisheries.

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## APPENDIX-I

### List of fishes recorded from Sunderban Estuarine System

(After Talwar, 1991; Talwar *et al.*, 1992)

*Species marked with asterix (\*) are discovered from this estuarine system*

- |        |                  |
|--------|------------------|
| Class  | CHONDRICHTHYES   |
| Order  | ORECTOLOBIFORMES |
| Family | HEMISCYLLIDAE    |
- Chiloscyllium griseum* Muller and Henle
- |        |                 |
|--------|-----------------|
| Family | STEGOSTOMATIDAE |
|--------|-----------------|
- Stegostoma fasciatum* (Hermann)
- |        |                   |
|--------|-------------------|
| Order  | CARCHARHINIFORMES |
| Family | CARCHARHINIDAE    |
- Carcharhinus hemiodon* (Valenciennes)  
*C. melanopterus* (Quoy & Gaimard)  
*C. limbatus* (Valenciennes)  
*C. sorrah* (Valenciennes)  
*C. leucas* (Valenciennes)
- \* *Glyphis gangeticus* (Muller & Henle)  
*Rhizoprionodon acutus* (Ruppell)
- \* *Scoliodon laticaudus* Muller & Henle  
*Lamiopsis temmincki* (Muller & Henle)
- |        |            |
|--------|------------|
| Family | SPHYRNIDAE |
|--------|------------|
- Eusphyra blochii* (Cuvier)
- |        |            |
|--------|------------|
| Order  | RAJIFORMES |
| Family | PRISTIDAE  |
- Anoxypristis cuspidatus* (Latham)  
*Pristis microdon* Latham  
*P. pectinata* Latham
- |        |              |
|--------|--------------|
| Family | RHINOBATIDAE |
|--------|--------------|
- Rhina ancylostoma* Schneider  
*Rhinobatos granulatus* Cuvier  
*R. obtusus* Muller & Henle
- \* *R. annandalei* Norman  
\* *R. lionotus* Norman  
*R. typus* Bennett  
*Rhynchobatus djiddensis* (Forsskal)
- |        |            |
|--------|------------|
| Family | DASYATIDAE |
|--------|------------|
- \* *Dasyatis zugei* (Muller & Henle)

\* *Himantura fluviatilis* (Hamilton-Buchanan)

\* *H. marginata* (Blyth)

*H. imbricata* (Schneider)

\* *H. bleekeri* (Blyth)

*H. uarnak* (Forsskal)

Class OSTEICHTHYES

Order ELOPIFORMES

Family ELOPIDAE

*Elops machnata* (Forsskal)

Family MEGALOPIDAE

\* *Megalops cyprinoides* (Broussonet)

Order ANGUILLIFORMES

Family ANGUILLIDAE

\* *Anguilla bengalensis* (Gray)

Family MORINGUIDAE

\* *Moringua raitaborua* (Hamilton-Buchanan)

\* *M. arundinacea* (McClelland)

Family MURAENIDAE

\* *Lycodontis tile* (Hamilton-Buchanan)

\* *L. sathete* (Hamilton-Buchanan)

Family MURAENSOCIDAE

*Congresox talabon* (Cuvier)

*C. talabonoides* (Bleeker)

*Muraenesox bagio* (Hamilton-Buchanan)

\* *M. cinereus* (Forsskal)

Family OPHICHTHIDAE

\* *Pisodonophis boro* (Hamilton-Buchanan)

Order CLUPEIFORMES

Family CLUPEIDAE

Subfamily CLUPEINAE

*Escualosa thoracata* (Valenciennes)

Subfamily ALOSINAE

\* *Ilisa (Tenuilosa) ilisha* (Hamilton-Buchanan)

*Hilsa toli* (Valenciennes)

Subfamily PELLONULINAE

\* *Corica soborna* Hamilton-Buchanan

Subfamily DOROSOMATINAE

\* *Anodontostoma chacunda* (Hamilton-Buchanan)

*A. thailandiae* Wongratana

*Nematalosa nanus* (Bloch)

Family PRISTIGASTERIDAE

*Ilisha megaloptera* (Swainson)

*I. melastoma* (Schneider)

*Opisthopecterus tardoore* (Cuvier)

*Pellona ditchela* Valenciennes

*Raconda russeliana* Gray

Family ENGRAULIDIDAE

*Coilia dussumieri* Valenciennes

\* *C. ramcarati* (Hamilton-Buchanan)

\* *C. reynaldi* Valenciennes

*C. neglecta* Whitehead

\* *Setipinna phasa* (Hamilton-Buchanan)

\* *S. brevifilis* (Valenciennes)

*S. taty* (Valenciennes)

*S. tenuifilis* Valenciennes

*Thryssa dussumieri* (Valenciennes)

*T. hamiltonnii* (Gray)

\* *T. purava* (Hamilton-Buchanan)

*T. stenosoma* Wongratana

Order GONORHYNCHIFORMES

Family CHANIDAE

*Chanos chanos* (Forsskal)

Order SILURIFORMES

Family BAGRIDAE

\* *Mystus bleekeri* (Day)

\* *M. gulio* (Hamilton-Buchanan)

*M. vittatus* (Bloch)

Family PANGASIIDAE

\* *Pangasius pangasius* (Hamilton-Buchanan)

Family ARIIDAE

\* *Arius arius* (Hamilton-Buchanan)

\* *A. gagora* (Hamilton-Buchanan)

\* *A. sagor* (Hamilton-Buchanan)

\* *A. sona* (Hamilton-Buchanan)

\* *A. caelatus* Valenciennes

*Arius platystomus* Day

*Batrachocephalus mino* (Hamilton-Buchanan)

*Osteogeneiosus militaris* (Linnaeus)

Family PLOTOSIDAE

*Plotosus canius* Hamilton-Buchanan

*Plotosus lineatus* (Thunberg)

Order AULOPIFORMES

Family HARPADONTIDAE

\* *Harpadon nehereus* (Hamilton-Buchanan)

Order BATRACHOIDIFORMES

Family BATRACHOIDIDAE

\* *Batrachthys grunns* (Linnaeus)

Order CYPRINODONTIFORMES

Suborder EXOCOETOIDEI

Family HEMIRAMPHIDAE

*Hyporhamphus limbatus* (Valenciennes)

*Zenarchopterus buffonis* (Valenciennes)

\* *Z. ectuntio* (Hamilton-Buchanan)

\* *Z. striga* (Blyth)

*Rhynchorhamphus georgii* (Valenciennes)

Family BELONIDAE

\* *Xenentodon cancila* (Hamilton-Buchanan)

\* *Strongylura strongylura* (van Hasselt)

*S. leiura* (Bleeker)

Suborder ADRIANICHTHYOIDEI

Family ORYZIIDAE

*Oryzias melastigma* (McClelland)

Suborder CYPRINODONTOIDEI

Family APLOCHEILIDAE

\* *Aplocheilus panchax* (Hamilton-Buchanan)

Order SYNGNATHIFORMES

Family SYNGNATHIDAE

\* *Ichthyocampus carce* (Hamilton-Buchanan)

*Hippichthys specifer* (Ruppell)

\* *Microphis cuncalus* (Hamilton-Buchanan)

Order SYNBRANCHOIDEI

Family SYNBRANCHIDAE

*Ophisternon bengalense* McClelland

*Monopterusuchia* (Hamilton-Buchanan)

- |                                                    |          |                 |
|----------------------------------------------------|----------|-----------------|
|                                                    | Order    | SCORPAENIFORMES |
|                                                    | Family   | SYNANCEIIDAE    |
| <i>Minous coccineus</i> (Alcock)                   |          |                 |
|                                                    | Family   | PLATYCEPHALIDAE |
| * <i>Platycephalus indicus</i> (Linnaeus)          |          |                 |
| * <i>Grammoplites scaber</i> (Linnaeus)            |          |                 |
|                                                    | Order    | PERCIFORMES     |
|                                                    | Suborder | PERCOIDEI       |
|                                                    | Family   | CENTROPOMIDAE   |
| * <i>Lates calcarifer</i> (Bloch)                  |          |                 |
|                                                    | Family   | AMBASSIDAE      |
| <i>Chanda nama</i> Hamilton-Buchanan               |          |                 |
| * <i>Ambassis nalu</i> (Hamilton-Buchanan)         |          |                 |
|                                                    | Family   | SERRANIDAE      |
| * <i>Epinephelus malabaricus</i> (Schneider)       |          |                 |
|                                                    | Family   | TERAPONIDAE     |
| <i>Terapon jarbua</i> (Forsskal)                   |          |                 |
| <i>T. theraps</i> (Cuvier)                         |          |                 |
| * <i>T. puta</i> (Cuvier)                          |          |                 |
|                                                    | Family   | SILLAGINIDAE    |
| * <i>Sillaginopsis panijus</i> (Hamilton-Buchanan) |          |                 |
| <i>Sillago sihama</i> (Forsskal)                   |          |                 |
|                                                    | Family   | CARANGIDAE      |
| <i>Caranx carangus</i> (Bloch)                     |          |                 |
|                                                    | Family   | LEIOGNATHIDAE   |
| <i>Leiognathus equulus</i> (Forsskal)              |          |                 |
| <i>L. blochii</i> (Valenciennes)                   |          |                 |
| * <i>Secutor ruconius</i> (Hamilton-Buchanan)      |          |                 |
| <i>Gazza minuta</i> (Bloch)                        |          |                 |
|                                                    | Family   | LUTJANIDAE      |
| * <i>Lutjanus johni</i> (Bloch)                    |          |                 |
|                                                    | Family   | LOBOTIDAE       |
| * <i>Datnioides quadrifasciatus</i> (Sevastianov)  |          |                 |
|                                                    | Family   | GERREIDAE       |
| * <i>Gerreomorpha setifer</i> (Hamilton-Buchanan)  |          |                 |
|                                                    | Family   | HAEMULIDAE      |
| * <i>Pomadasys argenteus</i> (Forsskal)            |          |                 |
|                                                    | Family   | SPARIDAE        |
| * <i>Acanthopagrus latus</i> (Houttuyn)            |          |                 |

## Family SCIAENIDAE

- \* *Pama pama* (Hamilton-Buchanan)
- \* *Daysciaena albida* (Cuvier)
- \* *Macrospinosa cuja* (Hamilton-Buchanan)
- \* *Johnieops sina* (Cuvier)
- Panna microdon* (Bleeker)
- Johnius carutta* (Bloch)
- J. belangerii* (Cuvier)
- \* *J. coitor* (Hamilton-Buchanan)
- Protonibea diacanthus* (Lacepede)
- \* *Pterolithus maculatus* (Kuhl & van Hasselt)
- Otolithoides biaurtius* (Cantor)
- \* *Bahaba chaptis* (Hamilton-Buchanan)

## Family TOXOTIDAE

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

## Family SCATOPHAGIDAE

- \* *Scatophagus argus* (Bloch)

## Suborder MUGILOIDEI

## Family MUGILIDAE

*Mugil cephalus* Linnaeus

- \* *Rhinomugil corsula* (Hamilton-Buchanan)
- Liza melinoptera* (Valenciennes)
- \* *L. parsia* (Hamilton-Buchanan)
- \* *L. subviridis* (Valenciennes)
- \* *L. tade* (Forsskal)
- Valamugil cunnesius* (Valenciennes)
- V. speigleri* (Bleeker)

## Suborder POLYNEMOIDEI

## Family POLYNEMIDAE

- \* *Eleutheronema tetradactylum* (Shaw)
- \* *Polynemus paradiseus* Linnaeus
- Polydactylus indicus* (Shaw)
- P. plebeius* (Broussonet)
- P. sextarius* (Bloch)

## Suborder CALLIONYMOIDEI

## Family CALLIONYMIDAE

- \* *Callionymus fluviatilis* Day
- C. sagitta* (Pallas)
- C. recurvispinis* (Linnaeus)

## Suborder GOBIOIDEI

## Family GOBIIDAE

- \* *Glossogobius giuris* (Hamilton-Buchanan)
- \* *Apocryptes bato* (Hamilton-Buchanan)
- \* *Pseudapocryptes lanceolatus* (Bloch and Schneider)
- \* *Boleophthalmus boddarti* (Pallas)
- B. dussunieri* Valenciennes
- Periophthalmus koelreuteri* (Pallas)
- P. pearsei* Eggert
- P. weberi* Eggert
- Acentrogobius globiceps* (Hora)
- Acentrogobius viridipunctatus* (Valenciennes)
- Apocryptodon madurensis* (Bleeker)
- Awaouchthys menoni* Chatterjee
- \* *Awaous gutum* (Hamilton-Buchanan)
- Bathygobius fuscus* (Ruppell)
- \* *Brachygobius nuntius* (Hamilton-Buchanan)
- Cryptocentrus gymnocephalus* (Bleeker)
- Glossogobius biocellatus* (Valenciennes)
- Gobiopsis macrostoma* Steindachner
- \* *Gobiopterus chuano* (Hamilton-Buchanan)
- Oligolepis acutipennis* (Valenciennes)
- Oxuderces dentatus* Eydoux & Souleyet
- Parachaeturichthys polynema* (Bleeker)
- Parapocryptes rictuosus* (Valenciennes)
- \* *Periophthalmodon schlosseri* (Pallas)
- \* *Periophthalmodon tredeceniradiatus* (Hamilton-Buchanan)
- \* *Scartelaos histophorus* (Valenciennes)
- Stigmatogobius hoevenni* (Bleeker)
- \* *S. sadanundia* (Hamilton-Buchanan)

## Family ELEOTRIDIDAE

- \* *Butis butis* (Hamilton-Buchanan)
- B. melanostigma* (Bleeker)
- \* *Eleotris fusca* (Schneider)
- E. lutea* Day
- Ophiocara porocephala* (Valenciennes)
- \* *Odonteleotris macrodon* (Bleeker)
- E. melanosoma* Bleeker
- Ophieleotris aporos* (Bleeker)

## Family GOBIOIDIDAE

*Brachyamblyopus urolepis* (Bleeker)\* *Odontamblyopus rubicundus* (Hamilton-Buchanan)*Pseudotrypauchen multiradiatus* Hardenberg*Taenioides anguillaris* (Linnaeus)\* *Taenioides buchanani* (Day)\* *Taenioides cirratus* (Blyth)

## Family TRYPAUCHENIDAE

\* *Amblyotrypauchen arctocephalus* (Alcock)*Ctenotrypauchen microcephalus* (Bleeker)\* *Trypauchen vagina* (Bloch & Schneider)*Trypauchenichthys sumatrensis* Hardenberg

## Suborder SCOMBROIDEI

## Family TRICHIURIDAE

\* *Lepturacanthus pantului* (Gupta)*Trichiurus gangeticus* Gupta

## Suborder MASTACEMBELIDEI

## Family MASTACEMBELIDAE

*Macrognaathus aral* (Bloch)*M. pancalus* Hamilton-Buchanan*Mastacembelus armatus* (Lacepede)

## Order PLEURONECTIFORMES

## Family BOTHIDAE

\* *Pseudorhombus arsius* (Hamilton-Buchanan)\* *P. javanicus* (Bleeker)

## Family CYNOGLOSSIDAE

*Cynoglossus lingua* Hamilton-Buchanan\* *C. cynoglossus* Hamilton-Buchanan\* *C. puncticeps* (Richardson)*C. macrostomus* Norman

## Family SOLEIDAE

*Euryglossa pan* (Hamilton-Buchanan)

## Order TETRAODONTIFORMES

## Family TETRAODONTIDAE

\* *Chelonodon fluviatilis* (Hamilton-Buchanan)\* *Chelonodon patoca* (Hamilton-Buchanan)\* *Lagocephalus lunaris* (Bloch & Schneider)\* *Takifugu oblongus* (Bloch)\* *Tetraodon cutcuta* Hamilton-Buchanan