

MANGROVE ECOSYSTEMS

**A MANUAL FOR THE ASSESSMENT
OF BIODIVERSITY**

**A follow up of the
National Agricultural Technology Project
(NATP.), ICAR.**

*Mangrove Ecosystem Biodiversity :
Its Influence on the Natural Recruitment of
Selected Commercially Important Finfish and Shellfish
Species in Fisheries*

Edited by :
Dr. George J. Parayannilam



Central Marine Fisheries Research Institute
(Indian Council of Agricultural Research)
P.B. No. 1603, Ernakulam North P.O; Cochin – 682 018, Kerala, India







MANGROVE ECOSYSTEMS

A MANUAL FOR THE ASSESSMENT OF BIODIVERSITY

A follow up of the
**National Agricultural Technology Project
(NATP.), ICAR.**

*Mangrove Ecosystem Biodiversity :
Its Influence on the Natural Recruitment of
Selected Commercially Important Finfish and Shellfish
Species in Fisheries*

Edited by :

Dr. George J. Parayannilam

Principal Scientist



भाऊ अनुप
ICAR



Central Marine Fisheries Research Institute
(Indian Council of Agricultural Research)
P.B. No. 1603, Ernakulam North P.O; Cochin – 682 018, Kerala, India



MANGROVE ECOSYSTEMS

A Manual for the Assessment of Biodiversity

Published by :

Prof. Dr. Mohan Joseph Modayil

Director

Central Marine Fisheries Research Institute, Cochin - 18, Kerala, India

Telephone : + 91-484-2394798

Fax : + 91-484-2394909

E-mail : mcmfri@md2.vsnl.net.in

Website : <http://www.cmfri.com>

ISSN : 0972-2351

CMFRI Special Publication No. 83

Edited by :

Dr. George J. Parayannilam

Editorial assistance :

Mr. P. K. Jayasurya

Dr. Ansy Mathew

Cover design :

Sreejith K. L.

© 2005, Central Marine Fisheries Research Institute, Cochin - 18.

Price :

Indian Rs. 600/-

Foreign \$ 60/-

Printed at :

Niseema Printers & Publishers, Cochin - 18, Kerala, India. Ph : 0484-2403760

Ichthyofauna of the Mangrove Ecosystem

Geetha Antony, George J. P., Ansy Mathew, Sunirmal Giri, Gurudas Chakravarty, S. K. Chakraborty, S. Dam Roy

Introduction

The mangroves are breeding, nursery, feeding and hiding grounds for a certain group of finfish, crustacea and shellfish among the aquatic fauna and include those which enter from the sea as well as those which migrate down from the upstream stretches of rivers. An inventory of the ichthyofauna of the mangrove ecosystems has been prepared as part of a NATP project to assess the biodiversity.

Objectives of studies on fish eggs and larvae:

1. To know more about larval development:

Morphogenesis in fish is of biological interest in view of the change from a pelagic egg and almost passive yolk-sac larvae to a freely moving and feeding post-larvae and later on to a shoaling or demersal juvenile. Amongst the vertebrates only fish and amphibians pass through several developmental stages with such great biological and ecological differences.

2. To know more about marine and fresh water ecosystems:

Fish eggs and larvae are important prey organisms, predators and grazers. Further more they can be used as indicators for the status of pollution and for natural and man-made changes in the ecosystem because larval populations are part of the ecosystem and react to any change in the system and their relationship to the abiotic environmental parameters.

3. To be able to rear fish larvae for aquaculture, re-seeding, ranging and introduction of fish population in natural habitats.
4. To know more about fish population: Fish eggs and larvae are used as indicators of the existence of adult stocks. It is reported that long time series of ichthyoplankton data is more reliable than from

fisheries to describe long-term changes in the abundance and distribution of fish stocks.

The present work on the ichthyofauna, provides taxonomic description and biological information of the larvae, juveniles and adult fish from selected mangroves of India.

Methodology

The series method of study was applied on the ichthyoplankton. Collection from a site may contain larvae of a species in various stages of development or such closely resembling material may be available from different collections. The larvae are sorted out to a series in sequences of size and development. The progressive developmental process leave a trace of the immediate previous stage and the latest stage show close resemblance to juvenile characteristics especially to meristic and partly morphological features of the adult. The built up series enable confirmation of the identity of the material. The easiest method in assessing the fish larval population is to identify the largest stage and work down to the smallest.

Identification of larvae

The larval stage includes that stage prior to the acquiring of juvenile characters and the transition stage when juvenile characters are acquired. The juvenile stage is defined as the stage in which all the fin elements are present. In some cases there is the specialized juvenile stage which is found only in a few groups of fishes. The standard larval terminologies used are as follows:

- | | |
|--------|--|
| Embryo | - Developmental stages to the moment of hatching. |
| Larva | - Developmental stages well differentiated from the juvenile and intervening between the moment of |

hatching and transformation; commonly divided into Prolarva and Postlarva.

- Prolarva - Still bearing yolk.
- Post larva - Larva following the absorption of yolk applied only when the structure continue to be strikingly unlike that of juvenile.
- Alevin - Larva of species in which post larval stages are not recognized i.e. in which the yolk bearing larva transforms directly into the juvenile.
- Juvenile - Young essentially similar to adult.

When larvae from a specific area is studied, basic information on the endemic and migrant adult species occurring in the area is to be known. It is also important to have clear knowledge of the meristic (countable) characters of the adult fishes.

At least four major characters are to be taken into account for identification of fish larvae. They are:

1. Morphometrics: Measurements of body parts over a size range of specimens from larva to early juvenile stage (Fig.1). Changes in body

proportions such as in body depth, head size, gut length, shape of viscera; fin positions including size at end of yolk sac stage and size at transformation stages.

2. Meristics: Countable structures such as myotomes or vertebrae, number of fin rays etc. It is possible to count fin rays and vertebrae in transparent post larvae but in less transparent juveniles it is necessary to resort to alizarin staining.
3. Pigment patterns and their changes during early stages (Fig.2). Melanophores are somewhat variable on larvae of the same size; may be expanded or contracted at the time of preservation and can be destroyed by exposure to light or through improper preservation.
4. Specialised larval characters such as spines on opercular bones or head; shape of eyes (sub-circular, stalked etc); elongated dorsal/ventral rays or spines, extended snout etc.

The very shape of the larvae itself broadly distinguishes the major groups from each other. e.g.: clupeids - elongate; scombroids, perches and carangids-laterally compressed. It may be instructive to look at the salient diagnostic features applicable to different groups of fish larvae :

Body Shape:

Body elongated:

Slender Clupeidae, Dussumieridae, Engraulidae, Belonidae, Hemirhamphidae, Syngnathidae, Synodontidae, Fistularidae.

Body rather slender Sphyraenidae, Sillaginidae, Mullidae, Bregmacerotidae, Gobiidae, Trypauchenidae, Cynoglossidae.

Ribbon like body Ophichthidae

Body Short:

Moderate short Mugilidae, Serranidae, Theraponidae, Carangidae, Lutjanidae, Leiognathidae, Sciaenidae, Thunnidae, Scombridae, Scomberomoridae, Apogonidae.

Deeply compressed Bothidae, Cynoglossidae, Pleuronectidae, Soleidae.

Oval body Monacanthidae, Balistidae, Antennaridae.

Depressed body Platycephalidae, Pagasidae, Dactylopteridae.

Head:

Crest on nape	Holocentridae, Carangidae, Leiognathidae, Coryphaenidae, Scorpaenidae, Platycephalidae.
Barbel on lower jaw	Exocoetidae
Elongated tentacle on operculum	Champsodontidae
Bony ridge over eyes	Carangidae, Stromateidae, Holocentridae, Histiophoridae, Scorpaenidae.
Protruded snout	Holocentridae, Histiophoridae, Pegasidae, Exocoetidae, Hemirhamphidae.
No spines on operculum	Labridae, Gobiidae, Trachypteridae.
Spines on operculum	Majority of Perciformes, Scorpaeniformes.

Fins:

Pelvic fins abdominal	Isospondyli, Iniomi, Scomberosox. They are soft rayed fishes lacking spines in the dorsal, anal and pelvic fin.
Single short dorsal fin	Gonostomatidae, Clupeidae, Engraulidae, Dussumieridae.
Single long dorsal fin	Bregmacerotidae, Serranidae, Carangidae, Coryphaenidae, Leiognathidae, Histiophoridae, Stromateidae, Bothidae, Pleuronectidae, Soleidae, Cynoglossidae.
Two dorsal fins	Mugilidae, Apogonidae, Mullidae, Gobiidae.
Pectorals enlarged	Exocoetidae, Stromateidae, Callionomidae, Platycephalidae, Champsodontidae.
Ventral fins absent	Angulliformes, Syngnathidae, Tetradontidae.
Elongated fin rays on dorsal	Bothidae, Soleidae, Cynoglossidae, Bregmacerotidae.
Elongated spines on the dorsal and ventrals	Serranidae, Ballistidae, Acanthuridae.

Alimentary canal:

Long and straight	Many Gonostomatidae, Clupeidae, Synodontidae.
Bulged or sac like	Cynoglossidae, Soleidae.
Short and coiled	Majority of Perciformes.

Anal opening:

At middle of body	Apogonidae, Carangidae, Thunnidae, Scombridae, Gobiidae, Scorpaenidae, Pleuronectidae, Bothidae.
Behind middle of body	Apodes, Hemirhamphidae, Exocoetidae, Fistularidae, Mugilidae, Sphyraenidae, Coryphaenidae.
Far backwards	Stomiatooids, Clupeides, Synodontids.
Far forwards	Bregmacerotidae, Atherinidae, Blennidae, Trypauchenidae.

Pigmentation :

Dense	Exocoetidae, Hemirhamphidae, Holocentridae, Mugilidae, Coryphaenidae, Histiophoridae.
Partial	Atherinidae, Bregmacerotidae, Mullidae, Apogonidae, Stromateidae, Theraponidae, Platycephalidae.
Blotches, spots	Engraulidae, Clupeidae, Synodontidae, Carangidae, Apogonidae, Serranidae, Leiognathidae, Thunnidae, Scromberomoridae, Pleuronectidae, Cynoglossidae.

Eye stalks present : Asteronesthidae, Bathylagidae, Myctophidae.

Myotomes/Vertebrae:

Less than 24	Callionomidae, Balistidae, Monacanthidae, Diodontidae, Tetrodontidae, Molidae.
24	Mugilidae, Sphyraenidae, Carangidae, Mullidae, Istiophoridae, Teraponidae, Leiognathidae, Serranidae, Lutjanidae, Ambassidae, Gobiidae and many others.
30-50	Clupeidae, Engraulidae, Gonostomidae, Myctophidae, Coryphaenidae, Labridae, Scombridae, Thunnidae, Sillaginidae, Chirocentridae, Scomberomoridae, Bregmacerotidae, Exocoetidae.
51-80	Elopidae, Albulidae, Megalopidae, Chirocentridae, Beloniformes, Syngnathidae.
100-200	Anguilliformes, Trichiuridae, Gempylidae.

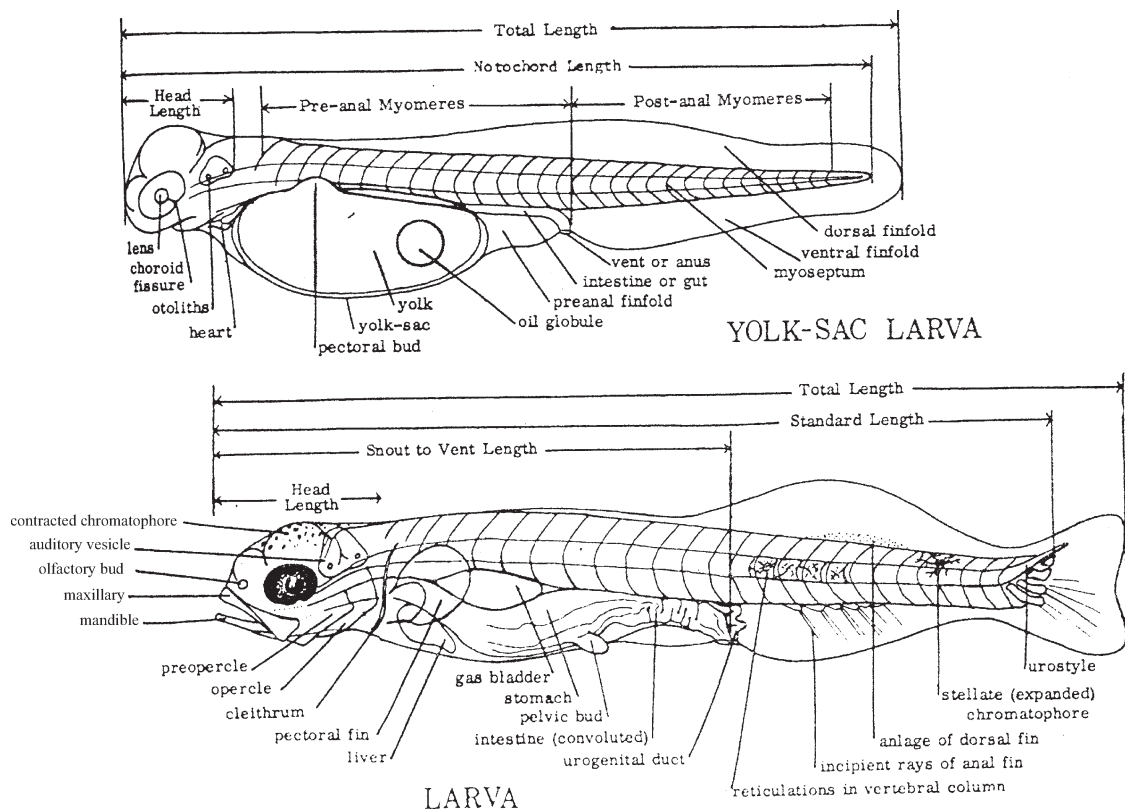


Fig. 1. Diagrammatic representation of morphology and development of egg and larval stages of a typical teleost (Jones *et al.*, 1976).

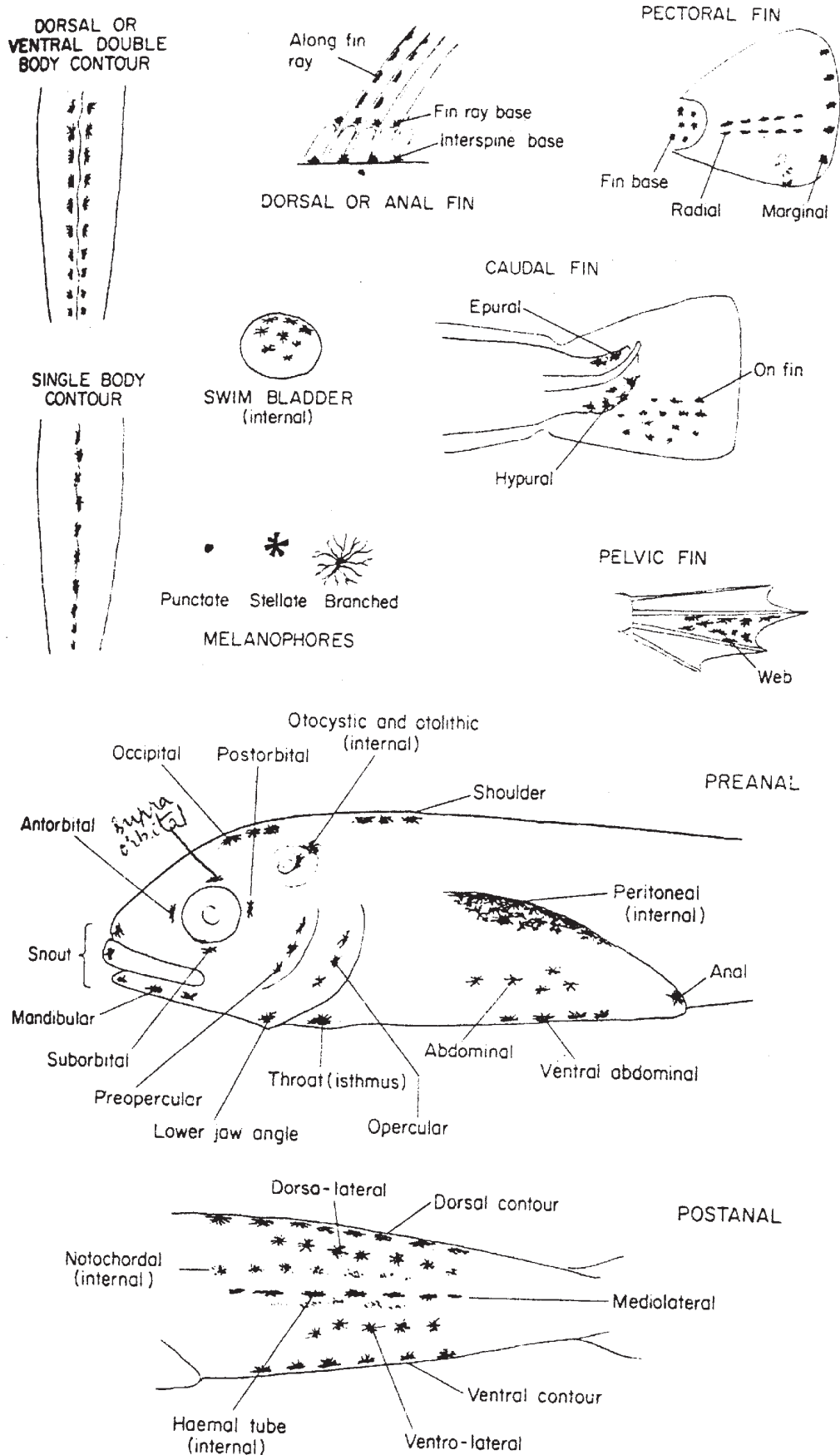
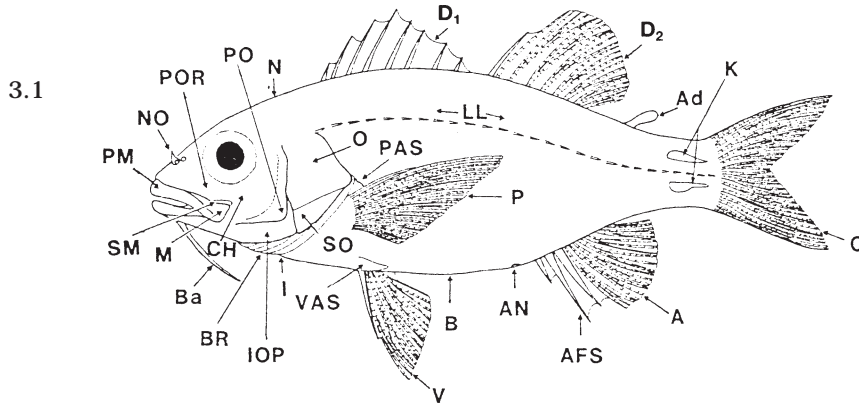
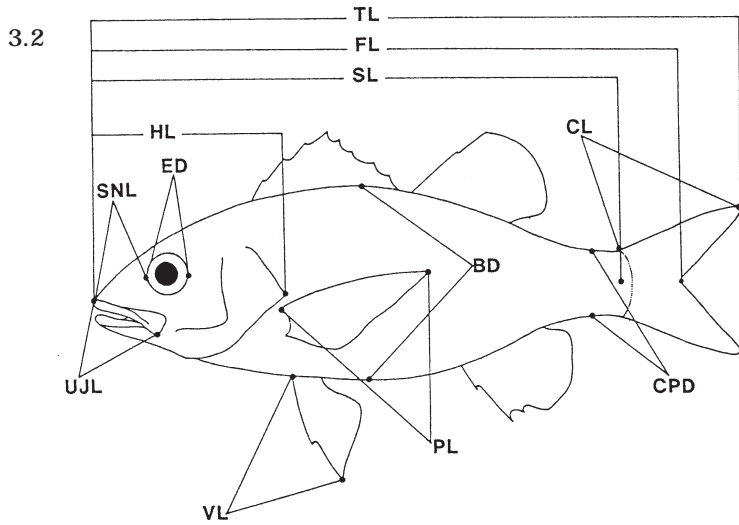


Fig. 2. Illustrating terms used in describing the melanophore pigmentation and fin structure of the postlarva (Russel, 1976)



A	anal fin	D ₂	second dorsal fin (generally with single spine in front of soft-rays)	O	opercle
Ad	adipose fin	I	isthmus	P	pectoral fin
AFS	anal fin spine	IOP	interopercle	PAS	axillary scale of pectoral fin
AN	anus (vent)	K	keels on caudal peduncle	PM	premaxilla
B	belly	LL	lateral line	POR	preorbital (lachrymal)
BA	barbel	M	maxilla (plural: maxillae)	SM	supramaxilla
BR	branchiostegal rays	N	nape	SO	subopercle
C	caudal (tail) fin	NO	nostrils (nares)	V	pelvic (ventral) fin
CH	cheek			VAS	axillary scale of pelvic fin
D ₁	first dorsal fin (generally spinous)				



BD	body depth	FL	fork length	SNL	snout length
CL	caudal fin length	HL	head length	TL	total length
CPD	caudal peduncle depth	PL	pectoral fin length	UJL	upper jaw length
ED	eye orbit diameter	SL	standard length (snout to base of caudal fin)	VL	pelvic (ventral) fin length

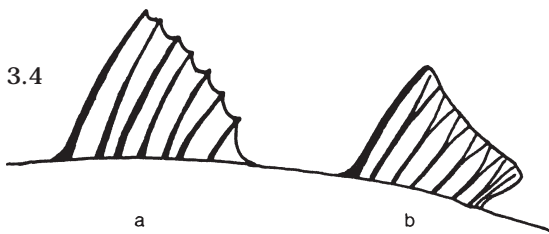
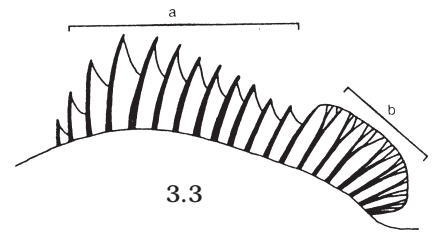


Fig. 3.1. External features of a teleost fish; 3.2. Measurements of a typical fish (Smith, 1986); 3.3 Fused first, spinous (a) and second, soft (b) dorsal fins; 3.4. First, spinous dorsal fin (a) and second, soft dorsal fin (b); 3.5. Rayed dorsal fin (a) and adipose dorsal fin (b).

Guidelines for identification

Order CLUPEIFORMES

Fin spines absent; a single dorsal fin located above middle of body, pelvic fins abdominal in position, lateral line absent.

Family CLUPEIDAE

Elongate larva with long guts. Single short dorsal fin. Median fin development does not begin until 7 mm notochord length. Clupeids develop pigment on the ventral mid line later than 7 mm notochord length (NL). Caudal fin with pigment streaks arranged in an oblique pattern, running down from the dorsal profile to the ventral posterior corner of the caudal peduncle. Early larva show typical crossed muscle fibres.

Genus *Sardinella*

Larval sardines can be identified from the general clupeoid group by their very rearward positioning of the anus. The gut length is greater than 80% of their notochord length. Myotome number 43-48. General pattern of pigmentation observed in all *Sardinella* species (Fig.4). Pigmentation associated with the caudal area in larva less than 8 mm NL.

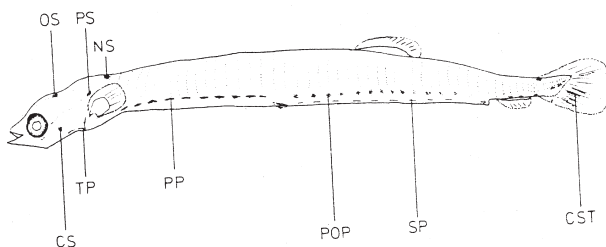


Fig. 4. Diagrammatic representation of sardine larva showing pigmentation pattern (Anon, 1974)

OS - Occipital Spot, PS - Pectoral Spot, NS - Neck Spot, CS - Cheek Spot, TP - Throat Pigment, PP - Pre-bladder Pigment, POP - Post-bladder Pigment, SP - Sub-guttal Pigment, CST - Caudal Streaks

Sardinella longiceps Valenciennes, 1847



Fig. 4.1. *Sardinella longiceps* (Munro, 1955)

D 16-17; A 14-15; Lateral scales 46-47; Tr 12-13

Common name Indian oil sardine

Vernacular name Chala, Mathi

Body elongate; belly keeled with scutes along ventral edge; snout not overshoot; mouth large, jaws equal; dorsal origin before ventral origin; upper jaw without median notch; last two rays of anal enlarged; ventral rays 9; dark spot at upper edge of opercle.

Larvae with 47-48 myotomes. Larvae below 7 mm total length have 40-43 or more pre-anal myotomes. As the larvae grow older there is a gradual reduction in pre-anal myotomes and an increase in post-anal myotomes. (Fig.4.2 a, b, c). Above 17 mm total length, myotome number is 35 pre-anal and 12 post-anal ones.

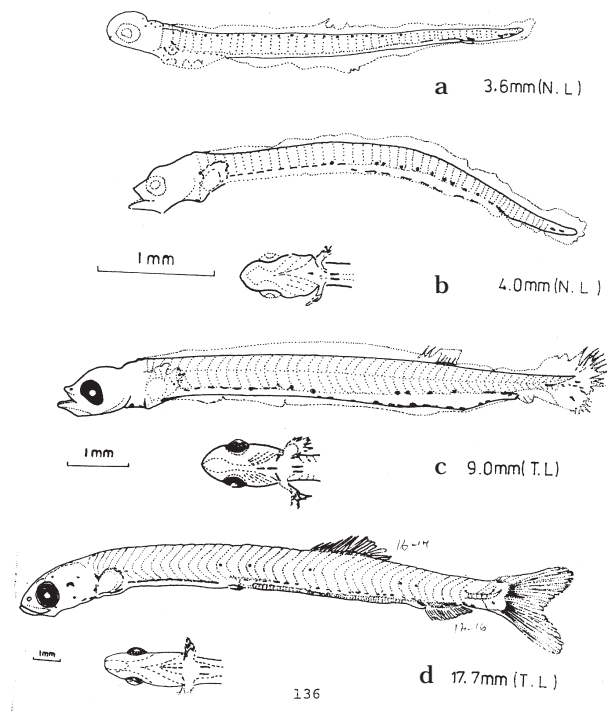


Fig. 4.2 Larvae of *Sardinella longiceps* (Anon, 1974)

Pigmentation of oil sardine larva is of the general pattern observed in all *Sardinella* species (Fig.3). It may vary in the faint or irregular post-bladder pigmentation or in the total absence or weak nature of certain pigments on the head or pectoral spot. Subguttal pigmentation in the form of paired or partly alternating dashes. Cross bars of throat pigments are clearly seen in most of the older larvae.

Distribution, behaviour and utilization: Spawners enter coastal waters forming very large shoals in June-July and juveniles dominate the fishery from November to January off the west coast of India. Feeds on phytoplankton especially diatoms such as *Fragilaria* and other algae. Marketed fresh or canned.

Oil used in industries and for protecting canoes. Fish also used as manure.

Genus *Dussumieria* Valenciennes, 1847

Dorsal origin nearer caudal than snout tip.

Dussumieria acuta Valenciennes, 1847.

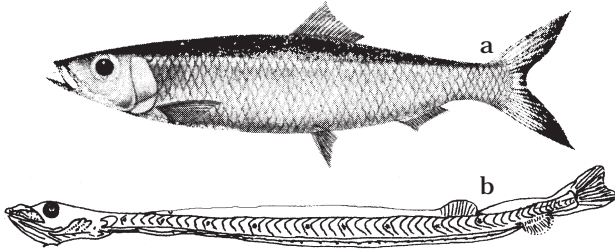


Fig. 5. (a) *Dussumieria acuta* (Day, 1971) (b) larva *Dussumieria* sp. (Vatanachai, 1974)

Common name Rainbow sardine

D 18-20, A 15-18.

Body elongate, cylindrical, belly rounded without scutes. Base of dorsal slightly longer than base of anal; pelvic fin below middle of dorsal fin base. Pre maxillae rectangular giving distinctive appearance to mouth.

Very slender larvae with a pointed snout; anus situated far backward; myotome number 57, anal opening below 45th-48th myotome (Fig.5.b).

Distribution : Pelagic inshore species, No special fishery.

Genus *Hilsa* Regan

Upper jaw with a distinct median notch at centre. Scales moderate-sized, evenly arranged, 37 to 47 in lateral series; lower edge of operculum at 20° to horizontal, marine or anadromous.

Hilsa (Tenualosa) toli (Valenciennes)

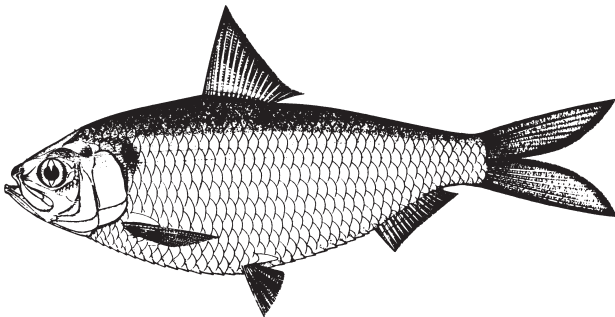


Fig. 6. *Hilsa (Tenualosa) toli* (Talwar & Jhingran, 1991)

Common name Toli shad

D iv-v 14-15; A iii 15-17; P i 13; V i 8

Body fusiform, moderately deep and strongly compressed; belly with 28 to 30 scutes. Head length 3.6 to 4 times in standard length; a distinct notch in upper jaw. Gillrakers fine, 60 to 100 on lower arm of first arch. Pseudobranch not attenuated, without ventral groove. Caudal fin long, 2.9 to 3.2 times in standard length. Colour in life, silvery shot with yellow and purple; a diffuse dark blotch behind gill-opening.

Distribution : Marine, pelagic and schooling in coastal waters, euryhaline often ascending rivers to breed.

Genus *Anodontostoma*

Oval deep laterally compressed body, last dorsal fin ray normal; pre-dorsal scale forming a single median row, scutes along ventral border of abdomen.

Anodontostoma chacunda (Ham. Buch. 1822)

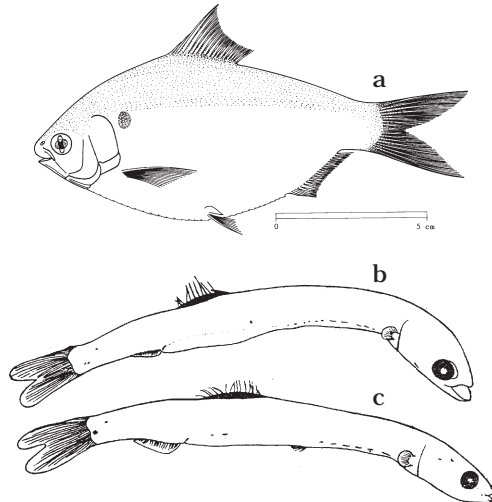


Fig. 7. (a) *Anodontostoma chacunda* (Fischer & Whitehead, 1974); Post-larvae (b) 12.8 mm stage (c) 15.57 mm stage (Bensam, 1967)

Common name Short nose gizzard shad

Vernacular name Thodi

D 17-18. A 19-20.

Snout shorter than eye. Mouth inferior, maxilla straight, thin and tapering. Prominent black spot on shoulder.

Myotome number 41; pre-anal 31 and post-anal 10 in the earliest larva which in the 15.57 mm specimen is 30 pre-anal and 11 post-anal. Origin of anal fin far behind the level of the hinder end of the dorsal corresponding to its future disposition. Fins more prominent at 8.7 mm stage, caudal fin become forked in the 12.8 mm stage. Mouth terminal, lower jaw longer than the upper. Pigmentation of the early post-

larva (Fig.7.b) consists of a series of chromatophoral streaks along the ventral aspect of the alimentary canal in its anterior half, a few pigment spots in the dorsal aspect of the mid-gut, the body above this region and the hind gut. A few pigment spots occur on the ventral aspect of the caudal region. A few black spots in the median region seen behind the operculum ventrally. Pigmentation at the tip of the lower jaw and along the lateral aspect of the body. 16 dorsal, 16 anal and 24 caudal rays in the 15.57 mm stage (Fig.7.c).

Distribution, utilization: Pelagic inshore species, sometimes in fair number, no special fishery. Marketed fresh.

Family ENGRAULIDAE

Sub-cylindrical body, scutes present along belly, snout strongly projecting, lower jaw underslung.

The elongate rod shaped engraulid larva have slightly greater body depth and are less laterally compressed than clupeidae. Median fin development begins at less than 6 mm notochord length. The typical crossed arrangement of muscle bands observed from the very early stage onwards. Melanophores restricted to ventral surface. Fewer melanophores in the foregut series at any given size than clupeidae.

The following changes of body form are characteristic of engraulid larvae: slender body deepens, head becomes round and mouth inferior, dorsal and anal fins shift anteriorly with rapid changes shortly after 15 mm standard length.

Genus *Stolephorus* Lacepede, 1803

Scutes needle like, only present between pectoral and pelvic fin bases, anal fin short, less than 25 fin rays.

Larval myotome count 39-42.

Stolephorus punctifer (Fowler, 1938)

Syn. *S.buccaneeri* Strasburg; *S.zollengeri* Bleeker

Common name Buccaneer anchovy

Vernacular name Kozhuva

D ii, 10-13; A ii, 12-15.

Belly rounded with 4-5 needle like scutes between pectoral and pelvic fin bases. Tip of maxilla bluntly rounded reaching only to front margin of preopercle. Compared to other species, dark in colour. The dusky brown lateral band is represented by a fairly silvery band.

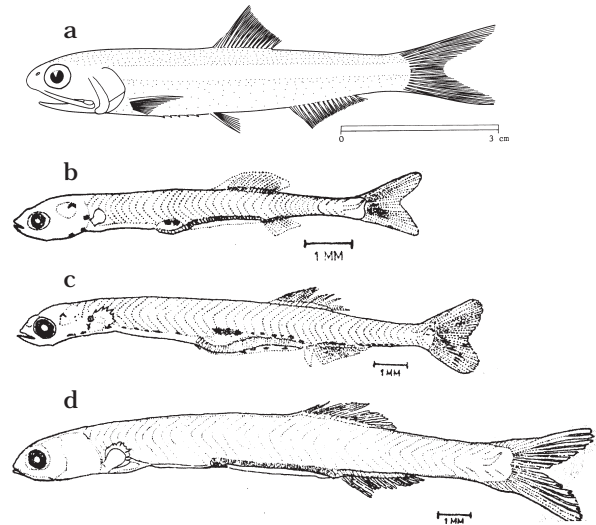


Fig. 8. (a) *Stolephorus punctifer* (Fischer & Whitehead, 1974) larvae (b) 7.5 mm (c) 10.5 mm (d) 15.0 mm (Sreekumari, 1971)

In 7.5 mm larva, anal opening below 27th myotome, about four-fifth of the distance to the caudal base. An airbladder noticed as a conspicuous organ. The posterior half of the alimentary canal shows a striated appearance. The peritoneal lining of the abdomen shows a few pigment spots. Pigment lines at the caudal fin region.

In 10.5 mm larva, almost all pigmentation characteristics are present. Pigmentation present throughout the ventral margin; distinct chromatophores at the pectoral base, above the auditory vesicle and near the anal opening. Air bladder portion has three stellate chromatophores followed by pigment lines upto the caudal base. Caudal fin with the characteristic caudal pigment streaks arranged in an oblique pattern running down from the dorsal profile to the ventral posterior corner of the caudal peduncle. Median fins have all the rays developed; pectoral has developed full complement of 13 rays. Pelvic fin rudiment as a thickening at the 13th myomere. There are 25 pre-anal and 17 post-anal myotomes (including urostyle).

Ventral fin develops 7 rays in 15 mm larvae. Development of caudal rays complete. Larvae retains its cephalic pigmentation. Slight forward shifting of the anal opening; 27 pre-anal and 14-15 post-anal myotomes.

Distribution, utilization: Pelagic in coastal waters. Marketed fresh or dried salted.

Genus *Thryssa* Cuvier, 1829.

Large, more compressed, fishes with a dark

humeral area behind gill opening. Anal fin longer with more than 25 fin rays.

Thryssa dussumieri (Valenciennes, 1848)

Syn. *Thrissocles dussumieri* Fowler, 1941

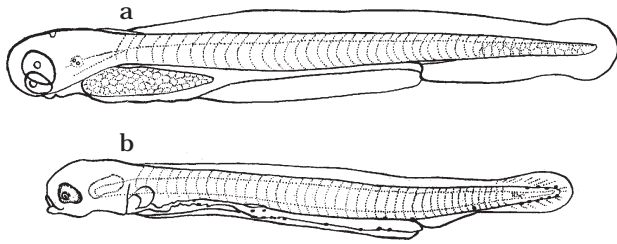


Fig. 9. *Thryssa dussumieri* larvae (a) 3.9 mm TL (b) 4.6 mm TL (Bensam, 1987)

Common name Mustached anchovy

Vernacular Managu

Myomeres 42. Larva of 3.9 mm has 28 pre-anal and 14 post-anal myomeres. 4.6 mm larva has 29 pre-anal and 13 post-anal myomeres. Pigmentation in the foregut, midgut and hindgut.

Thryssa mystax (Schneider, 1841)

Syn. *Thrissocles mystax* Fowler, 1941.

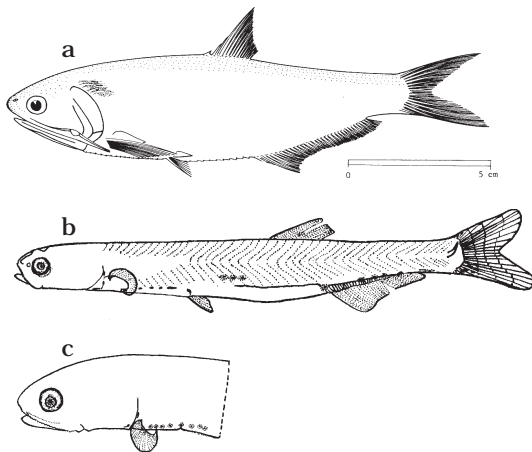


Fig. 10 (a) *T.mystax* (Fischer & Whitehead, 1974) (b) Postlarva 18.8 mm (c) Cephalic region of a postlarva 23 mm (Bensan, 1987)

Common name Mustached anchovy

Vernacular name Manangu

D 15-16, A 36-38.

In adult, belly keeled with 16 to 19 scutes in front of pelvic fin base and 9 to 11 scutes behind. Maxilla long, its tip reaching to base of pectoral fin.

In 18.8 mm larva, myomeres 45; 27 pre-anal and 18

post-anal; 15 dorsal, 6 pelvic, 30 anal and 24 caudal rays. In 23 mm postlarva, snout more prominent, maxillary extends behind eye region; dorsal fin origin is well in front of the middle of the body. Myomeres changed in position, 24 pre-anal and 21 post-anal.

Distribution, utilization: In coastal waters, also in estuaries. Forms significant catches in Kerala. Marketed fresh and dried salted.

Order **GONORHYNCHIFORMES**

Mouth small, toothless, suprabranchial organs (bilateral pouches behind fourth gill arch) present. Eyes covered with skin. Pectoral fin base horizontal; pelvic fins abdominal; well developed scaly axillary process at base of pectoral and pelvic fins; no fin spines. Branchiostegal rays 4.

Family **CHANIDAE**

Body torpedo-shaped, compressed with regular, grooved, cycloid scales. Head naked. Mouth small, maxilla not reaching past centre of eye; jaws toothless. Dorsal fin inserted opposite to pelvic fins. Caudal fin deeply forked. Dorsal and anal fins with basal scaly sheath; large axillary scales above pectoral and pelvic fins.

Genus *Chanos* Lacepede

Body compressed; abdomen rounded and smooth. Mouth terminal. Scales small; lateral line present.

Chanos chanos (Forsskal)

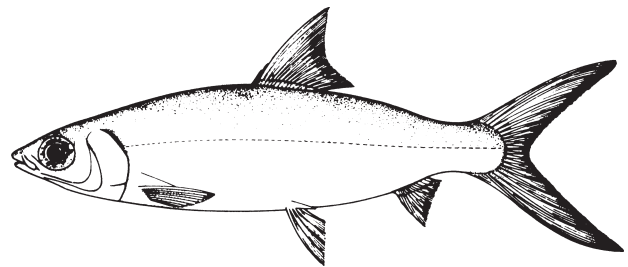


Fig. 11. *Chanos chanos* (Talwar & Jhingran, 1991)

Common name Milk fish

D 13-17; A 9-11; P 15-17; V 11-12

Lower jaw with a small tubercle at tip, fitting into a notch of upper jaw. Dorsal fin inserted at midpoint of body; anal fin short, placed far behind dorsal fin base. Scales small, cycloid; head naked; lateral line with 75 to 90 scales. Colour in life, brilliant silvery, darker dorsally. Caudal and anal fin margins dusky.

A large yolk sac in 3.2 to 5.3 mm larvae. Eyes not prominent, no fin buds. Pre-anal myomeres vary

between 33 to 34 and post-anal 8 to 10; anus situated far back. A number of black branching pigment cells are present especially in the dorsal and anal fin folds.

Late larval stage with a total body length of 10-16mm possesses 33 pre-anal myomeres. Fine black pigment spots are spread all over the surface of the body with more density in the dorsal region.

Distribution : Inhabits coastal waters entering estuaries, river and lakes. Although an inhabitant of the sea in its adult stages, its fry, fingerlings and even early juveniles can be obtained mostly from the brackish water regions.

Order MYCTOPHIFORMES

Fin spines absent; adipose fin present.

Family **SYNODONTIDAE** (Lizard fishes)

Maxilla narrow, less than 20 anal rays. Paired ventro-lateral pigment patches from the very early stage larvae. Slender elongated shape of the larvae retained throughout the developmental stages. No forward movement of any of the fins as in clupeids. Air bladder absent.

Genus *Saurida* Valenciennes, 1849

Mouth large with numerous sharp teeth, head lizard like. Myotome number varies from 46 in the newly hatched larvae (4mm), 31 pre-anal and 15 post-anal, to 49 in larvae above 7 mm, 34 pre-anal and 15 post-anal.

Saurida tumbil (Bloch, 1795)

Syn. *Saurida argyrophanes* Richardson, 1846

Common name Greater lizard fish

Vernacular name Arana meen

D 11-13, A 10-11.

Eye less than inter-orbital. Brownish, lighter below, mottled with traces of cross-bars.

Six pairs of peritoneal pigment spots on the ventro-lateral side from the very early stages of development which is species specific (Figs. 12.b-d). The anterior most pair on the posterior border of the gill cleft, below the end of the opercular flap and the last pair in front of the anus. Larvae above 9.9 mm length develop a small dash of pigment behind the posterior 6th pair of pigment spots slightly above the level of anal opening. A branching chromatophore present on the ventral side in between the anal opening and the caudal at the level of the 40th myomere.

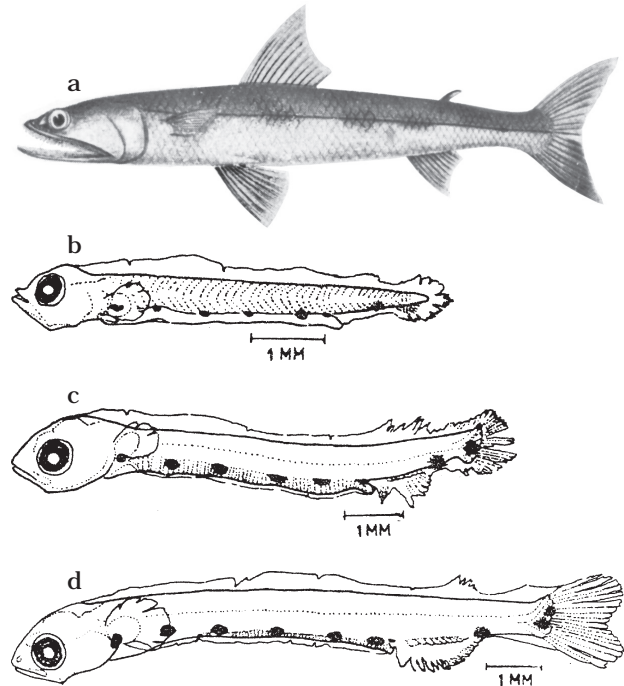


Fig. 12 (a) *Saurida tumbil* (Munro, 1955); Larvae (b) 5.4 mm (c) 7.4 mm (d) 9.9 mm (Dileep, 1977)

Pigmentation of mid-ventral line between anal fin and caudal peduncle increases and in the juvenile (25-31 mm) the entire anal fin base is pigmented. Dorsal fin formation with 11-13 rays complete by 18 mm stage. Second dorsal fin, an adipose fin devoid of fin rays form above the anal fin as a rounded lobe at 9.3 mm and is fully developed in 15.5 mm larvae.

Distribution, behaviour, utilization: Commonly found on muddy bottoms between 20-60m depth, enter shallow waters. Mainly piscivorous, but also feeds on crustaceans. Marketed fresh.

Order ANGUILLIFORMES

Body very elongate; fin-spines absent; pelvic fins absent; usually scaleless.

Family OPHICHTHIDAE

Body long, cylindrical anteriorly. Snout pointed, mouth terminal or inferior; teeth on jaws variable with genera, gill openings small. Branchial region and throat swollen supported by a basket of free branchiostegal rays, a unique feature of this family. No spines in fins. Pectoral fins present or absent; pelvic fins always absent.

Subfamily OPHICHTHINAE

Dorsal and anal fins discontinuous. Tip of tail finless and pointed.

Genus *Ophichthus* Ahl, 1789

Snout moderate or short, jaws stout and short, capable of closing completely.

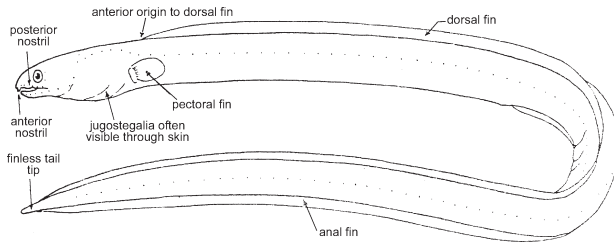


Fig. 13. *Ophichthus* sp. (Fischer & Bianchi, 1984)

Order **CYPRINODONTIFORMES**Family **HEMIRHAMPHIDAE** (Half beaks)

Body elongate, with a prolonged lower jaw and a short triangular upper jaw. No spines in fins; dorsal and anal fins posterior in position; pelvic fins abdominal, with six rays; pectoral fins usually short; caudal fin rounded, truncate or forked.

Genus *Zenarchopterus* Gill

Dorsal fin origin slightly before anal fin; anal fin base shorter than dorsal fin base, 8 to 14 rays. One of the anal soft rays is expanded in width as a secondary sexual character of the male.

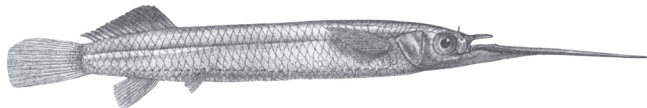
Zenarchopterus striga (Blyth)

Fig. 14. *Zenarchopterus striga* (Day, 1971)

Common name Hooghly halfbeak

D i 10-11; A ii 7; P i 9; V i 5

Body very elongate and slender, laterally compressed. Upper jaw as long as broad at its base, its length 7.6 to 9.25 times in free lower jaw. Dorsal fin rays normal; sixth and seventh anal rays enlarged and thickened. Predorsal scales 29. Body yellowish; a distinct black lateral stripe with a silvery hue; beak blackish.

Distribution : Inhabits fresh water and estuaries. This halfbeak is of no interest to fisheries.

Family **CYPRINIDAE**

Barbels one or two pairs or absent; no suborbital or preorbital spine; body usually laterally compressed; pharyngeal teeth in one to three rows.

Subfamily **CYPRININAE**

Lower jaw without any symphyseal process; dorsal fin inserted before or opposite to origin of pelvic fins; generally with a spine; lateral line running along median line of caudal peduncle.

Genus *Puntius* Hamilton - Buchanan

Lips distinct, no horny covering on inner side of lips; scales with few and strongly radiating striae.

Puntius sarana subnasutus (Valenciennes)

Fig. 15. *Puntius sarana subnasutus* (Day, 1971)

Common name Peninsular olive barb

Vernacular name Kurichi

Diii 8; Aii 5; Pi 16; V i 7

Body oblong and fairly deep, its depth 2.7 to 2.9 times in standard length. Head fairly small, its length 4.4 to 3.8 times in standard length. Eyes moderate, its diameter about 3.5 times in head length. Mouth moderate; barbels two pairs, maxillary pair much longer than orbit, rostral pair slightly shorter. Dorsal fin inserted equidistant between tip of snout and base of caudal fin; its last unbranched ray osseous, fairly strong (weak in young) and posteriorly serrated. Scales moderate; lateral line complete, with 28 to 31 scales; predorsal scales 10.

Colour : A dark band behind operculum and a black blotch on lateral line on about 24th scale. Fins orange; caudal fin with a black superior and inferior edge.

Distribution : River systems of peninsular India, very common in the Kerala backwaters.

Fishery information : This barb attains a length of 25 cm. It is of considerable economic importance.

Subfamily **RASBORINAE**

Lower jaw generally with a symphyseal process, fitting in a notch of emargination of upper jaw; dorsal fin inserted behind base of pelvic fins, devoid of a spine; lateral line if present, abruptly bend downwards and if complete, running along lower half of caudal

peduncle.

Genus *Danio* Hamilton-Buchanan

Lower lip present, mouth small to moderate, maxilla not extending beyond vertical through anterior margin of eye, lower jaw with a symphyseal process. Anal fin with 13 to 20 rays; dorsal fin inserted anterior to origin of anal fin. Lateral line complete.

Danio aequipinnatus (McClelland)

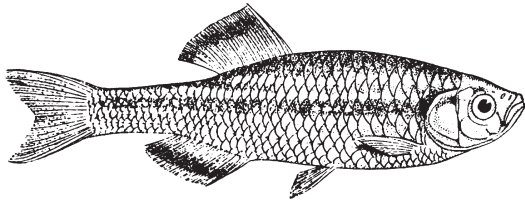


Fig. 16. *Danio aequipinnatus* (Day, 1971)

Common name Giant danio

D ii-iii 9-12; A ii-iii 14-16; Pi 11-12; Vi 6

Body elongate and compressed; its depth 2.9 to 3.5 times in standard length. Head length 3.5 to 4.3 times in standard length; snout length 3.3 to 5, eye diameter 3 to 4, both in head length.

A pre-orbital spine, backwardly directed from lachrymal bone.

Mouth small, directed upwards; barbels two short pairs, rostral pair about half eye-diameter, the maxillary barbels minute.

Dorsal fin inserted well in advance of origin of anal fin, extending to over anterior anal fin rays. Caudal fin forked. Lateral line complete with 35 to 37 scales; predorsal scales 14 or 15.

Colour : A well marked lateral band of dark blue along sides which runs along the entire length from caudal fin to head, breaks up into three bands in adults separated by golden lines before reaching gill opening; a well defined black blotch near upper angle of gill opening generally present.

Distribution : A widely distributed and beautiful species of the fresh waters of our area; an ideal aquarium fish.

Family **HORAICHTHYIDAE**

Small, translucent, elongate and more or less strongly compressed fishes. Mouth comparatively large, premaxillaries not protractile. Anal fin long with 28-32 rays. In males, the six anterior rays of the anal

fin are separated from the rest of the fin and modified into a large gonopodium. Dorsal fin is short and situated behind the anal. In females the right pelvic fin is usually absent. Caudal fin rounded. Genital opening of the female asymmetrically situated and the region surrounding it strengthened by the development of genital pads.

Genus *Horaichthys*, Kulkarni, 1940

Anal rays form gonopodium, genital opening of female shifted to one side and callous pads developed around it. Right pelvic fin absent in females.

Horaichthys setnai, Kulkarni, 1940

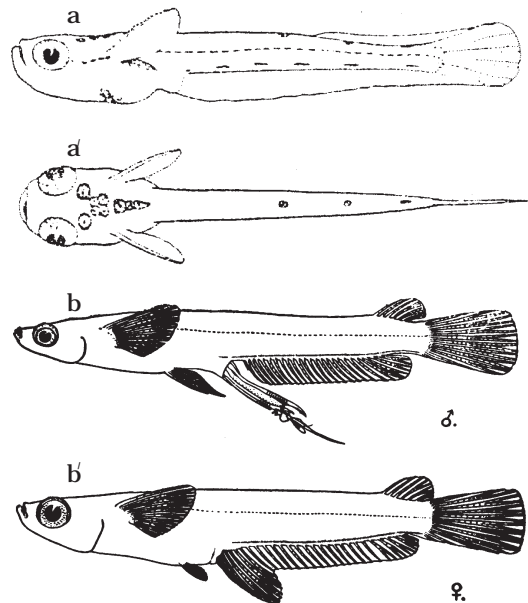


Fig. 17. *Horaichthys setnai* Kulkarni. (a, a') Newly hatched larva in lateral and dorsal views x 20 (b, b') adults (Kulkarni, 1940)

Common name Thready top-minnow

D 6-7; A 28-32; V 5

Head slightly depressed; mouth directed upwards; teeth sharp and conical on both jaws. In female, anal fin rays simple but the second to sixth rays more elongated, pectoral fins large and well developed thick muscular bases. Colour in life nearly transparent; head with a prominent dark occipital spot behind eyes and number of minute spots scattered all over as well as on upper margin of jaws.

Newly hatched larvae measures 3.5-4.0 mm. Body laterally compressed and tapers to the caudal extremity. Eyes and mouth well developed. Minute teeth in lower jaw. Pectoral fins fully developed, have

a broad base and are placed high up at the sides of the body. Vertical fins appear as continuous fin fold starting dorsally at about 2/3 of the body from the anterior end and pass round the caudal region. No other fins are present. Larvae almost transparent except for the prominent black eye and a few dark spots on the head. The number of these large chromatophores are not constant; generally they are 2-4 in number. The second pair of the chromatophores on the head fuses at times to form a large chromatophore in the centre of the head. As seen in Fig.17 a' there are two or three smaller chromatophores behind the larger ones followed by three or four still smaller, slightly oblong black spots on the mid dorsal side of the body. These spots are absent in some larvae. A row of dash-like black spots present in the middle of the body on the lateral line; so closely set that they form an almost continuous line. There is another row of five or six dots similar to those on the dorsal side and situated just above the base of the ventral vertical fold on both sides. A number of small black dots visible in the axilla of the ventral fins. On the abdomen there are four or five irregular chromatophores. A few tiny spots present on the caudal rays.

In 10 mm larvae pelvic fins visible; these fins are paired in some and single in others. Individuals with paired fins are in majority of cases males, while those with only one fin are females. Anal fin is similar in both sexes with 28-32 fin rays. Dorsal and anal fin have developed rays and are quite distinct from caudal. Some pigment spots have become smaller but this number has increased considerably on different parts of the body. The morphological development is complete in 12 mm larva.

Fishery information: Hardly 2 cm in length, it is the smallest known fish in India. An estuarine species capable of living temporarily in fresh water. Being always on the surface water, it destroys the early instars of mosquitoes and other insects.

Order **SILURIFORMES**

Barbels around the mouth

Family **BAGRIDAE**

Dorsal fin with a pungent spine, caudal not pointed, not united with dorsal. Anal short. Nostrils not close together; posterior one with barbel. Head and body smooth; size up to 1 m.

Genus *Mystus* Scopoli

Eyes not covered with skin; barbels usually longer than head. Interneural shield absent.

Mystus gulio (Hamilton-Buchanan)

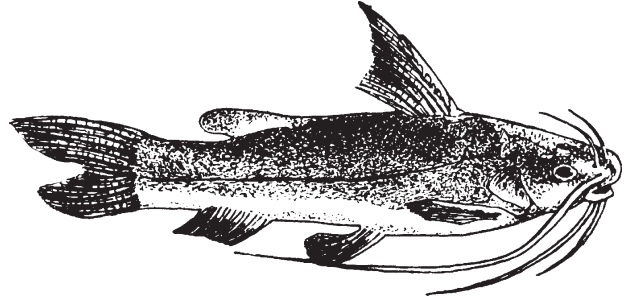


Fig. 18. *Mystus gulio* (Misra, 1976)

Common name Long-whiskered catfish

DI 7; A iii-iv 9-11; PI 8-9; V i-5

Differs from all other *Mystus* by its adipose whose base is shorter than base of anal. No dark blotch on base of caudal fin; occipital crest rugose; branchiostegal rays 9.

Distribution : In estuaries and coastal waters.

Family **ARIIDAE**

Paired maxillary and mandibularly barbels either both present or one type absent. Dorsal fin short with a more or less serrated spine followed by 7 soft rays; Adipose fin present, relatively short fins; caudal fins forked.

Genus *Arius* Valenciennes

Both mandibularly and maxillary barbels present. Teeth on palatine. Teeth on hind margin of dorsal spine directed downwards.

Arius arius (Hamilton-Buchanan)

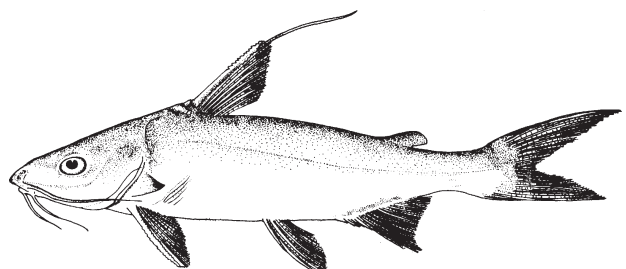


Fig. 19. *Arius arius* (Jayaram, 1982)

Common name Threadfin sea catfish

DI 7; AV-VI 14-16; PI 10; Vi 5

Body elongate and robust; head depressed; median fontanelle groove on top of head shallow, not reaching to base of supra occipital process.

Barbels three pairs; maxillary barbels reaching to anterior third of pectoral fin. Mouth subterminal and narrow; jaw teeth villiform; teeth on palate globular, in a single large ovate patch on each side with a horn like conical projection anteriorly.

Tip of dorsal spine prolonged into a filament. Adipose fin with a well defined black spot.

Distribution : Inhabits seas, estuaries, tidal waters and brackish water lakes.

Order SCORPAENIFORMES

Cheeks with a bony extension of suborbital bone to preopercle. Well developed spines on head and prominent spines in dorsal fin; pectoral fins usually rounded; caudal fin rarely forked.

Family PLATYCEPHALIDAE

Elongate fishes with head moderately to strongly depressed. Larvae with crest on nape. Juveniles and adults with bony ridges of head usually bearing spines or serrations. Pectorals enlarged. Two dorsal fins well separated; pelvic fins thoracic in position set far apart towards sides of body. Vertebrae 27; pre-anal 12 + 15 post-anal.

Genus *Platycephalus* Bloch, 1795

Pored scales in lateral series 65 or more; teeth on vomer in one transverse patch. Soft dorsal rays 13.

Platycephalus indicus (Linnaeus, 1758)

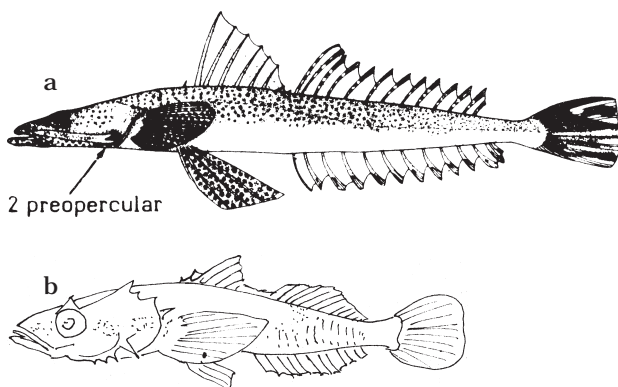


Fig. 20. (a) *Platycephalus indicus* (Talwar & Jhingran, 1991)
(b) *Platycephalus* sp. larva 9.8 mm (Vatanachai, 1974)

Common name Bartail flathead

DI/VIII/I + 13; A13

Head bearing smooth bony ridges, preocular and preopercular spines.

Cociella crocodilus (Fischer and Bianchi)

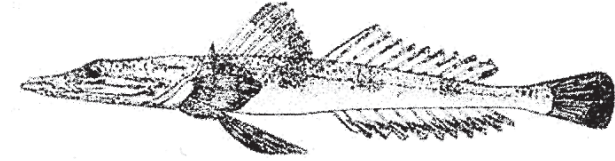


Fig. 21. *Cociella crocodilus* (Fischer & Bianchi, 1983)

D IX, 11; A 11.

51 to 55 pored scales in lateral scale series; only the anterior 2-16 pored scales of the lateral series bearing spines.

Order PERCIFORMES

Either 2 dorsal fins or one dorsal fin with the anterior elements being sharp spines; pelvic fins with 1 spine and 5 soft rays placed well forward on ventral surface of body.

Family CENTROPOMIDAE

Body elongate or oblong, moderately compressed with a deep caudal peduncle. Mouth large with lower jaw longer than upper. Opercle with a single stout spine; preopercle with a serrated posterior border. Dorsal fin deeply notched almost dividing spinous from soft rayed part. Pelvic fins below pectoral fin. Caudal fin rounded.

Genus *Lates* Cuvier

Head rather pointed, with concave dorsal profile at nape and becoming convex in front of dorsal fin. Upper jaw reaching to behind eyes. Horizontal limb of preopercle with 3 or 4 large, flattened and triangular spines.

Lates calcarifer (Bloch, 1790)

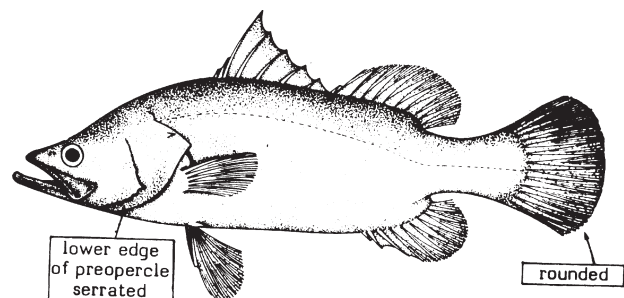


Fig. 22. *Lates calcarifer* (Talwar & Jhingran, 1991)

Common name Barramundi

D VII-IX + I 10-11; A III 7-8; P 17; V I 5

Mouth large, slightly oblique, teeth villiform on jaws; some teeth on tongue. Colour in juveniles olive brown above with silvery flanks and belly or green like above and silvery below.

Larvae measure about 1.5 mm in length immediately after hatching. In the larvae with body length of 4mm, two large branching chromatophore are present behind the eye and three large chromatophores in the middle region of the lateral sides. 8 pre-anal myomeres and 12 post-anal myomeres are countable; chromatophore in dense patch on the dorsal side of the gut and along base of the dorsal fin.

Early juveniles are darkly pigmented; Specimens measuring 20mm in length and above possess a brown band or stripe running between the snout and the dorsal fin with 3 to 5 dark grey vertical bands of chromatophores. The larval preopercular spines are reduced as a serration and only one strong spine exists. The opercular spine is yet to develop in early juveniles of less than 30mm in length.

Distribution: A coastal and estuarine species; enter estuaries in pursuit of food and shelter but return to marine environment for spawning.

Family CARANGIDAE

Myotome count quite stable (24) except in some genera. Armature of the head is another important character distinguishing the genera from each other. The long and strong spine on preopercle is at the corner between its horizontal and vertical edges. Sagittal crest- its presence or absence, its shape, position and its denticulations distinguish some genera and species. Anal spine separate from the rest of the fin, more dorsal fin rays than anal rays. Body pigmented; pigmentation increases in post larvae and juveniles.

Genus *Scomberoides* Lacepede, 1801

Laterally compressed elongated body with 6-7 short and stout dorsal spines. Myotome number 26.

Scomberoides lysan (Forsskal, 1775)

Syn. *Chorinemus sanctipetri*(Cuv & Val)

Common name Double spotted queen fish

D VI-VII + I 19-21, A II + I 17-19

Body strongly compressed. Upper jaw extends to posterior margin of eye in adults. Gill rakers 21-27 on first arch. Posterior soft dorsal and anal fin rays

consisting of semidetached finlets. Adults with a double series of 6 to 8 dusky roundish blotches above and below lateral line; distal half of dorsal fin lobe abruptly and heavily pigmented.

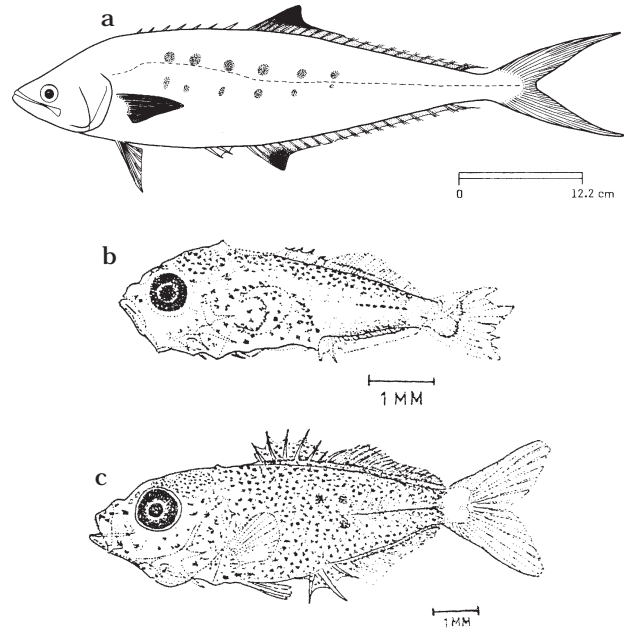


Fig. 23. (a) *Scomberoides lysan* (Fischer & Bianchi, 1983) larvae (b) 6 mm (c) 10 mm (Premalatha, 1971)

Body of larvae short, mouth oblique in position with a few pigments at its tip, upper margin of lower jaw serrated; 4 opercular spines, 2-3 in the horizontal portion, 3rd one at the corner between the horizontal edge and the ascending part of the pre-opercular; below the third spine is the fourth one which is longer than the rest. A small point like crest behind occipital. Out of 26 myotomes, 10 pre-anal and 16 post-anal. The chromatophores at the occipital region gradually increases with change in size, dorsal and ventral margins of the body with thick pigmentation upto the 20th myotome; single chromatophore above anal opening; ventral margin with pigment spots towards caudal end; dark line of pigments in the lateral line on 14th to 19th myotome region which gradually extends to the caudal base; pigmentation in the region of air bladder well developed.

Pigmentation intensifies in juveniles. Body dense brown in colour from 7 mm onwards. Conspicuous change in body form noticed in 10 mm larva. Larva deep bodied and stubby with a pointed snout. Dorsal crest reduced in size. Caudal base remains free of any pigments. 2-3 patches of chromatophores above and below the lateral line.

In the 10.5 mm larvae meristic characters are

as follows. D VII-I-20, A II- I 19, P-17, C 8+7. Total number of vertebrae 10+16 including urostyle. 6-8 dark blotches above lateral line and 3-5 faint ones below.

Behaviour, utilization: Moves in small schools and inhabits inshore waters. Feeds primarily on other fishes and small crustaceans. Young use specialized juvenile dentition to aggressively remove scales and epidermal tissue from other fishes. Spines of first dorsal and anal fins are venomous and capable of inflicting painful stings. Marketed fresh and dried salted.

Genus *Caranx* Lacepede

Adipose eye lids moderately to well developed, leaving anterior half of eyes exposed. Teeth in a band; in upper jaw, outer row enlarged; a single series in lower jaw with 2 to 4 anterior canines. Scutes prominent; breast rarely naked.

Caranx sexfasciatus Quoy & Gaimard, 1824.

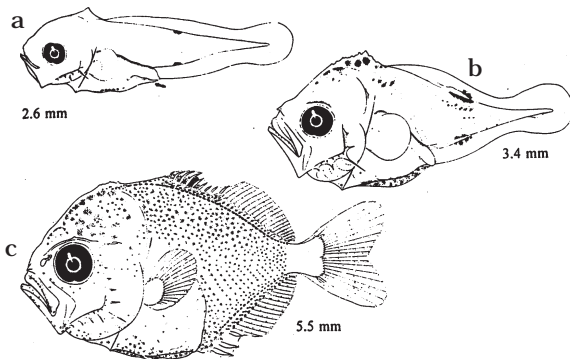


Fig. 24. *Caranx sexfasciatus* Preflexion larvae (a) 2.6 mm (b) 3.4 mm (c) Postflexion larva 5.5 mm (Moser, 1985)

Common name Big eye trevally

Total vertebrae 25; deep bodied; supraoccipital crest form at 3 mm; heavily pigmented preanal fin fold; strong pre-opercular spination, upto 6 below and 4 above elongate angle spine in posterior series and upto 1 above and 4 below angle in anterior series; single spine on post temporal and supracleithrum but none on supraocular or pterotic ridge.

Pigmentation: In the 2.6 mm larvae (Fig. 24.a) above gas bladder and gut, several on ventral margin of gut coil, one on terminal gut section anterior to anus, opposing blotches on dorsal and ventral margins of tail.

By 3.0 mm (Fig. 24.b), one to several above

mid brain, one or more on supraoccipital crest, a pair at tip of snout, one on dorsum at mid trunk, streaks on dorsal and ventral margins of tail with lateral streak forming between them; on pre-anal finfold spreading on to trunk. By 4 mm, scattered over upper half of head and on trunk and tail except for caudal region; heavier laterally in region of tail streaks and streaks on dorsal and ventral body profiles extending on each side of dorsal and anal.

By 5.5 mm (Fig. 24.c), entire head and body covered except for caudal peduncle. By 14 mm caudal peduncle covered and bars beginning to form.

Distribution, utilization: Distributed throughout the Indo-west Pacific, juveniles occur in estuaries. Feeds primarily on fish and crustaceans. Marketed fresh and dried salted.

Genus *Carangoides* Bleeker

Body ovate to oblong, compressed. Adipose eyelids feebly developed. Fine teeth in jaws. Scales small not embedded in skin. Lateral line anteriorly with a feeble to moderate arch, posterior straight part with moderate armed scutes often weakly developed. First dorsal fin with 7 or 8 spines connected by a membrane; second dorsal and anal fins anteriorly only slightly elevated. No detached finlets behind dorsal and anal fins; anal fin base about equal in length to soft dorsal fin base. Pectoral fins long and sickle-shaped.

Carangoides malabaricus (Bloch)

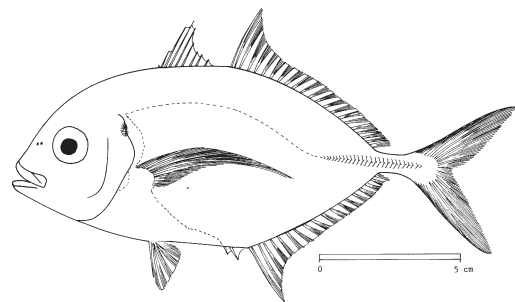


Fig. 25. *Carangoides malabaricus* (Fischer & Whitehead, 1974)

Common name Malabar trevally

Vernacular Vattapara

Body strongly compressed, ovate in young. Head profile steep forming a notch in front of eyes particularly when mouth is open. Two dorsal fins; first dorsal with one forward pointing spine and 8 normal spines; second dorsal with 1 spine and 20-23 soft rays. Dorsal and anal fin-bases equal. Anal fin

with 2 detached spines followed by 1 spine and 17 or 18 soft rays.

Lateral line anteriorly forming a long low arch, twice as long as straight portion, the latter beginning under 12th to 14th soft dorsal rays, 25 to 28 feeble scutes on lateral line.

Distribution: Inhabits coastal waters; juvenile inhabit shallow inshore areas. Commercial catches vary in length from 10 to 15 cms.

Family **AMBASSIDAE**

Body oblong, compressed. Dorsal fin deeply divided before last spine with 7 or 8 spines and 8-11 soft rays; anal fin with 3 spines and 8-11 soft rays; last dorsal and anal rays split to their base; caudal fin forked with 15 branched rays. Vertebrae 10+14. Swim bladder present.

Genus *Ambassis* Cuvier, 1828

Scales large, in longitudinal series. 1 or 2 rows of cheek scales.

Ambassis gymnocephalus (Lacepede, 1801)

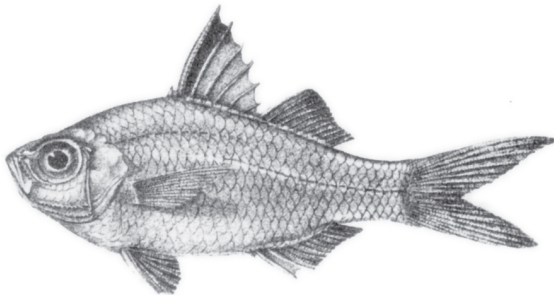


Fig. 26.1. *Ambassis gymnocephalus* (Day, 1971)

Common name Bald glassy perchlet

Vernacular name Nandan

D VII+I-10; A III 9-10; PII 12-14; V 1-5.

Lateral line interrupted, supra orbital ridge serrated, hind margin of preoperculum entire, head length about 2.8 times in standard length.

Newly hatched larvae measures 1.12 mm (Fig.26.2.a), yolk mass oval, its anterior end projecting in front of the head and hind end extending to the level of the fifth somite. Oil globule at the anterior end of the yolk mass with yellow and grey pigment spots. Twenty four myotomes. Longitudinal patches of black pigment spots along the dorsal and ventral borders of myotomes. About nine hours later after hatching, larva is 1.56 mm long (Fig. 26.2.b).

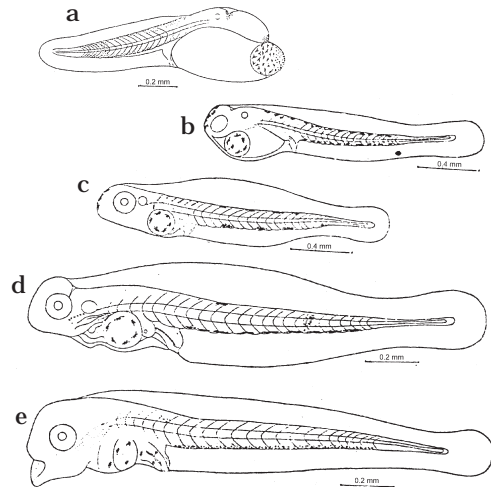


Fig. 26.2. *Ambassis gymnocephalus* Larvae (a) 15 hours after collection (b) 9 hours after hatching (c) 21 hours after hatching (d) 33 hours after hatching (e) 70 hours after hatching (Nair, 1957)

Yolk mass and oil globule considerably reduced so that the head projects in front of the yolk mass. Gut curved downwards not opening to the outside. Patches of yellow and grey pigments on the oil globule are replaced by the five or six branched pigment spots. Along the dorsal and ventral border, irregular row of branched pigment spots. 24 myotomes of which 18 are post-anal.

In about 21 hours of hatching, larva is 1.7 mm (fig.26.2.c). Yolk reduced, black branching pigment cells reduced in number along the ventral border to four large branching pigment spots. In larva after 33 hours of hatching (Fig. 26.2.d) pigment spots spread out to form a more or less dark line along the ventral border.

70 hours after hatching (Fig.26.2.e) eyes quite conspicuous, yolk disappeared, oil globule reduced, pigmentation along the dorsal border of the myotomes and anterior border of the head disappeared. Along the ventral border, pigment spots appear as a continuous row of prominent dark spots.

In juveniles of 1.65 cm, stellate chromatophores found on the dorsal along the base of the fins and post-anal on the ventral body margin.

Distribution, utilization: Common in the backwaters and lagoons of India. Sundried and sold as dry fish.

Family **LEIOGNATHIDAE**

Deep bodied, compressed rather small fishes with extremely protrusible jaws that point downwards. Scales small and are more or less absent over the head

and breast. Bony ridges over the head that end in a nuchal spine. Anal long with three spines.

Genus *Leiognathus* Lacepede

Protracted mouth point downwards

Leiognathus decorus (de Vis)

Syn. *Leiognathus brevirostris* (Valenciennes)

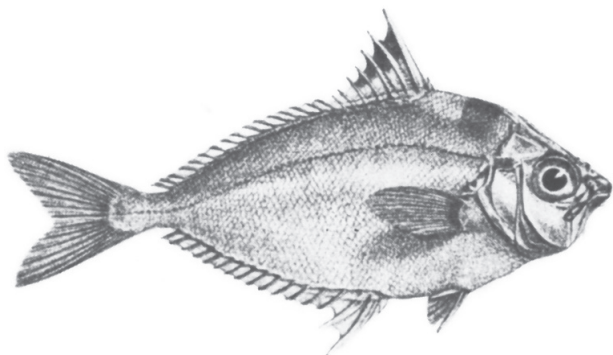


Fig. 27. *Leiognathus decorus* (Day, 1971)

Common name Short nose pony fish

Vernacular name Mullen

DVIII 16; A III 14; P i 17; V I 5

Brown blotch across nape; breast naked. Upper half of body with dark brown wavy to zigzag vertical lines.

Family **TERAPONIDAE**

Body oblong, slightly compressed. Preopercle serrate, opercle with about 6 spines, of which the dorsal one is the strongest and the longest.

Genus *Terapon* Cuvier, 1816

Post temporal bone serrate posteriorly, not covered by scales. Dorsal notched before last spine. Body with distinct dark stripes extending to caudal.

Terapon jarbua (Forsskal, 1775)

Syn. *Sciaena jarbua* Forsskal, 1775

Therapon jarbua Chevey, 1932



Fig. 28. *Terapon jarbua* (Smith, 1986)

D XI-XII, 9-11; A III, 7-10

Jaws equal, gape slightly oblique; preopercle strongly serrate, particularly at angle; lower opercular spine very long and strong, extending distinctly posteriorly. Spinous part of the fin strongly arched and deeply notched, first spine very short, 4th to 6th spines longest, and the penultimate spine about half the length of the ultimate. Four black downwardly curved stripes on body. Spinous part of the dorsal fin with a blackish band on upper portion of the fin membranes between third to sixth spine; soft part with membranes between first 3 rays tipped with black and membranes between 5th to 7th rays entirely black; caudal fin with median rays pigmented; both caudal lobes with dark tips and a transverse band.

Distribution, behaviour, utilization: Found in inshore waters, occurring in brackish and fresh waters. Feeds on fishes and invertebrates; commonly a scale eater. Marketed fresh and dried salted.

Family **SILLAGINIDAE**

Mouth small, terminal and protrusible. Two dorsal fins (little or no interspace), first consisting of 10-13 slender spines. Lower part of preopercle sharply angled inwards to meet that of the other side, thus forming the ventral surface of the head.

Genus *Sillago* Cuvier

Snout and head not depressed; second dorsal spine not elongate; eyes normal, 17 to 22 per cent of head length; air ladder present.

Sillago sihama (Forsskal)

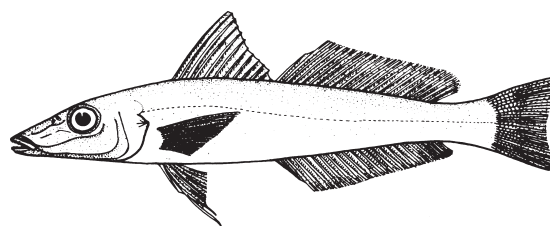


Fig. 29. *Sillago sihama* (Talwar & Jhingran, 1991)

Common name Silver sillago

D XI + I 20-23; 21-24; P 17; V I 5

Body elongate; gill rakers on lower arm of first gill arch 7 to 9. Air bladder with two very distinct post coelomic extensions.

In post-larvae measuring 6.5 mm length, the spinous first dorsal fin is not usually formed and a thick fin fold is visible; 20 and 21 soft rays develop in the second dorsal and anal fins respectively; caudal

fin with 18 countable rays which are 3-4 segmented. As the 6mm larva grows to 20mm, pre-anal myomere count increases from 10 to 14 while, the post-anal myomere count decreases from 24 to 20 due to the gradual shifting of the position of the anus.

Pigmented spots (each one below each ray) line the base of the anal fin of the larvae; post-larvae measuring between 8-13mm often have 2 pigment spots at the anterior portion of the caudal peduncle.

Distribution: A nearshore species, penetrates estuaries for considerable distance, goes out to the sea for breeding.

Family LUTJANIDAE

Mouth moderate to large; jaws with more or less distinct canine teeth; vomer with small conical teeth; no enlarged pores on chin.

Larvae with 24 myomeres, pre-anal length approximately 50% total length, light pigmentation. The presence of long, smooth preopercular spines and the early development of spines in the dorsal and pelvic fins distinguish lutjanids from most similar larvae.

Genus *Lutjanus* Bloch

Body compressed, moderately deep to slender. Jaws with several enlarged canine teeth. Colour pattern largely consisting of yellow, pink or red.

Lutjanus argentimaculatus (Forsskal)

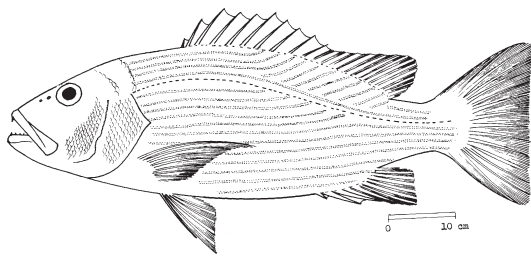


Fig. 30. *Lutjanus argentimaculatus* (Fischer & Whitehead, 1974)

Common name Mangrove red snapper

D X 13-14; A III 8-9

Head profile slightly convex; preopercle unnotched, its vertical and horizontal margins finely serrated. Caudal fin slightly emarginate. Longitudinal rows of scales above lateral line parallel to dorsal profile anteriorly, but appearing to rise obliquely under soft part of dorsal fin or under posterior part of spiny dorsal fin. Scale rows below lateral line horizontal.

Distribution: Juveniles usually inhabit mangrove and shallow water areas. Feeds mainly on crustaceans and fishes.

Lutjanus russelli (Bleeker, 1849)

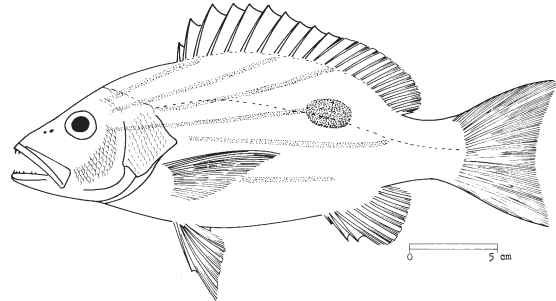


Fig. 31. *Lutjanus russelli* (Fischer & Whitehead, 1974)

Common name Russell's snapper

Head profile a little concave, inter-orbital space convex. Dorsal fin with 10 spines and 14 soft rays, anal fin with 3 spines and 8 soft rays. Caudal emarginate. Longitudinal rows of scales above lateral line appear to rise obliquely to dorsal profile, those below lateral line horizontal. A dark, variable blotch above lateral line below junction of spinous and soft parts of dorsal fin. About 8 golden/light brown lines on body, lower ones horizontal and upper ones rising obliquely to dorsal profile.

Distribution: Inhabits shallow waters; juveniles found in mangrove areas; feeds on bottom living invertebrates.

Family GERREIDAE

Two nostrils on each side of head. Dorsal fin inserted in anterior half of body; anterior rays of soft dorsal and anal fins not elongate. Lateral line complete. Mouth strongly protractile. Head scaled, no nuchal crest; gill membranes free from isthmus; branchiostegal rays 6.

Genus *Gerres* Cuvier

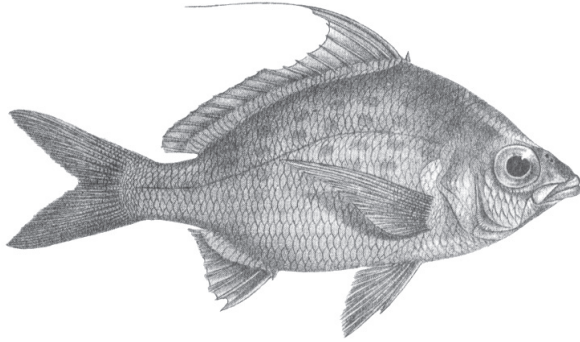
Anal fin with 3 spines and 7 soft rays. Dorsal fin with 9 spines.

Gerres filamentosus Cuvier

Common name Whiptail silver-biddy

D IX 10-11; A III 7; P i 14; V I 5

Body deep and compressed, its depth 2 to 2.5 times in standard length. Predorsal distance equal to or less than depth of body.

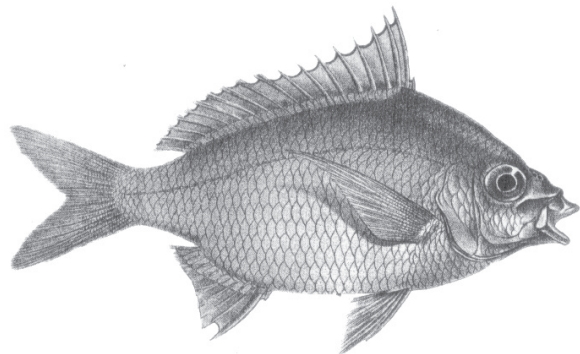
Fig. 32. *Gerres filamentosus* (Day, 1971)

Second dorsal spine laterally compressed, produced into a filament whose tip extends past level of first anal spine. Scales moderate; lateral line with 44 to 47 scales.

Pigmentation: 7 to 10 vertical series of ovoid bluish spots on upper portion of sides. Pectoral, pelvic, caudal and anal fins dusky; dorsal fin hyaline, except for end of filamentous spine which is black.

Distribution: Inhabits coastal waters, enters brackish waters.

***Gerres poietii* Cuvier**

Fig. 33. *Gerres poietii* (Day, 1971)

Common name Strong spine silver-biddy.

Body deep and fairly compressed, its depth 2.1 to 2.3 times in standard length.

D X 9; A III 7; P i 4; V I 5

Second dorsal spine shorter than head; second anal spine exceptionally robust, often as long as anal fin base. Scales moderate; lateral line with 38 to 40 scales; 4 scale-rows between lateral line and base of 5th dorsal spine.

A fine black line outlining margin of membrane of dorsal fin; tips of first few rays of anal fin and trailing edge of caudal fin dusky.

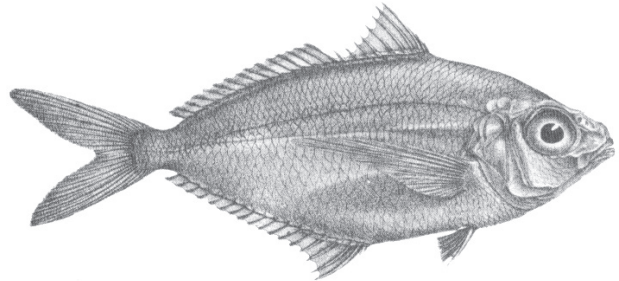
Distribution: Inhabits estuaries and coastal lagoons,

also coastal waters.

Genus ***Pentaprion*** Bleeker

Body compressed, oval. Anal longer than soft part of dorsal.

Pentaprion longimanus (Cantor)

Fig. 34. *Pentaprion longimanus* (Day, 1971)

D IX-X, 14-15; A V-VI, 12-14

Pelvic branched rays 13-14. Readily distinguished by the large number of radials in the long anal fin.

Family **SCATOPHAGIDAE**

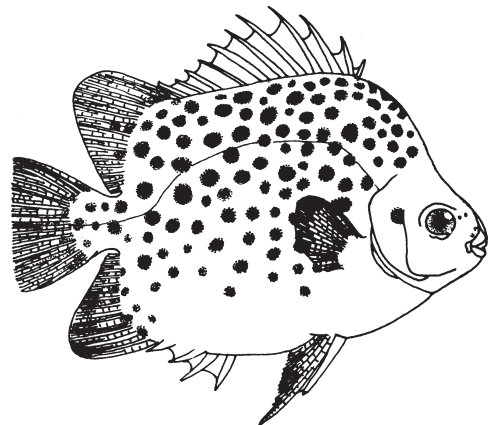
Body deep and strongly compressed; greatest body depth more than half of total length. Anal fin with 4 spines.

Genus ***Scatophagus*** Cuvier

Body squarish in outline, with triangular head projecting anteriorly. Head small, mouth small, not protractile; jaw teeth in several rows. Pectoral fins relatively small. Caudal fin rounded in juveniles.

Scatophagus argus (Linnaeus)

Syn. *Chaetodon argus*

Fig. 35. *Scatophagus argus* (Talwar & Jhingran, 1991)

Common name Spotted scat

D XI 16-18; A IV 14-15; P 16-17; V I 5

Body quadrangular, compressed. Head profile rising steeply to nape. Snout and interorbital space rounded. Dorsal fin deeply notched. Colour in life variable; young fishes of 2 cm dark in colour, finest colouration attained in fishes of about 5-6 cm in total length. Uniform greenish/bluish silvery with numerous dark spots mainly confined to upper portion of sides.

The body of the juvenile is somewhat oval in shape and very compressed; head large and possess bony plates; strong shoulder spine (supra scapular spine) present; spinous dorsal fin bright purple in colour having a brownish tinge posteriorly; black chromatophores and red pigmented cell groups are present on the body.

Distinct red pigmented cell groups in five locations along dorsal profile: at the nape, spinous dorsal origin, junction between the spinous and soft dorsal, on the middle of the soft dorsal, and at the end of the soft dorsal/beginning of the caudal peduncle.

Distribution : Inhabits harbours, natural embayments, estuaries, mangroves and the lower reaches of freshwater rivers.

Family MUGILIDAE

Robust body, abdominal pelvic fins, widely separated short-based dorsal fins, lack of spines on the opercular series bones, position of vent almost at the middle region. Post larval development characterised by dense pigmentation.

Genus *Mugil* Linnaeus

Hind tip of maxilla not curved below tip of premaxilla; adipose eyelids well developed.

Mugil cephalus Linnaeus, 1758

D₁ IV, D₂ I 8; A III 8

No spines on head or pectoral girdle. Robust form. Heavily pigmented throughout development.

Pigmentation: Late yolk-sac larvae - Anteriorly on both jaws; ventral to mid and hind brain; in optic capsule, heavy on dorsum from mid brain to myomere 18, light dorsolaterally on trunk and tail to myomere 18, extending up onto sides of tail; few on notochord tip dorsally.

Pre-flexion larva - Increasing on all areas except last 4 myomeres and lower half of head, lightly pigmented.

Flexion larva - Gradually spreading, only last 1-2 myomeres and hypural area unpigmented,

pigmentation denser on dorsal and ventral margins and lateral mid line.

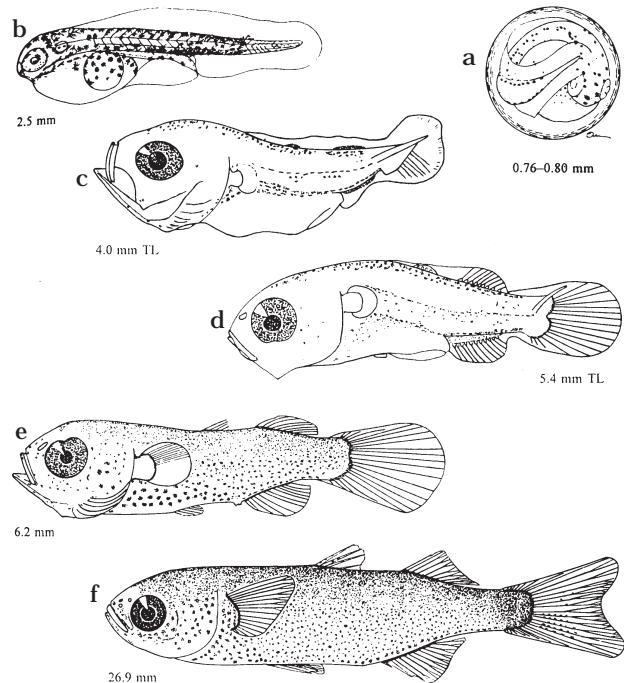


Fig. 36. *Mugil cephalus*

(a) Egg, 0.76-0.80 mm (b) Yolk-sac larva, 2.5 mm (c) Late preflexion larva, 4.0 mm TL; (d) Late flexion larva, 5.4 mm TL; (e) Postflexion larva, 6.2 mm TL; (f) Pelagic juvenile, 26.9 mm SL (reproduced from Moser, 1985)

Post-flexion larva - Uniformly covered by 6 mm except distal margin of fin bases. Transformation length between 7.5 and 12.0 mm. Hypural area and proximal part of caudal pigmented, silvery beginning ventrolaterally on abdominal area by 8.0 mm.

Juvenile 26.9 mm (Fig.36.f) vertebrae 24; precaudal 11-12, caudal 12-13.

Distribution: The most common mullet in the estuaries of India.

Genus *Valamugil* Smith

No fleshy lobes between arms of lower jaw.

Lower third of upper lip without papillae.

Hind tip of maxilla curved down below tip of premaxilla.

Tip of maxilla hidden beneath tendon when mouth is closed; hind margin of scales digitated.

Valamugil speigleri (Bleeker)

D₁ IV, D₂ 1 8; A III 9; P 16; V i-5.

Adipose eyelids well-developed, covering most of iris.

Minute villiform teeth on both lips, absent on vomer and palatines; lips thin, lower lip with a high symphyseal knob. Preorbital fairly wide, filling space between lip and eye, notched on anterior edge.

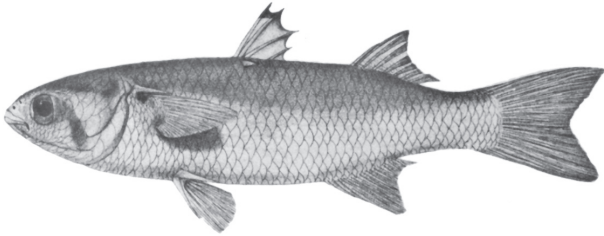


Fig. 37. *Valamugil speigleri* (Day, 1971)

First dorsal fin inserted nearer to snout tip than to caudal fin base; second dorsal fin origin on vertical through end of anterior-quarter of anal fin base. Pectoral fins slightly shorter than head length, reaching vertical through second dorsal spine. Pectoral axillary scale long, 32 to 34% of pectoral fin length; second dorsal and anal fins densely scaled; scales in lateral series 37 to 40.

Pectoral fins with a black axillary spot. First dorsal fin margin black; other fins dusky.

Genus *Liza* Jordan and Swain

No fleshy lobes between arms of lower jaw. Lower third of upper lip without papillae. Hind tip of maxilla curved down below tip of premaxilla.

Hind margin of scales not digitated; tip of maxilla visible when mouth is closed.

Liza subviridis (Valenciennes)

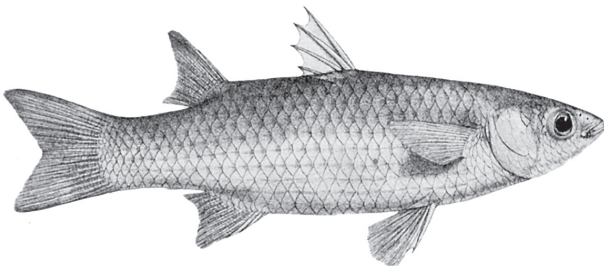


Fig. 38. *Liza subviridis* (Day, 1971)

Common name Greenback mullet

D₁ IV, D₂ i 8-9; A iii 9; P 16; V i 5

Adipose tissue covering iris.

Teeth labial, several rows of fine teeth on upper lip, one row of villiform teeth on lower lip.

Preorbital narrow, filling only 3/4 of space between lip and eye, anteriorly notched.

First dorsal fin inserted nearer to caudal fin base than to snout-tip, or midway between them; second dorsal fin origin on vertical between anterior-third and half of anal fin base.

Pectoral fin length 74 to 76% of head length. Pectoral axillary scale rudimentary or absent; second dorsal and anal fins densely scaled; scales in lateral series 27 to 32; 11 scales in transverse series.

Caudal fin edged with black.

Distribution: Inhabits coastal waters, including estuarine areas.

Liza tade (Forsskal)

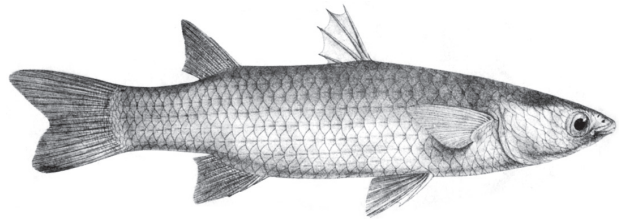


Fig. 39. *Liza tade* (Day, 1971)

Common name Tade mullet

D₁ IV, D₂ I 8; A III 9; P 17; V I 5

Body slender and elongate. Head wide, much depressed and pointed, its length 19 to 25% of standard length. Preorbital wide. First dorsal fin inserted nearer to snout tip than to caudal fin base (but midway in young ones); second dorsal fin origin on vertical through posterior half of anal fin base. Pectoral fin length 75 to 79% of head length, inserted slightly below horizontal line through centre of pupil; pelvic fin origin nearer to anal fin origin than to tip of snout. Caudal fin forked. Pectoral axillary scale rudimentary or absent; second dorsal and anal fins densely scaled; scales in lateral series 30 to 35.

Head of juveniles dorsoventrally more flattened, broader and somewhat pointed towards the snout. Second dorsal fin originates vertically through the posterior half of the anal fin base. Larvae measuring 1.7mm have pigments along the ventral aspects of the post-anal region and above pectoral region, a few minute spots at the caudal end.

Distribution : Indo-west Pacific. Primarily marine, but entering estuaries and back waters.

Genus *Sicamugil* Fowler

Spine on operculum above pectoral fin base.

Adipose eye lids absent.

Lips thin; lower lip with a symphyseal knob; no distinct teeth on jaws and palatines.

Sicamugil hamiltonii (Day)

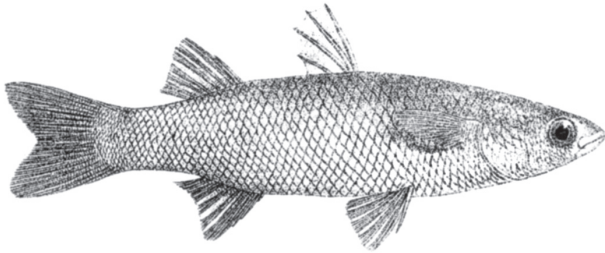


Fig. 40. *Sicamugil hamiltonii* (Day, 1971)

D₁ IV, D₂ i 8; A iii 9; P 12-14; V i 5

Dorsal fin inserted near to base of caudal fin than to tip of snout. Anal fin origin anterior to vertical from second dorsal fin origin.

Scales 43 to 47 in longitudinal series.

Colour: Back grayish, flanks and belly silvery shot with gold.

Family **CICHLIDAE**

Body moderately deep and compressed. Single nostril on each side of snout. Dorsal fin with 12 to 22 spines and 8 to 23 soft rays; anal fin with 3 to 16 spines and 6 to 24 soft rays. Lateral line in two sections, anterior one curved, parallel to dorsal profile, posterior one straight, along posterior part of the body.

Genus ***Etroplus*** Cuvier

Anal fin with 12-16 spines.

Etroplus suratensis (Bloch)

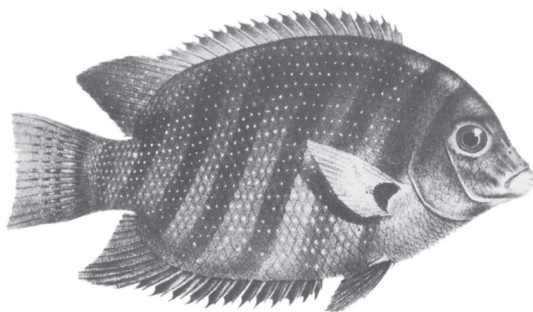


Fig. 41. *Etroplus suratensis* (Day, 1971)

Common name Banded pearl spot

Vernacular name Karimeen

D XVIII – XIX, 14-15; A XII – XIII, 11-12

Body very deep, short, oval and strongly compressed. Eyes large, its diameter 3 to 4 times in length of head.

Mouth small. Caudal fin slightly emarginate. Scales weakly ctenoid; lateral line interrupted at 16th or 18th scale; 35 to 40 scales in longitudinal series. Colour light green with six to eight not very prominent vertical bands (first across occiput, last across base of caudal fin) most of scales above lateral line with a central white pearly spot. Pectoral fins yellowish with a black blotch at its base.

Distribution, utilization: Inhabits brackish waters and mouths of rivers; often open sea. Thrive well where luxuriant growth of aquatic vegetation is available. Attain 10-12 cm and 113 g in one year in ponds. An excellent delicious fish, especially when large.

Etroplus maculatus(Bloch)

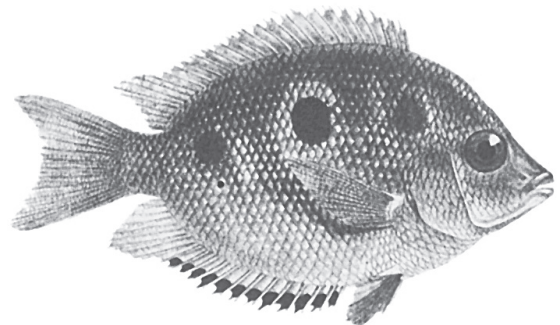


Fig. 42. *Etroplus maculatus* (Day, 1971)

Common name Spotted etroplus

Vernacular name Pallathi

D XVII-XX 8-10; A XII-XV 8-9; P i 15-16; V i 5

Body disc-shaped, very deep and strongly compressed.

Eyes large, the diameter about 3 times in head length. Mouth small; teeth villiform in 2 or 3 rows on jaws.

Caudal fin lunate. Scales weakly ctenoid; lateral line interrupted, with about 35 scales in longitudinal series.

Colour: Numerous horizontal lines of deep golden spots; three large, round black blotches on flanks, middle blotches largest and darkest. Spinous dorsal fin with several brown and yellow spots; pelvic fins deep black; anal and caudal fins yellowish, the former with a deep black border while the latter fin is with a reddish edge.

Distribution: Inhabits fresh and brackish waters along coastal areas of peninsular India.

Family **POLYNEMIDAE**

Body moderately elongate, somewhat compressed. Eyes with adipose tissue. Mouth subterminal, the

overhanging snout conical and prominent. Two widely separated dorsal fins. Pectoral fins divided into two sections, upper normal with rays attached and lower with 4 to 7 long unattached (free) rays; pelvic fins subabdominal.

Genus *Eleutheronema* Bleeker

Lower lip absent except towards the mouth corners; teeth extending on exterior part of jaws. Pectoral fins inserted low on body, upper part of its base well below middle line of body; a sharp fold of skin projecting down or forward from lower end of base of pectoral fin. Lateral line nearly straight.

Eleutheronema tetradactylum (Shaw)

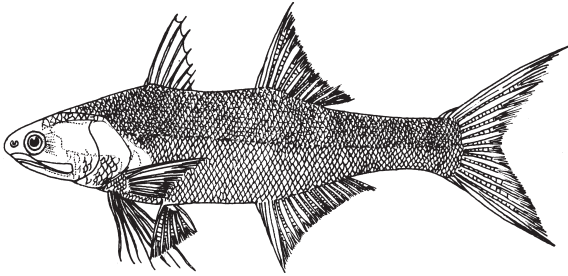


Fig. 43. *Eleutheronema tetradactylum* (Talwar & Jhingran, 1991)

Common name Fourfinger threadfin

D₁ VIII, D₂I 13-15; A II 15-17; P 17 + iv; V I 5

Pectoral fin in two parts, upper part with all rays unbranched and lower part with 4 free filamentous rays. Caudal fin forked, with lobes equal.

In larvae measuring around 7.5 mm in length, the mouth is large with prominent upper and lower jaws; cleft of the mouth located slightly towards the ventral profile of the head. Pectoral fins are not yet fully developed; spinous portion of the anal fin is traceable to some extent but not the spinous portion of the dorsal fins; caudal fin is somewhat truncated. Pre-anal myomere count increases and the corresponding post-anal myomere count decreases within the given range due to the posterior shifting of the anus. A black pigment spot is present at the nape region of the larvae and at times in the upper jaw.

Distribution : Inhabits sandy shores and muddy estuaries. Enters the estuary for breeding when the salinity of the water starts rising, ascends higher up the rivers than any of the other polynemids. Young ones are found in abundance in the lower reaches of the estuaries and the fishery of this species is sustained by the juveniles.

Genus *Polynemus* Linnaeus

Lateral line with its anterior part rising in long, low curve; pectoral fins inserted high on body, upper part of its base in level with midline of body or higher; without a sharp pectoral fold extending down from lower part of base of pectoral fin to cover bases of one or more of pectoral filaments; free pectoral filaments 7 or 8, very long.

Polynemus indicus (Shaw)

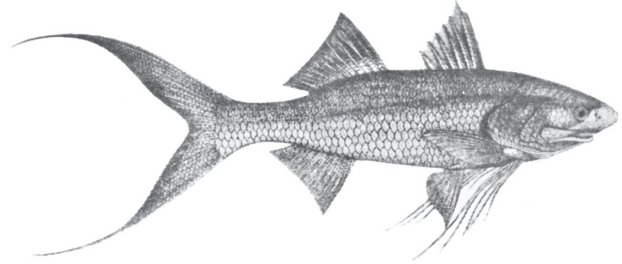


Fig. 44. *Polynemus indicus* (Munro, 1955)

Common name Indian tassel fish

D VIII; I, 13-14. A II-III, 11-12. P (2-3)+(12)+5

First 2-3 pectoral rays simple, remainder branched. Pectoral filaments reach almost to anal origin. Second dorsal originates in front of anal. Swim-bladder thick and very long. Body golden, much darker above, with faint lines along scale rows. Fins yellowish.

Larvae of 21st day after hatching attained a length of 22.4 mm and had become completely opaque. Dorsal fins formed; caudal fin distinctly forked, pelvic fin appeared as small buds; lower lobes of the pectoral fin was very conspicuous. Patches of dark black pigments noticed over the eyes and in the head region.

Larvae of 40th day of 31.8 mm length exhibited all adult characters. The young fish was black purplish at the back and the abdomen was silvery white dashed with gold.

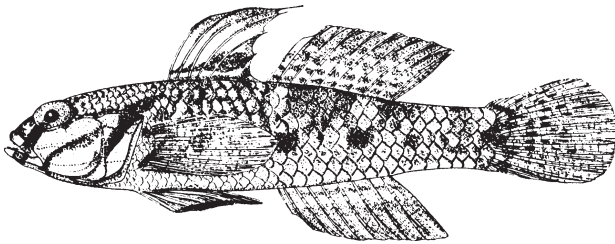
Distribution : Inhabits shallow sandy inshore areas; entering fresh waters during breeding seasons.

Family **GOBIIDAE**

Body elongate with scales; pelvic fins united, forming a disc.

Genus *Acentrogobius* Bleeker, 1874

Scales large, ctenoid; gill opening to just below pectoral base; pelvic a disc.

Acentrogobius audax Smith, 1959.Fig. 45. *Acentrogobius audax* 5.5 cm TL (Smith, 1986)

Common name Mangrove goby

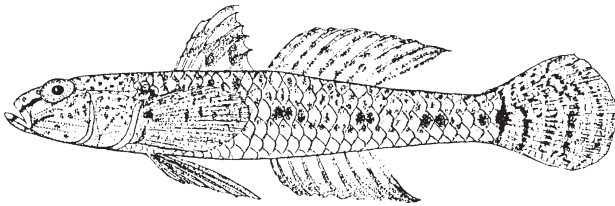
D VI + I, 9; AI, 9; P 17

No opercular scales. Caudal peduncle with curved dark bar followed by a dark bar on caudal base.

Distribution: Tropical species found on mud and sand bottoms.

Genus *Favonigobius* Whitley, 1930

Gill opening extending to below mid-operculum; no scales on opercle or pre-opercle; ventral a disc.

Favonigobius reichei (Bleeker, 1953)Fig. 46. *Favonigobius reichei* 5 cm TL (Smith, 1986)

Common name Tropical sand goby

D VI + I, 8; AI 8; P16

Snout gently sloping; bar from eye to upper jaw at an angle of about 40° with body axis.

Body with numerous small spots; mid side with 4 or 5 slightly enlarged groups of black spots, last spot on peduncle paired; median fins spotted.

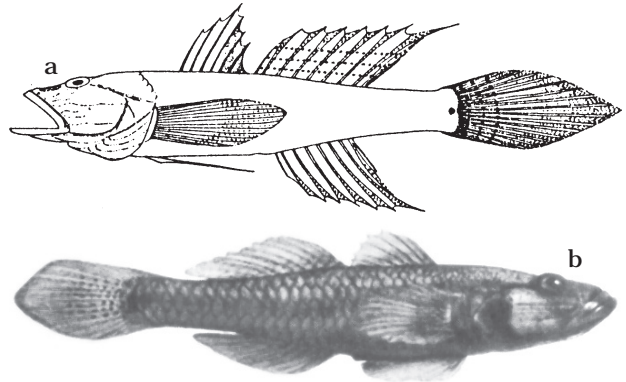
Genus *Glossogobius* Gill, 1862.

Snout elongate; head depressed; gill opening from below rear of preopercle to below eye. Pelvic fins form a disc. Scales ctenoid; operculum and cheek naked.

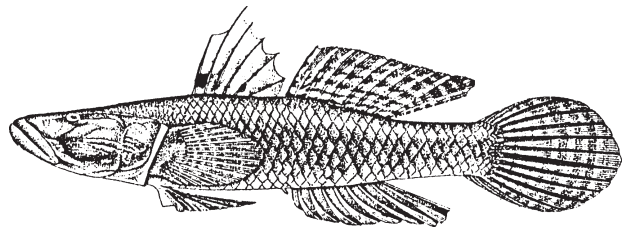
Glossogobius callidus (Smith, 1937)

Common name River goby

D VI + I, 8-10; AI, 7-9; P 14-19; lateral scales 28-32.

Fig. 47. *Glossogobius callidus* (a) 9 cm (b) 10.5 cm (Smith, 1986)

Dorsal with some spotting, but spots not prominent along front edge of 2nd dorsal; a thin dark stripe from eye to upper lip; enlarged vertical bar or spot at caudal base.

Glossogobius giuris (Hamilton -Buchanan)Fig. 48. *Glossogobius giuris* 23.5 cm (Smith, 1986)

D VI; I, 8-9; A 1, 8;

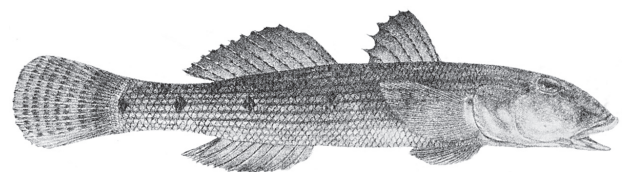
Lateral row scales 30-34; 16-22 predorsal scales.

Papillae pattern: lines 9-10 in three or more rows, lines 15 and 16 separated, lines 17 and 18 separated, lines 20, 21 and 22 unbranched.

Dorsal with small spots forming longitudinal stripes, spots darkest along spine of 2nd dorsal.

Genus *Awaous* Valenciennes

Head elongate, broader than deep; interorbital space broad. Small finger like flaps on shoulder girdle. Dorsal fins close to each other; all dorsal spines thin and flexible, pelvic fins united and form disc. Scales on body ctenoid.

Awaous gutum (Hamilton-Buchanan)Fig. 49. *Awaous gutum* (Day, 1971)

DVI+I 10; A I 10; P i 15-17

Eyes fairly small, its diameter 4.5 to 5 times in head.

Scales on operculum, breast and belly cycloid, on occiput ctenoid; 51 to 58 scales in longitudinal series. Predorsal scales 17 to 24.

Colour: Head with irregular blackish spots and two longitudinal blackish streaks from eye to maxilla; body with blackish spots; a blackish spot on base of caudal fin and also on base of pectoral fin. Fins yellowish; first dorsal fin with 3 or 4 and second dorsal fin with 5 or 6 longitudinal dark streaks.

Fishery information: Inhabits rivers and estuaries. This species attains a length of 15 cm SL; of no interest to fisheries.

Family **TRYPAUCHENIDAE**

Body eel-like, pelvic fins united, eyes very small. Pouch like cavity in opercular region.

Genus *Trypauchen* Valenciennes

Body elongated and compressed. Head compressed with a bony median crest on occiput. Eyes minute. Mouth very oblique. Lower jaw prominent. Dorsal and anal fin continuous, confluent with caudal fin. Pectoral fins small; pelvic fins small, completely united forming a disc. Caudal fin pointed. Scales small, cycloid.

Trypauchen vagina (Bloch & Schneider)

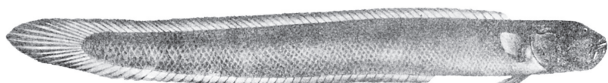


Fig. 50. *Trypauchen vagina* (Day, 1971)

Common name Burrowing goby

D VI 39-47; A I 40-46; P 15-17

Body elongate and compressed. Teeth in several rows pointed, outer row enlarged. Dorsal and anal fin continuous. Scales small, 80-100 in longitudinal series; head naked.

Distribution, utilization: Inhabits seas and estuaries. Attains a length of 22 cm. This species is of no interest to fisheries.

Suborder **Gobiodei**

Head with mucous canals and open pores. Mouth terminal bordered by protractile premaxillaries. Spinous dorsal fin with 1 to 8 flexible spines; anal fin similar to soft dorsal fin without or with a feeble spine. Pelvic below pectoral fins with one spine and 4-5 soft rays. Vertebrae 25-35.

Family **ELEOTRIDIDAE**

Body oblong to elongate; pelvic fins separate, bases close together. Mouth never inferior, teeth small and conical, in several rows. Two dorsal fins; first fin with 6 flexible spines, second fin short based, rays I 8 to 19. Anal fin inserted just behind dorsal fin origin, rays I 6 to 19. Caudal with 15 or 17 rays. Pelvic fins I 5, widely separated. Body scaled, no lateral line on body.

Genus *Butis* Bleeker

Preopercle angle without spines; no teeth on vomer; bony ridge above eye. Jaws and snout elongate, snout flat, about twice eye diameter; lower jaw projecting; head flat.

Butis butis (Hamilton – Buchanan)

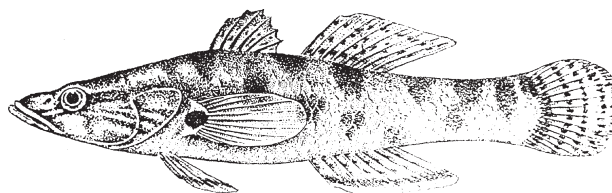


Fig. 51. *Butis butis* (Talwar & Jhingran, 1991)

Common name Duck bill sleeper

D₁ VI, D₂ I 8; A I 8; P 18-20; V I 5

Blackish, lighter below, with several dark lines. Caudal fin black with a light margin dorsally. Pectoral fin base with one or two black spots.

Distribution, utilization: Carnivores, often sluggish fishes of shallow waters from marine to fresh water conditions, especially estuaries. Of no interest to fisheries.

Family **TRICHIURIDAE**

Body extremely long, compressed and ribbon like. Mouth large, lower jaw projecting. Dorsal fin low and long based, inserted shortly behind eyes, its anterior spinous part shorter than posterior soft portion; tail tapering to a point. Scales absent; lateral line single.

Genus *Trichiurus* Linnaeus

Pelvic fin absent; pectoral reaching lateral line; head profile not convex.

Trichiurus lepturus, Linnaeus

Common name Ribbon fish

D III, 124-138; A II, 105-108; P 10-12

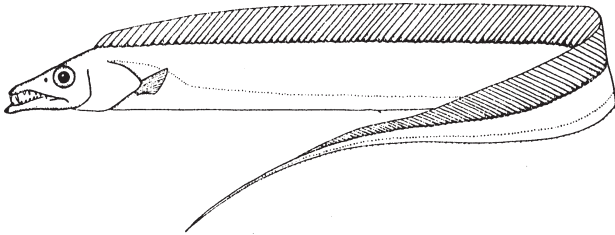


Fig. 52. *Trichiurus lepturus* (Smith, 1986)

Head with a prominent crest. Lower rear margin of gill cover concave. Small cartilaginous knob on tip of each jaw. Anal not apparent, with 2 minute triangular spines and about 105 soft rays reduced to minute spinules.

Juveniles (59-240 mm length) with following fin formula : D128; A 98; P 10-11. Post-anal myomeres more than 100. Single ventral pigment patch on tail, series of melanophores along dorsal margin.

In yolk sac larvae, few scattered pigments from tip of snout to above midbrain, few on gut; large ventral patch posteriorly on tail, extends well onto finfold. Dorsal series of pigments beginning at dorsal origin by 6.5 mm, spreading anterior above hindbrain by 7.4 mm and caudad to ca. 90% body length by 20mm; few pigments at tip of lower and upper jaws after 16mm; series on dentary; 1-2 ventrally on basihyal; anteriorly on gut.

Distribution: Often benthopelagic on continental shelf and slope. Inhabits coastal water and estuaries.

Family SCOMBRIDAE

Small or relatively large scales, larger on cheeks; 5-7 detached finlets. Includes mackerels, tunas, seerfishes, billfishes etc. Salient features of Scombroid larva are their short truncated shape, large head relative to the rest of the body and presence of strong preopercular spines and the sharply pointed snout with well developed teeth on jaws.

Genus *Rastrelliger* Jordan & Starks, 1908

Adult body depth greater than head length. Absence of preopercular spines identifies the larvae and post larvae of *Rastrelliger* from other scombroids.

Rastrelliger kanagurta (Cuvier, 1816)

Common name Indian mackerel

Vernacular name Ayala

D X; 12; 5 A 12; 5

Body moderately deep, its depth at margin of gill cover 4.0-4.8 times in standard length.

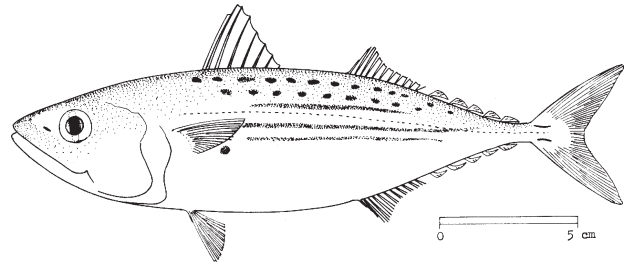


Fig. 53.1. *Rastrelliger kanagurta* (Fischer & Whitehead, 1974)

Head longer than body depth. Well developed adipose eyelids. Second dorsal and anal fin followed by 5 finlets.

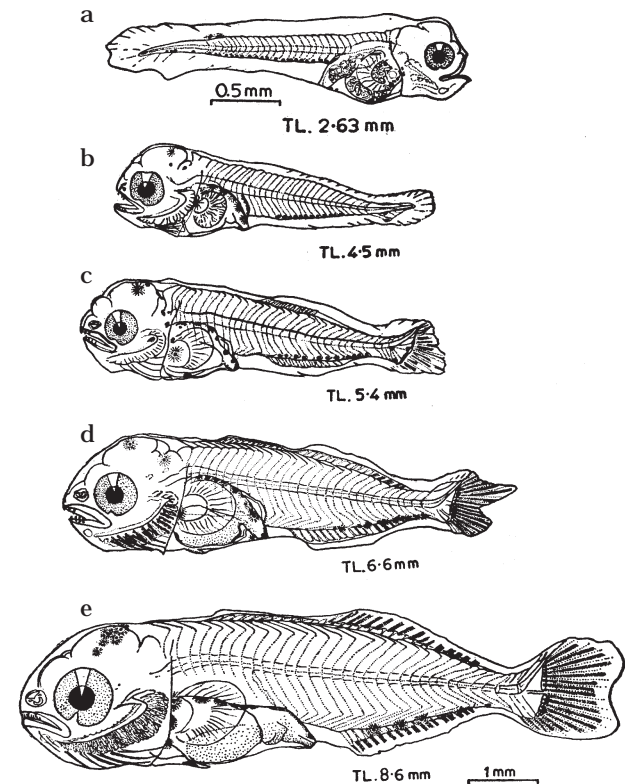


Fig. 53.2. Camera Lucida drawings of larvae of *Rastrelliger kanagurta* (Silas, 1974)

Short bodied larva with 31 myomeres, 10 of which are pre-vent in position. Number of myomeres are variable until the full complement is formed in 2.63 mm larva (Fig.53.2 a). Myomeres grow obliquely with zig zaging in most of the segments by about 5.4 mm. The head, especially the mouth with the more prominent lower jaw, the large eyes and the short intestine are characteristic. The upper jaw and snout region appears 'pug-nosed'. Disposition of melanophore pigmentation is characteristic. A row of

about 30 melanophores present from behind the base of the larval pectoral fin to close to the end of the urostyle along the ventral side. This number decrease with growth and in older larvae, the post vent row of melanophores vary from 11 to 14.

In larvae above 4 mm, the post vent melanophores are absent in the first four myomeres behind the vent. Stellate chromatophore on the occipital region of the head after the hypural plates are formed. Chromatophores along the dorsal part of the peritoneum and ventral side of abdomen are diffuse. On the caudal region, a melanophore present at the base of the urostyle and two on the dorsal margin of two of the lower hypural plates (Fig. 53.2 a-c). Stellate chromatophore at the base of the larval pectoral fin, a dark chromatophore above the stomach and another on the posterior border of the intestine at the place where it bends downwards to the vent, present.

Family **STROMATEIDAE**

Ovate, compressed body covered with moderately small scales. Head mostly scaly. Lateral line simple and complete. Moderately small mouth with weak jaws and a single series of slender pointed teeth. Dorsal with a distinct spinous portion but spines more or less wholly embedded in the skin.

Pampus chinensis (Euphrasen)

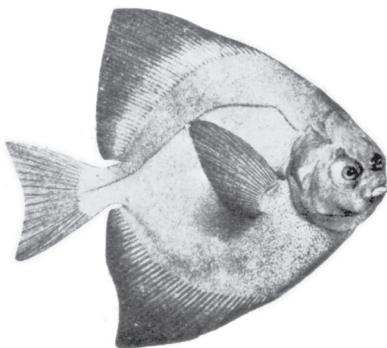


Fig. 54. *Pampus chinensis* (Munro, 1955)

Common name Chinese pomfret

D 43-50; A 39-42; P 23-25

Posterior part of dorsal comprising rays of gradually decreasing height after 16th. Anal similarly concave along its border. Caudal emarginate in young, more slightly forked in adults.

Body of the juveniles is compressed and deep, terminal mouth; gill opening looks like a vertical slit. Stellate pigment is at times present on the head;

preoperculum ridge is not yet discernible at this stage; dorsal profile between the snout and dorsal fin origin slightly depressed. Blade-like spines absent prior to the dorsal and anal fin origin. Pelvic fins absent.

Distribution : Inhabits waters over muddy bottoms of the continental shelf ; down to 100 m.

Pampus argentius (Euphrasen)

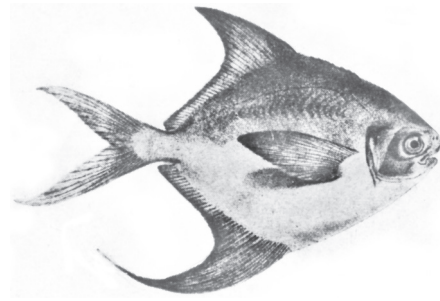


Fig. 55. *Pampus argentius* (Munro, 1955)

Common name Silver pomfret

D V-IX; I, 37-43; A I, 38-43; P 23-26

Posterior part of dorsal comprising rays of equal length. Blade like spines present anterior to dorsal and anal fins; caudal fin deeply forked with longer lower lobe; medians fins are not very broad; dorsal and anal fins originate well behind the pectoral fin origin; groove like pigmentation at times present near the nape.

Distribution : Inhabits waters over muddy bottoms, down to 100 m.

Family **SIGANIDAE**

Relatively short, round snout, seven spines in the anal fin, two spines in the pelvic fins, a forward -pointing spine in front of the dorsal fin and no spines laterally along the tail.

Siganus javus (Linnaeus)

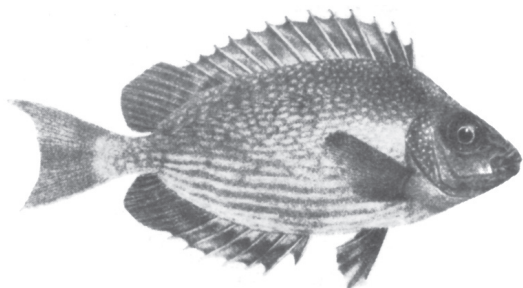


Fig. 56. *Siganus javus* (Day, 1971)

D XIII, 10; A VII, 9

Common name Streaked spinefoot

Back dark bronze, paler below, with blue spots on head and upper sides; blue undulating lines on mid and lower sides. 30-35 scale rows between lateral line and base of dorsal spines. Body depth 2.0-2.3 times in standard length.

Distribution: Indonesia, India, Thailand, Taiwan, New Guinea, Gulf of Oman.

Order PLEURONECTIFORMES

Flattened body shape; eyes present on one side of body only.

Genus *Solea* Quensel 1806.

Larval finfold sometimes show stellate pigments. During post larval development there is a metamorphosis involving the shifting of the left eye to the right side.

Solea heinii Steindachner 1902

Possess a hump at the posterior dorsal aspect of the skull in early stages.

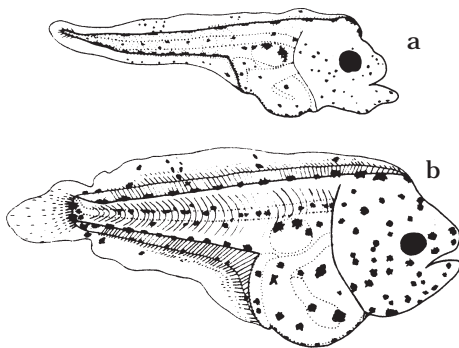


Fig. 57. *Solea heinii* larvae (a) 2.7 mm (b) 3.2 mm standard length (Balakrishnan & Devi, 1974)

A circular intestinal coil which soon transforms into an oval one and fills the space between the cleithrum and intestine; a much forwardly bent distal half of the cleithra. Eyes symmetrical and black; swim bladder present. A snout which is almost equal to or exceeds the horizontal diameter of the eye. Dense dark brown pigment spots or patches all over the body. 32 myotomes in 2.5 mm larva, and 33 in 2.7 mm stage. 37 vertebrae including urostyle visible in 3.2 mm larva. In 3.2 mm larva, median fins are continuous but remain separate from caudal, 68 dorsal and 55 anal rays, hypurals well developed, urostyle strongly deflected dorsalward, 14 caudal rays visible.

S. heini differs from *S. ovata* in the presence of a hump, number of fin rays, pattern of pigmentation and length of larvae at different stages.

Genus *Cynoglossus* Hamilton – Buchanan 1822

Embryo pigmented with stellate chromatophores on its body and larval fin fold. A tentacle develops dorsal to the head in early postlarval stage which is the first dorsal ray followed by the development of the second to a few more rays in further stages.

Cynoglossus puncticeps Richardson, 1846.

Larvae comparatively small. Presence of elongated rays at the anterior end of the dorsal fin fold, development of ventral fin at a very early stage, number of vertebrae 49, metamorphosis taking place when the larvae attain a length of 4.3 to 4.9 mm are the characteristics that distinguish *C. puncticeps* from other cynoglossids.

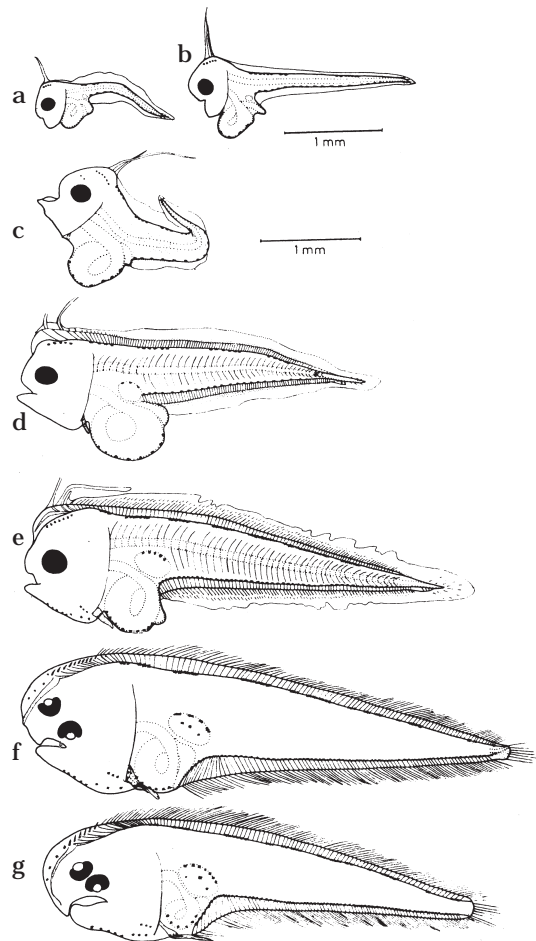


Fig. 58. Larvae of *Cynoglossus puncticeps* (a) 1.4 mm S.L. (b) 2.2 mm S.L. (c) 2.5 mm S.L. (d) 3.4 mm S.L. (e) 4.2 mm S.L. (f) Metamorphosed larva of *C. puncticeps* 4.9 mm S.L. (Balakrishnan & Devi, 1974)

At 1.4 mm (Fig. 58.a) dorsal fin fold commence at the level of the eye where a tentacular process and ray is present. At 2.2 mm (Fig.58.b) second elongated

ray differentiated. Interspines differentiate at 2.5 mm (Fig.58.c). At 3.5 mm, bases of 98 dorsal and 79 anal rays discernible; anterior end of dorsal fin fold continues to grow beyond the elongated rays. Swim bladder occupies the space between 5th and 10th vertebrae.

In the metamorphosed larva of 4.9 mm (Fig.58.f) right eye lies in front of the left one. Tubular nostril in front of the left eye. Cleft of the mouth asymmetrical, the left oblique and the right curved, anus on the right side. 49 vertebrae. Dorsal fin fold extended to the snout and first interneural spine extends to its tip corresponding to the rostral hook of the adult. 107 dorsal and 83 anal rays, elongated dorsal rays lost, caudal with 7 rays, pectoral fin absent, 4 rays in the ventral fin.

Cynoglossus brevis Gunther 1862

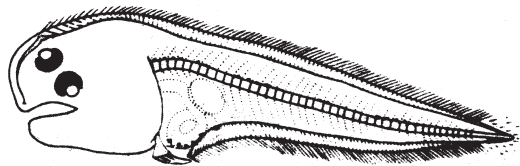


Fig. 59. Metamorphosed larva of *C. brevis* 4.0 mm standard length (Balakrishnan & Devi, 1974)

Metamorphose earlier than *C.puncticeps*. In the 4.0 mm metamorphosed larva, the right eye lies a little in front of the left one, cleft of the mouth assymetrical. Head length more, but the number of vertebrae (43), fewer than in *C.puncticeps*. Development of fin rays early, 94 dorsal and 76 anal rays discernible. Elongated rays of dorsal fin absent; pectoral fin absent, ventral fin has 4 rays.

Cynoglossus cynoglossus Hamilton Buchanan, 1822

Robust body, myotome 47 at 1.6 mm (Fig.49.a) functional mouth and eye not differentiated indicating a longer larva than *C.puncticeps*. Mouth absent, intestine parallel to the body. Rudiments of first elongated dorsal rays supported by first interneural spines seen as a small tentacular organ at the anterior end of the dorsal fin fold. Irregular dark brown pigment patches and spots over the body.

At 1.9 mm (Fig.49.b), mouth developed, intestine seen as a circular coil, tentacular organ lengthier. 47 vertebrae countable in 3.5 mm larva (Fig.49.c), two elongated rays present in place of dorsal tentacle, rostral hook extends over to snout. Swim bladder present between 5th and 10th vertebrae. 97 dorsal, 78 anal and 7 caudal rays in 4.1 mm larva. In the

metamorphosed larvae of 4.7 mm (fig.49.f) right eye lies a little in front of the left eye.

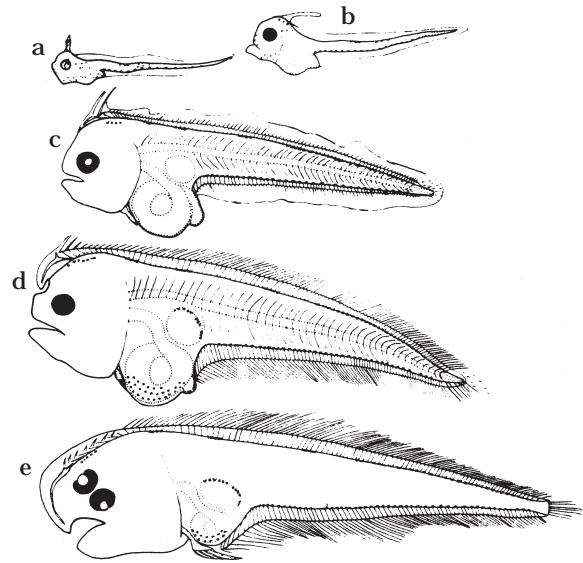


Fig. 60. Larva of *C. cynoglossus* (a) 1.6 mm SL (b) 1.9 mm SL (c) 3.5 mm SL (d) Metamorphosed larva of 4.7 mm (Balakrishnan & Devi, 1974)

102 dorsal, 76 anal and 7 caudal rays present. Elongated dorsal rays absent at the anterior end.

Cynoglossus lida (Bleeker) 1852

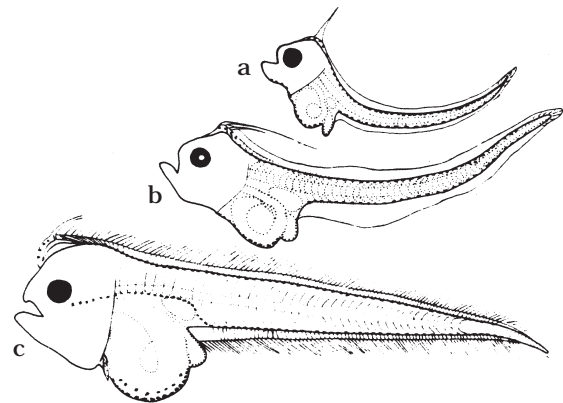


Fig. 61. Larva of *C. lida* : (a) 2.1 mm SL (b) 3.3 mm SL (c) 4.6 mm SL (Balakrishnan & Devi, 1974)

Ratio between standard length and depth at cleithra comparatively more than *C.puncticeps*, *C.brevis* and *C.cynoglossus*. At 2.1 mm, mouth and anus well developed, intestine a circular coil with rectal portion remaining separate from the rest; a small swim bladder present; two elongated rays at the anterior end of dorsal fin fold. At 3.3 mm, vertebral segments discernible, ventral fin rudiments visible. Remain a symmetrical post larva even at 4.6 mm (Fig.61. c). 45 vertebral segments, 100 dorsal and 82 anal rays

discernible; interspines developed smaller than other species. Rostral hook reaches only half way over the snout.

Cynoglossus macrostomus Norman

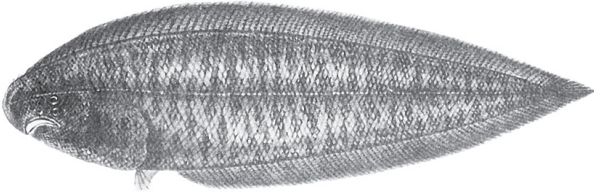


Fig. 62. *Cynoglossus macrostomus* (Day, 1971)

Common name Malabar sole

D 100-106; A 78-84; V 4; C 10

Body tongue-shaped.

Snout obtusely pointed; angle of mouth reaching well beyond lower eye, eyes nearly contiguous.

Two lateral lines on ocular side, separated by 14 to 16 rows of scales; no lateral line on blind side.

Scales ctenoid on both sides of body.

Colour: in life, ocular side light brown with dark brown mottling forming diffuse, irregular cross bands; blindside whitish, dorsal and anal fins grey-black.

Distribution: Inhabits shallow and sandy bottoms of the continental shelf, also in estuaries.

Order **TETRADONTIFORMES**

Gill opening restricted to lateral slits. opercular bones and branchiostigal rays covered by thick skin, pelvic fins absent or strongly reduced; anal fin spines absent; caudal fin rays 7 to 10; mouth small with strong teeth frequently coalesced into a biting plate.

Family **TETRADONTIDAE**

Body broadly rounded in cross-section, heavy and blunt. Head large, broad and blunt. Jaws with fused teeth.

Dorsal and anal fins inserted far posteriorly; no fin spines; pelvic fins absent.

Genus ***Chelonodon*** Muller

Nasal organ in form of a depression with slightly raised margin expanded before and behind into a pair of flaps, side naked.

Chelonodon patoca (Hamilton -Buchanan)

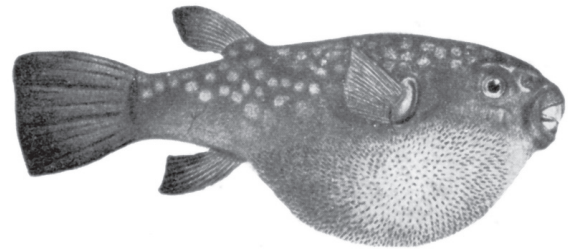


Fig. 63. *Chelonodon patoca* (Day, 1971)

Common name Gangetic puffer fish

D 9-10; A 8-10; P 15-16

Head very broad, upper profile of snout to caudal fin evenly arched; inter-orbital space flat and broad.

Nostril a round depression surrounded by a low rim produced into a posterior and anterior flap.

Body with a spiny patch on back, throat and belly; sides naked.

Colour: Body brown, belly golden yellow (in life); black and sides with white spots; juveniles have broad dark bars across back, between eyes, above base of pectorals and below dorsal.

Distribution: Indo-west pacific.

Suggested References

- Anon, 1974. Plankton, fish eggs and larvae studies. *Progress Report No.7*, UNDP/FAO Pelagic Fishery Project, Cochin: 21 pp.
- Bensam, P. 1967. On a few post-larval stages of *Anadontostoma chacunda* Hamilton. *Indian J. Fish.*, **14** (1) 48-53.
- Bensam, P. 1987. Early developmental stages of some marine fishes from India. *La mer*, **25**: 43-52.
- Balakrishnan, K.P. and C.B.L. Devi 1974. Larvae of some flat fishes from a tropical estuary in : *The early Life History of Fish*. Blaxter, J.H.S. (Ed.). Springer - Verlag, Berlin.
- CMFRI, 1989. Proceedings of the Summer Institute in Recent *Advances on the Study of Marine Fish Eggs and Larvae*. P.O. Box 1603, Ernakulam North P.O., Cochin - 682 018.
- Day, F. 1971. The fishes of India being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon. Vol II Atlas. Today & Tomorrow's Book Agency, New Delhi.
- Dileep, M.P. 1977. The larval development and distribution of *Saurida tumbil* (Bloch). *Proc. Symp. on Warm Water Zooplankton*, N.I.O, Goa: 460-473.

- Fischer, W. and G.Bianchi (Ed.) 1984. FAO species identification sheets for fishery purposes. Western Indian Ocean, *Fishing area 51*.
- Fischer, W. and P.J.P. Whitehead, 1974. FAO identification sheets for fishery purposes. Eastern Indian Ocean (*fishing area 57*) and Western Central Pacific (*fishing area 71*). **Vol. 1&2**.
- Jayaram K.C. 1982. Aid to the identification of the silurid fishes of India, 5. Ariidae and Plotosidae. *Rec. Zool. Surv. India Occ. Paper*, (8) : 1-41.
- Jones W. Philip, F.Douglas Martin and Jerry D. Hardy Jr. 1976. Development of fishes of the Mid – Atlantic Bight – An atlas of egg, larval and juvenile stages. *Vol.I to VI, Fish and Wildlife Services*, US Dept. of Interior.
- Kulkarni C.V. 1940. On the systematic position, structural modifications, bionomics and development of a remarkable new family of cyprinodont fishes from the province of Bombay. *Rec. Indian Mus.*, **42** (2): 379-423.
- Kuthalingam, M.D.K. 1960. Studies on the life history and feeding habits of the Indian thread-fin *Polynemus indicus* (Shaw). *J. Zoo. Soc. India*. **12** (2) : 191-197
- Misra, K.S. 1976. *The fauna of India and the adjacent countries*. Pisces 3. Teleostomi : Cypriniformes, Siluri. xxi + 387 pp.
- Moser H.Geoffrey (Ed.) 1985. *The early stages of fishes in the Californian current region*. CALCOFI Atlas No.33. National Marine Fisheries Service, Southwest Fisheries Science Centre, La Jolla, California.
- Munro, Ian S.R. 1955. *The marine and fresh water fishes of Ceylon*. Dept. of External Affairs, Canberra. 394 pp + 52 plates.
- Nair, G.S. 1957. On the breeding habits and development of *Ambassis gymnocephalus* (Lac.) *Bull. Cent. Res. Ins. Univ. Travancore*, 5 C (1) : 69-76.
- Premalatha P. 1977. A study of the development and distribution of the larvae of leather skin *Chorinemus sanctipetri* (Cuv & Val). *Proc. Symp. on Warm Water Zooplankton*, N.I.O, Goa: 450-459.
- Prince Jayaseelan, M. J., Ramanathan, N., Sundararaj, V., Venkataramanujam, K. and Devaraj, M. 1998. *Manual of fish eggs and larvae from Asian mangrove waters*. UNESCO.
- Russel, F.S. 1976. *The eggs and planktonic stages of British marine fishes*. Academic Press, London. 524 pp.
- Sarojini, K.K. and Malhotra, J.C. 1952. The Larval Development of the so-called Indian Salmon, *Eleutheronema tetradactylum* (Shaw). *J. Zool. Soc. India*. **4** (1): 60-71.
- Silas, E.G. Larvae of the Indian mackerel, *Rastrelliger kanagurta* (Cuvier) from the west coast of India. *Indian J. Fish.*, **21** (1): 233-253.
- Smith M. Margaret and Philip C.Heemstra (Ed.) 1986. *Smiths' Sea Fishes*, Springer Verlag, New York. 1047 pp.
- Sreekumari, A. 1977. Development and distribution of the larvae of the whitebait *Stolephorus zollingeri* Bleeker. *Proc. Symp. Warm Water Zooplankton. Spl. Publ.*, N.I.O., Goa. 440-449.
- Talwar, P.K. and Jhingran, A.G. 1991. *Inland fishes of India and adjacent countries*. Oxford and IBH Publ.Co., New Delhi. 1158 pp.
- Talwar, P.K. and Kacker, R.K. 1984. *Commercial Sea Fishes of India*. Zool. Surv. India.
- Vatanachai, S. 1974. *Proc. Indo-Pacific Fish. Counc.*, 15th Session. Section III : 111-130.

Fishery in Mangroves - A livelihood for Artisanal Fisherfolk



Pearl spot (*Etroplus suratensis*)-
A prominent brackishwater species exploited from Kerala mangroves.



Eel (*Anguilla anguilla*)-
Catadromous migrate from river to sea through an estuary/mangrove for breeding.



Cat fish (*Tachysurus*)-
from mangroves by gillnets and hook & line.



Processing & Marketing of mixed catch of fish, prawn & shellfish by artisanal fishery.

