

## A SYSTEMATIC REVIEW OF THE FISHES OF THE FAMILY LEIOGNATHIDAE\*

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### ABSTRACT

The fishes of the family Leiognathidae form a well-defined group and are widely distributed in the Indo-Pacific. Though small in size, a few species form dense schools in shallow regions, offering great potentialities for commercial exploitation. They are an important source of food and fish meal.

The revision collates earlier literature, supplementing with original data based on examination of fresh material of 18 species of the three genera, *Leiognathus* Lacépède, *Secutor* Gistel and *Gazza* Rüppell from the seas around India and re-examination of types of some species.

The characters mainly used by earlier authors to separate the species are the presence or absence of scales on head and chest, number of lateral line scales and their posterior limit, and proportional measurements. Since scales are markedly small and deciduous, accurate counts are difficult to obtain. Proportional measurements show a great amount of overlap amongst species which, therefore, need to be used with discretion. While meristic counts are of little taxonomic value, colour pattern has been found useful in distinguishing at least groups of species, if not species.

Beside giving detailed descriptions and keys, the revision assigns a place to every nominal genus and species, gives diagnoses for all genera and species arguing the case for synonymies with whatever detail the individual cases may demand.

The species described here include two new records and one new species already reported by the author from the Seas around India.

### INTRODUCTION

FROM the abundance point of view on an all India basis, the fishes of the family Leiognathidae, rank as one of the important groups of fishes at the present day. In recent years new fishing grounds have been found and their catches have been substantially increased. Because of this fishery importance, a comprehensive study of this group was undertaken. Before any detailed biological studies are made, a systematic study of the family was considered necessary especially since the family was not revised after Day (1876) and Weber and de Beaufort (1931). A few of the species described by these authors also need comment and clarification as to their position in the system. Some of the characters described by them for the same species are also found contradictory. Certain others have dealt with species from certain geographical areas (Smith, 1949; Herre, 1953; Munro, 1955; Smith and Smith, 1963; Marshall, 1964; Munro, 1967; Tiews & Cweces-Borja, 1965) along

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with the keys to species which include characters that are difficult to ascertain. The present account assigns a place to every nominal genus and species and gives diagnoses for all genera and species arguing the case for synonymies with whatever detail the individual cases may demand. For this purpose, fresh material of all the genera and available species collected at several places along the Indian coast were examined. Data were also obtained on re-examination of types of some species and included at relevant places.

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#### RELATIONSHIPS OF THE FAMILY

The family Leiognathidae is one of the families of fishes of the division Perciformes of the sub-order Percoidea under order Percomorpha. Authors differ in associating Leiognathidae with Gerridae in one family. Bleeker (1845) included *Equula* (*Leiognathus*) and *Gazza* under Carangidae, removing *Gerres* and *Pentaprion* to a subfamily Gerriformes. Gunther (1862) placed the family Gerridae in the "Acanthopterygii Pharyngognathi" and *Equula* and *Gazza* in Carangidae. Regan (1913) included *Leiognathus*, *Gazza* and *Gerres* in the family Leiognathidae closely allied to Lutianidae. Jordan (1923) stated that the resemblance of *Leiognathus* to *Gerres* seems to be superficial, not indicating any special affinity. Weber and de Beaufort (1931) do not agree with this view and united *Leiognathus* and Gerridae in the family Leiognathidae. Berg (1940) included Leiognathidae and Gerridae in the family Leiognathidae. Smith (1949) separated *Leiognathus* and *Gerres* into two separate families, Leiognathidae and Gerridae respectively which has been followed by Munro (1955). In the present account also, Leiognathidae and Gerridae are treated as separate families. No doubt, the two groups are closely related which lead many earlier authors to combine them into a single family but the differences are deep enough to justify their separation. In support of this view, may be cited the characters of the Leiognathidae like the presence of bony ridges and a nuchal spine on top of head, small scales which are absent on head (except in *L. elongatus*), gill membranes attached to isthmus in contrast to those of Gerridae. In addition, possession of five branchiostegals is characteristic of Leiognathidae whereas there are six branchiostegal rays in Gerridae.

#### CHARACTERS OF THE FAMILY LEIOGNATHIDAE

Body oblong or elevated, compressed, covered with small, smooth cycloid scales, absent on head (except in one species, *L. elongatus*), scales on breast, often thin and diaphanous, the breast appearing naked, lateral line complete, becoming obsolete posteriorly. Head on top with bony ridges and a nuchal spine. Eyes lateral. Gape of mouth small, horizontal or oblique. Mandible straight or concave. Mouth very protractile, the long premaxillary stalk lying in a groove on top of head; when fully protracted it forms a tube directed horizontally, upwards or downwards. The upper parts of maxillae form a ring through which the premaxillary stalk slides up and down. Lower margin of preoperculum serrate. Branchiostegal

five; gill membranes attached to isthmus, pseudobranchiae present. Lower pharyngeal bones free. Teeth wanting on palate; in jaws, minute, in single series or in upper jaw a series of sharp teeth and a curved caniniform tooth on each side of symphysis, in lower jaw a series of curved, pointed teeth, with a pair of symphyseal caniniform teeth with a notch between them to receive the upper caniniform teeth. A single dorsal with VIII spines and 16 rays with a conspicuous basal sheath; anal with III spines and 14 rays; second dorsal and anal spine the longest. Pectorals short; ventrals thoracal, with one spine and 5 rays and an axillary scale-like process. Caudal deeply emarginate.

#### THE GENERA

The family Leiognathidae as defined above includes according to some authors two (*Leiognathus* Lacépède and *Gazza* Rüppell) and according to others three (*Leiognathus* Lacépède, *Gazza* Rüppell and *Secutor* Gistel) genera. While all earlier authors referred to two genera (*Leiognathus* and *Gazza*), recent authors like Smith (1949) and Munro (1955) placed the fishes in the three genera. A few authors used the generic name *Equula* (Bleeker, 1817; Cuvier, 1817; Cantor, 1850; Günther, 1860; Kner, 1865-67; Day, 1876; Macleay, 1881; de Vis, 1884; Klunzinger, 1884; Meyer, 1885; Dunyaev, 1904; Jordan and Seale, 1906; Seale, 1910 and Weber, 1913) for *Leiognathus* but the latter had priority as most modern authors have used.

#### KEY TO THE GENERA OF THE FAMILY LEIOGNATHIDAE

- I. Caniniform teeth absent.
  1. Mouth horizontal, when protracted directed downwards.....*Leiognathus* Lacépède
  2. Mouth oblique, when protracted directed upwards.....*Secutor* Gistel
- II. Caniniform teeth present.....*Gazza* Rüppell

#### THE SPECIES UNDER THE THREE GENERA

From the entire range of their distribution in the Indo-Pacific, 17 species of this family have so far been recognised valid by a number of authors. Of these, 13 were placed under the genus *Leiognathus* Lacépède, two under the genus *Secutor* Gistel and two under the genus *Gazza* Rüppell.

In the present study 17 species, 13 of *Leiognathus* and two each of *Secutor* and *Gazza* were collected, including two new records for the Indian seas, namely *Leiognathus leuciscus* (Günther) and *L. smithursti* Ramsay & Ogilby (James, 1969) and a new species, *L. jonesi* James (James, 1971). The 14th species of *Leiognathus* viz., *L. elongatus* Günther has so far not been collected from Indian seas. Therefore, the description of this species given by Smith & Pope (1906) along with data on the type obtained from the British Museum were included in this account. Thus it makes a total of 18 species - 14 under *Leiognathus* and 2 each under *Secutor* and *Gazza*.

In addition to the 13 widely recognised species of *Leiognathus* till recently, three more species have been lately mentioned, one by Marshall (1964) and two by Munro (1967). *L. moretoriensis* Whitley, referred to by Marshall (1964) was revived only by him. Similarly, *Equulites novaehollandiae* Steindachner was revived by Munro (1967) who also described a new species, *Leiognathus rapsoni*. Material of these three species was not available to the present author but on the evidence

of published accounts at least the former two may prove to be synonyms of known and recognised species. Comments on these are given at relevant places.

### Genus *Leiognathus* Lacépède

- Leiognathus* Lacépède, 1803, *Hist. nat. Poissons*, 4: 448. (Type species: *Leiognathus argenteus* Lacépède).  
*Equula* Cuvier, 1817, *Regne Animal*, 2: 223,  
*Deveximentum* Fowler, 1904, *Journ. Acad. nat. Sci. Philad.*, p. 517.  
*Clupea* Lacépède, 1803, *Hist. nat. Poissons*, 5: 460, 463.  
*Aurigequula* Fowler, 1908, *Proc. Acad. nat. Sci. Philad.*, 70: 17.  
*Scomber* Forsskal, 1775, *Descr. animal.*, p. 75; Bloch, 1785, *Naturgesch. Eische*, taf. 428.  
 Bloch & Schneider, 1801, *Syst. Ichth.*, p. 36.  
*Eubleekeria* (*Leiognathus*) Fowler, 1904, *Journ. Acad. nat. Sci. Philad.*, (2) 12: 516.  
*Leiognathus* Regan, 1920, *Ann. Mag. nat. Hist.*, (9) 5: 420.  
*Zeus* Bloch, MS. Cuvier & Valenciennes, 1835, *Hist. nat. Poissons*, 10: 84.  
*Leiognathus* (*Eubleekeria*) Fowler, 1904, *Journ. Acad. nat. Sci. Philad.*, 2 (12): 516.

Body compressed, oval or elevated; dorsal and ventral profile equal, subequal or usually the dorsal more convex. Covered with small, cycloid, conspicuous, sometimes deciduous scales, absent on head and in some species on a small area of the chest. When present on chest, may be conspicuous or diaphanous, the chest often appearing naked. Lateral line curved, the posterior limit of which is often difficult to determine. Head small, snout pointed or truncate, the rostro-dorsal profile of head straight or curved, interorbital space concave bordered on each side by supraorbital bony ridge, the supraorbital ridges continued as outer borders of the nuchal spine which ends at some distance from dorsal fin. The supraorbital ridges commence at the inner one of a pair of postnasal spines, the outer of which is situated near the rim of orbit; the latter may be crenulated superiorly. Mouth small, horizontal or oblique; when protracted forming a tube directed downwards. The lower margin of lower jaw straight or concave. Lower margin of pre-operculum serrated. Five branchiostegals. Gill membranes attached to isthmus. Gill rakers small, with lateral spines. Pseudobranchiae present. Minute setiform teeth in a single series in jaws, palate toothless. A single dorsal with VIII spines and 16 rays; anal with III spines and 14 rays; the second dorsal and anal spine the longest, in some species filiform. Soft dorsal and anal with a basal scaly sheath. Pectorals short; ventrals with I spine and 5 rays and an axillary scale-like process. Caudal deeply forked.

*Distribution*: Red Sea and east coast of Africa through Indian Ocean and Pacific, to China, Japan and the Pacific Islands. Some species are locally restricted, others live in coastal waters in shoals, found in estuaries, backwaters, freshwater and brackish water lakes.

#### KEY TO SPECIES OF THE GENUS *LEIOGNATHUS* LACÉPÈDE

1. Depth more than three times in standard length; cheeks scaly.....*Leiognathus* (Günther)
2. Depth less than three times in standard length; cheeks not scaly.
  - A1. Dorsal profile more convex than ventral.
  - B1. Lower margin of lower jaw strongly concave, breast apparently naked.
  - C1. Second dorsal spine longer than half height of body; faint vertical bands descend from the back.....*L. fasciatus* (Lacépède)

- C2. Second dorsal spine less than half height of body; no vertical bands on back.....  
.....*L. equulus* (Forsskal)
- B2. Lower margin of lower jaw slightly concave; breast with prominent scales.
- D1. Snout blunt; eye larger than snout.
- E1. Second dorsal spine longer than height of body; second anal spine about length of head; faint broad bands on back.....*L. smithursti* (Ramsay & Ogilby)
- E2. Second dorsal spine much shorter than height of body; second anal spine shorter than head.
- F1. Jet black blotch on spinous dorsal; dorsal and anal spines strong .....  
.....*Leiognathus splendens* (Cuvier)
- F2. Grey blotch on spinous dorsal; dorsal and anal spines weak.....  
.....*Leiognathus jonesi* James
- D2. Snout pointed; eye smaller than or equal to snout; few unequal, wavy, black or brown vertical lines descend from back.....*L. dussumieri* (Valenciennes)
- A2. Dorsal profile less convex than ventral, orange coloured blotch on spinous dorsal...  
.....*L. bindus* (Valenciennes)
- A3. Dorsal and ventral profiles more or less equal.
- G1. Blunt snout; back without irregular black marks or blotches; predominant deep black blotch on spinous dorsal, yellow longitudinal band on each side, in fresh condition...  
.....*L. daura* (Cuvier)
- G2. Pointed snout; back with irregular black marks or blotches.
- H1. Second dorsal spine longer than half height of body..... *L. leuciscus* (Günther)
- H2. Second dorsal spine not longer than half height of body.
- I1. Lower margin of lower jaw strongly concave; grey or brown blotch on nape.
- J1. Scales (prominent) present on chest, distinct black blotch on spinous dorsal.....  
..... *L. blochii* (Valenciennes)
- J2. Scales absent on chest; no black blotch on spinous dorsal in adults; present in juveniles, yellow patch in breast region.....*L. brevirostris* (Valenciennes)
- I2. Lower margin of lower jaw slightly or not concave, no blotch on nape.
- K1. Upper profile of head rises to back with a concavity; crowded zigzag black marks on back.....*L. berbis* (Valenciennes)
- K2. Upper profile of head rises to back without a concavity; few irregular black marks on back.....*L. lineolatus* (Valenciennes)

### 1. *Leiognathus elongatus* (Günther) (Plate II A)

*Equula elongata* Günther, 1874, *Ann. Mag. nat. Hist.*, 4 (14): 369. Meyer, 1885, *Ann. Soc. Esp. Hist. nat.*, 14 : 26.

*Leiognathus elongatus* Smith & Pope, 1906, *Proc. U. S. Nat. Mus.*, 31 : 466; Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6:318-320; Smith, 1949, *The Sea Fishes of Southern Africa*, p. 518; Tiews & Caeses-Borja, 1965. *Philippine J. Fish.*, 7 : 59-85.

*Leiognathus stercorarius* Evermann & Seal (1906) 1907, *Bull. Bur. Fish.*, 26 : 67.

*Leiognathus elongatum* Jordan, Tanaka & Snyder, 1913, *Journ. Coll. Sc. Univ. Tokyo*, 33 : 132 (name only after Smith & Pope).

While 17 species of the family Leiognathidae could be collected from the Indian seas, *L. elongatus* has so far not been collected and there are no earlier reports of its occurrence in Indian Seas. As Günther's (1874) original description is not detailed, the account of the species by Smith & Pope (1906) is repeated below. The photograph of the type obtained from British Museum is given in Plate II A.

*Description* (after Smith & Pope 1906): Head 3.75; depth 3.75; eye 3.25; snout 3.25; dorsal VIII, 16; anal III, 14.

Body very elongate and moderately compressed, its depth not greater than length of head; dorsal and ventral profiles about evenly curved and tapering, gently to the very short and slender peduncle; caudal peduncle about 0.66 diameter of eye; head acute, the upper surface weakly convex, the sides compressed to form a very narrow surface on the ventral side; mandibular slightly concave; eye of moderate size, its diameter equal to snout; interorbital equal to eye, with a median ridge from snout to occiput and supraocular ridges enclosing triangular space, lower preopercular margin with very fine serrations; scales small, cycloid, deciduous; opercle naked, cheeks scaly; lateral line conspicuous, with about 42 tubular pores; second and third dorsal spines longest 1.75 in depth of body and 2 in distance from origin of fin to anterior margin of eye; longest anal spine (second) less than 0.5 head, caudal deeply forked; pectorals 1.5 in head; ventrals somewhat less than 2 in head. Colour in alcohol yellowish-brown above with purplish tinge below that may have been silvery in life; scales everywhere covered with fine black punctuations which are larger and more scattered on lower side of head and body, back and sides marked with a number of irregular dark purplish spots and vermiculations, a black spot at base of each dorsal and anal ray; axil of pectoral black, posterior edge of gill cavity black, showing through opercular edge; a short black band on tip of snout above mouth, fins without definite colour markings.

Described from a specimen 90 mm long from Kagoshima, collected June 16, 1903, by H. M. Smith.

*Type*: Cat. No. 55613, USNM. This species may be easily recognised by its elongate form and mottled colouration.

The data on the type of *Equula elongata* obtained from the British Museum are given in Table 1.

TABLE 1. *Data on the type of Equula elongata*

Character	<i>E. elongata</i> BMNH.1858. 4. 21. 243 ex Amboina	Character	<i>E. elongata</i> BMNH 1872. 4. 6. 108 ex N. Celebes
S. L.	59.3	Dorsal spines	
fork L.	65.0	2nd	4.5 (tip dam.)
total L.	68.5 (tip dam.)	3rd	5.5
head	16.2	Pre-dorsal	23.5
depth	13.1	Pectoral L.	8.1
snout	5.1	Caudal L.	10.0 (tip dam.)
eye diam.	5.2	Posterior limit of extension of lateral line	No scales
Interorbital	4.8	scales on chest	nil
		Colour	Upper 1/3 light brown, silver below. No spots or bars.

*Distribution*: East coast of Africa, Indo Australian Archipelago including Celebes, Philippine Islands and Japan.

*Remarks*: The species is unique in the family to show presence of scales on the cheek and the head as well as depth of body 4 or more in standard length. Weber and de Beaufort (1931) stated that *L. elongatus* Smith & Pope and *L. stercorarius*

Evermann & Seale are identically characterised and united these and *E. elongata* Gunther under the name *L. elongatus* (Günther).

## 2. *Leiognathus fasciatus* Lacépède (Plate 1 A)

*Clupea fasciata* Lacépède, 1803, *Hist. Nat. Poiss.*, 5: 460, 463 (Type locality: Mauritius).

*Equula filigera* Cuvier, 1814, *Mem. Mus. Hist. nat.* I, P. 402; Valenciennes in Cuvier and Valenciennes, 1835, *Hist. nat. Poiss.* 10: 93. Bleeker, 1845, *Nat. & Geneesk. Arch. Ned Ind.*, (3) 2: 518. Cantor, 1850, *Journ. Asiat. Soc. Bengal*, 18: 1132. Bleeker, 1852, *Nat. Tijdschr. Ned. Ind.*, 3: 165. Bleeker, 1852, *Makreel. Vissch.*, 79, *Verh. Batav. Gem.*, 24.

*Equula cora* Cuvier, 1829, *Regne Animal*, ed. 2, 2: 212 (Based on Russell, pl. 66).

*Equula longispinis* Valenciennes, in Cuvier and Valenciennes 1835 *Hist. nat. Poiss.*, 10: 94.

*Equula kara* Valenciennes, in Cuvier & Valenciennes, 1835, *Ibid.*, 10: 95.

*Equula fasciata* Valenciennes, in Cuvier and Valenciennes 1835, *Ibid.*, 10: 96. Günther, 1860, *Cat. Brit. Mus.*, 2: 498. Kner, 1865-67, *Novara Exp. Fische*, p. 167. Günther, 1873-76, *Fische Sudsee*, p. 144. Day, 1878, *Fish. India*, p. 243. Klunzinger, 1884, *Fische Roth. Meer.*, p. 107. Meyer, 1885, *Ann. Soc. Espana. Hist. nat. Madrid*, p. 26. Duncker, 1904, *Aus. Mitteilungen aus den Natur-historis chen Museum*, 21: 157-158. Weber, 1913, *Siboga Exp. Fische*, p. 270. Munro, 1967, *The Fishes of New Guinea*, p. 239.

*Equula longispina* de Vis, 1884, *Proc. Linn. Soc. N. S. Wales*, 9: 542.

*Leiognathus fasciatus* Jordan & Seale, 1905, 1906, *Bull. Bur. Fish.*, 25: 273. Jordan & Seale (1906). 1907, *Ibid.*, 26: 15. Evermann & Seale (1906) 1907, *Ibid.*, 26: 69. Kendall & Goldsborough, 1911, *Mem. Mus. Comp. Zool.*, 26: 274. Fowler, 1918, *Copeia*, 58: 63; 1927, *Proc. Acad. nat. Sci. Philad.*, 79: 273; 1928, *Fish. Oceania.*, *Mem. Bish. Berm. P. Mus.*, 10: 153. Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6: 320-322. Herre, 1934, *Fishes 1931 Philippine Exped.*, p. 37. Umali, 1936, *Edible fishes. Manila*, p. 124. 1936, *Philippine J. Sci.*, 63: 235. Herre, 1953, *U. S. Fish & Wildl. Ser.*, *Res. Rep.* 20: 293. Munro 1955, *The Marine and Freshwater Fishes of Ceylon*, p. 145. Tiews & Caces-Borja, 1965, *Philippine J. Fish.*, 7: 59-85. Smith & Smith, 1963, *Fishes of Seychelles*, p. 25. James & Badrudeen, 1969, *J. mar. biol. Ass. India*, 10: 107-113 (1968).

*Aurigequula fasciata* Fowler, 1908, *Proc. Acad. nat. Sci. Philad.*, 70: 17.

*Aurigequula longispinis* Whitley, 1932, *Mem. Qland. Mus.*, 10 (2), pl. 13, fig. 1.

**Material:** 19 specimen 71-166 mm S. L. (92-212 mm T.L.) from Vedalai, Kilakarai (Gulf of Mannar) and Andaman Islands.

**Description:** D. VIII, 16; A. III, 14. Oblong compressed dorsal profile more convex than the ventral, the former steeply rising opposite the hind border of eye with a conspicuous concavity in the occipital region. Height 1.67-1.97, head 2.95-3.67 in S. L. (2.13-2.54 and 3.79-4.36 in T. L. respectively); eye 2.78-3.93 in head. Interorbital space slightly concave to flat, bounded by two prominent ridges which continue as the outer borders of the nuchal spine, which is slightly more than twice in head. Central portion of nuchal spine elevated. Two small spines on top of head opposite the front border of eye, the outer more prominent than the inner which is located opposite the ridge bounding the interorbital space. Mouth when protracted, directed downwards, gape of mouth below lower border of eye, end of maxilla not surpassing front border of eye. Lower margin of lower jaw strongly concave, Preopercle with an obtuse angle, its lower margin finely serrate. Teeth small, numerous; gill rakers in 10 specimens 71-120 mm S.L. (92-152 mm T.L.) on outermost arch (14-16)+(0-1)+5, total 19-2,1; gill rakers well developed, those at extremities curved backwards, each

with a double row of small spines. Scales small, all over the body except breast. Lateral line concave at commencement, convex afterwards, less so than dorsal profile, and extends almost upto base of caudal fin. Dorsal and anal spines weak, laterally compressed, second dorsal spine filiform, compressed, 0.86-1.49 in height of body, 1.62-2.67 in S. L. and 2.08-3.47 in T. L., second anal spine elongate, filiform, 1.30-3.04 in head, the third and fourth dorsal spines and third anal spine serrated anteriorly for about half length from base. Pectorals 3.88-4.65 in S. L., and 5.00-5.89 in T. L. Ventrals 5.96-7.11 in S. L., 7.60-9.04 in T. L., with a prominent axillary scale, and do not reach origin of anal. Caudal deeply forked.

Colour silvery, back less so than abdomen. As many as 11 grey vertical bands on the sides, superimposed by few yellow dots in fresh condition which fade gradually and appear as diffuse bands. Margin of soft dorsal grey. Posterior margin of caudal lobes black. Pectorals, ventrals and anal hyaline but pectoral axil yellow, its base dotted black.

*Distribution:* Red Sea, Zanzibar, Madagascar, Mayotee, Mauritius, Seychelles, Muscat, India, Sri Lanka, Philippines, Queensland, New Britain, Samoa, Fiji Islands.

*Remarks:* Jordan and Seale 1905 (1906) described the life colours of the species as consisting of "spots on sides and dorsal bars dull brassy; axil brassy and brassy shades on dorsal and anal fins". Another specimen was "silvery, faintly streaked and barred above". This is in agreement with the colour in fresh condition, described here. It is therefore evident that the colour of live or fresh specimens is different from that of dead specimens kept for sometime.

### 3. *Leiognathus equulus* (Forsskal) (Plate I B)

*Scomber equula* Forsskal, 1775, *Descr. Animal*, p. 75. (Type Locality Red Sea); Klauswitz & Nielsen, 1965, *Spol. Zool. Mus. Haun.* 22: 11, 23 (ref. to Forsskal's species).

*Scomber edentulus* Bloch, 1785, *Naturgesch. Fische*, Taf. 428; Bloch & Schneider, 1801, *Syst. Ichth.*, p. 36.

*Leiognathus argenteus* Lacépède, 1803, *Hist. nat. Poiss.*, 4 : 448-449.

*Equula ensifer* Cuvier, 1829, *Regne Animal*, Ed. 2, 2 : 212.

*Equula ensifera* Valenciennes in Cuvier and Valenciennes, 1835, *Hist. nat. Poiss.*, 10: 66; Bleeker, 1845, *Nat. & Geneesk. Arch. Ned. Ind.*, (3) 2 : 1-518; Bleeker, 1852, *Makreel. Vissch.*, p. 80 *Verh. Bat. Gen.*, 24. Kner, 1865-67, *Novara Exp. Fische*, pp. 1-166.

*Equula caballa* Valenciennes, in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 1-73. Rüppell, 1938, *Neue Wirbelt. Fische*, pp. 1-51, 52. Cantor, 1850, *Journ. Asiat. Soc. Bengal*, 18 : 1-1128. Günther, 1860, *Cat. Brit. Mus.*, 2 : 1-499. Klunzinger, 1880, *Sitzb. Akad. Wien.*, p. 379.

*Equula serrulifera* Richardson, 1848, *Voy. "Erebus" & "Terror"* *Ichth.*, p. 137.

*Equula edentula* Günther, 1860, *Cat. Brit. Mus.*, 2 : 498. Day, 1878, *Fish. India*, p. 238. Macleay, 1881, *Descr. Cat. Austral. Fish.*, 1: 184. Meyer, 1885, *An. Soc. Espana Hist. Nat. Madrid*, 14 : 31. Vinciguerra, 1890, *Ann. Mus. Civ. Storia Nat. Genova*, 9 (2) : 171. Duncker, 1904, *Die Fische der malayischen Halbinsel. Aus. Mitteilungen aus den Naturhistorischen Museum*, 21 : 157-158. Gilchrist & Thompson, 1908, *Ann. S. Afric. Mus.*, 6 : 188. de Beaufort, 1913, *Bijdr. Dierk. Leiden*, p. 120.

*Leiognathus edentulus* Bleeker, 1963, *Ned. Tijdschr. Dierk.*, 1: 235. Jordan & Seale, 1905 (1906), *Bull. Bur. Fish.*, 25 : 272-273. Fowler, 1905, *Proc. Acad. nat. Sci. Philad.*, 57 (2) : 510.

- Equula equula* Klunzinger, 1884, *Fishe Roth. Meer*, 1 : 107. Munro, 1967, *The Fishes of New Guinea*, p. 239.
- Leiognathus obscura* Seale, 1901, *Occas. Papers. Bern. P. Bishop Mus.*, 1 : 74.
- Leiognathus edentulum* Jordan & Evermann, (1902) 1903, *Proc. U. S. nat. Mus.*, 25 : 338.
- Leiognathus (Leiognathus) edentulus* Fowler, 1904, *Proc. Acad. nat. Sci. Philad.*, 12 (2) : 513-517.
- Leiognathus edentula* Evermann & Seale, (1907), 1907, *Bull. Bur. Fish.* 26 : 69. Jordan & Dickerson, 1908, *Proc. U. S. nat. Mus.* 34 : 610. Seale & Bean, 1908, *Ibid.*, 33 : 229-248.
- Leiognathus coma* Jordan & Richardson, 1908, *Bull. U. S. Bur. Fish.*, 27 : 253.
- Leiognathus caballa* Jordan & Richardson, (1907), 1908, *Bull. Bur. Fish.*, 26 : 253. Seale, 1910, *Philippine, J. Sci.*; 5 (D) : 273.
- Leiognathus equula* Jordan & Seale, 1905 (1906), *Bull. Bur. Fish.*, 25 : 272-273. Jordan & Starks, 1917, *Ann. Carnegie Mus.*, 11 : 444. Barnard, 1925-27, *Ann. S. Afric. Mus.*, 21 : 624. Fowler, 1918, *Copeia*, 58 : 63. Fowler, 1927, *Proc. Acad. Nat. Sci. Philad.*, 79 : 273. Fowler, 1928, *Fish. Oceania Mem. Bern. Bishop. Mus.*, 10 : 153. Smith, 1959, *The Sea fishes of Southern Africa*, p. 243. Misra, 1959, *Rec. Ind. Mus.*, 57 : 256-257. Smith and Smith, 1963, *Fish. Seychelles*, p. 25.
- Leiognathus equulus* Chaudhuri 1923, *Mem. Ind. Mus.*, 5 : 730. Weber and de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6 : 322-324. Herre, 1933, *J. Pan. Pacific Res. Inst.*, 8 : 3. Herre, 1934, *Fishes, 1931 Philippine Exped.*, p. 37. Umali, 1934, *Philippine J. Sci.* 54 : 371. Umali, 1936, *Edible Fishes, Manila*, p. 123, fig. 82. Herre, *Fishes 1936-37 and 1940-41 Expeds. Villadolid*, 1937, *Philippine J. Sci.*, 63 : 215. Umali, 1937, *Ibid.*, 63 : 234. Domanty, 1940, *Ibid.*, 71 : 100. Domanty, 1940, *Ibid.*, 72, 379. Herre, 1953, *U. S. Fish & Wildl. Ser. Sci. Rep.* 20 : 292-293. Schultz *et al. fish. Marshall & Marianas Isl.* 3 : 165. Klausewitz & Nielsen, 1965, *Spol. Zool. Mus. Hava*, 22 : 11, 23. Tiews & Caeces-Borja, 1965, *Philipp. Jour. Fish.*, 7 : 59-85. Munro, 1955, *The Marine and freshwater fishes of Ceylon*, p. 146.

**Material:** 22 specimens, 66-193 mm S. L. (85-242 mm T. L.) from Mandapam, Rameswaram, Kilakarai and Pamban (Palk Bay and Gulf of Mannar).

**Description:** D. VIII, 16; A.III, 14. Oblong, compressed, dorsal profile more convex than the ventral, gently rising from the occipital region. Height 1.73- 1.90, head 2.83-3.24 in S. L.; (2.25-2.40 and 3.64-4.10 in T. L. respectively), eye 2.73-3.87 in head. Interorbital space flat, bounded by two ridges which continue behind as the outer edges of the nuchal spine. The median portion of the spine is elevated, longer than both eye, and interorbital space, about  $2\frac{1}{2}$  in head. Two small spines on top of head, opposite front border of eye, the outer more prominent than the inner which is opposite the ridge forming outer boundary of interorbital space. Mouth on protraction directed downwards, gape of mouth below lower border of eye, end of maxilla reaching front border of eye. Lower margin of lower jaw strongly concave, preopercle with an obtuse angle, its lower margin finely serrate. Teeth small, numerous, gill rakers in 10 specimens, 50-171 mm S.L. (65-212 mm T.L.) on left outermost arch (14-18) + (0-1) + (4-6), total 19-23, gill rakers long, tips sharp with tendency to fork, each with a double row of about 20 small spines. Scales small, all over the body, except on breast. Lateral line concave at first, later on convex, less so than dorsal profile, extends almost upto base of caudal fin. Dorsal and anal spines weak, laterally compressed, second dorsal spine 2.07-2.59 in height of body, 3.85-4.84 in S. L. and 4.80-6.07 in T. L. third and fourth dorsal spines and third anal spine serrated anteriorly for about half length from base, pectorals 3.73-4.52 in S.L., 4.75-5.59 in T.L. ventrals 5.69-6.37 in S.L., 7.17-8.19 in T.L. with a prominent axillary scale, do not reach origin of anal. Caudal not deeply forked, the lobes appear round with their hind margins convex.

In juveniles (50–66 mm T. L.) back less silvery than abdomen. Grey vertical bands descend from back to about midheight clearly seen in fresh specimens but rapidly disappear on preservation in formalin. Membrane between anal spines conspicuously yellow. Posterior margin of caudal lobes pale yellow and dusky. Other fins hyaline. Snout dotted black. In adults (about 200 mm T. L.) back greyish, abdomen silvery, faint washed bands scarcely seen on sides. Axil of pectoral grey, posterior margins of caudal lobes dusky, margin of soft dorsal black, pectorals, anal and ventrals colourless.

*Distribution:* Red Sea, Beira, Zanzibar, Natal Coast, Delagoa Bay, Chinde, Madagascar, Bourbon, Mauritius, Muscat, India, Sri Lanka, Siam, Bangkok, Formosa; Rikyiu Islands, Philippines, Indo-Australian Archipelago, Marianas, Australia (Port Darwin, Queensland, Cleveland Bay), Solomon Islands, New Calendonia, Samoa, Fiji Islands—in sea, brackishwater, rivers.

*Remarks:* For this species, Fowler and Bean (1923) described that scales entirely cover chest. Weber and de Beaufort (1931) pointed out that scales are present on chest except in a triangular area below pectoral and according to them, the descriptions of earlier authors that the chest is naked in this species are erroneous. While the chest is certainly covered by diaphanous scales, their absence in a small area below pectoral is difficult to detect. Fowler and Bean (1923) have also described upper 2/3 of spinous dorsal over first 3 membranes jet black such a colouration does not seem to have been described by others and not found in the present study also (see also note under *L. dussumieri*).

#### 4. *Leiognathus smithursti* (Ramsay and Ogilby) (Plate I E)

*Equula smithursti* Ramsay & Ogilby, 1886, *Proc. Linn. Soc. N. S. Wales* (2) 1 : 11.

*Leiognathus smithursti* Jordan & Seale 1905, (1906), *Bull. Bur. Fish.*, 25 : 272–273. Jordan & Dickerson, 1905, *Proc. U. S. nat. Mus., Washington*, 34 : 610. Fowler, 1928, *Fish. Oceania, Mem. Bern. P. Bish. Mus.*, 10 : 153. Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6 : 331–332. Tiews & Caeces-Borja, 1965, *Philippine J. Fish.*, 7 : 59–85. James, 1967, *J. mar. biol. Ass. India*, 9 : 300–302.

*Material:* Two specimens, 92 and 110 mm S. L. (118 and 141 mm T. L.) from Mandapam and Vedalai (Gulf of Mannar).

*Description:* D. VIII, 16 ; A. III, 14. Length of head 3.17–3.23, height 1.86–1.89 in S. L. (4.06–4.14 and 2.38–2.43 in T. L. respectively) Eye 2.83–3.05 in head, equal to snout which is equal to interorbital space. Snout blunt and lower margin of lower jaw slightly concave. Dorsal profile much more convex than the ventral. The upper profile of head to back smooth with a gentle concavity. Supraorbital edge smooth. Two small spines above the upper anterior angle of eye; lower limb of preopercle finely serrated. Teeth small, close-set, in numerous rows. Dorsal spines weak, first minute, second greatly elongate, more than half the total length of body, and much higher than height of body, the fourth serrated at the base. Second anal spine elongate, as long as the head. Pectoral 5.52–5.61 in total length. Caudal forked. Scales small, diaphanous covering the body except chest. Lateral line strongly convex, extends beyond end of soft dorsal and anal fins but stops short of origin of caudal fin. Gill rakers (on left outermost arch) in both specimens 12+8, total 20, well developed, each with a row of small, sharp spines on either side. Abdomen more silvery than back which shows a few faint broad bands, unevenly spaced. Tip of snout grey, fins colourless except margins of caudal lobes which are light grey. Pectoral base with minute black dots, which, on the axil side continued forwards and descend

for a short distance along margin of opercle as a narrow band. A grey band from angle of operculum terminating at origin of lateral line. This band is not clear in the smaller specimen.

*Distribution:* New Guinea (Hood Lagune), Fiji, Philippines and India.

*Remarks:* In the original description of the species, the colour is stated to be silvery, washed with blue on the back, sides of head tinged with gold, the snout and a band from upper angle of eye to opercle black. While the faint broad bands on back may represent the washed blue and the snout is grey, other colours appear to fade quickly. The colour description given by Jordan & Dickerson (1908) is also slightly different from the original and the present account.

##### 5. *Leiognathus splendens* (Cuvier) (Plate I C, Fig. 1 a)

*Equula splendens* Cuvier, 1829, *Regne Anime, dit.*, 2a, 2 : 212. Cantor, 1850, *Journ. Asiat. Soc. Bengal*, 18 : 1131. Günther, 1860, *Cat. Brit. Mus.*, 2 : 501. Kner, 1865-67: *Novara Exp. Fish.*, p. 168. Day, 1878, *Fish. India*, p. 259. Klunzinger, 1884, *Fische Roth Meer.*, p. 107. Macleay, 1884, *Proc. Linn. Soc. N. S. Wales*, 9 : 25. Weber, 1913, *Siboga Exp. Fische*, p. 267. de Beaufort, 1913, *Bijdr. Dierk. Leiden*, p. 120.

*Equula gomorah* Valenciennes, in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10: 80 Rüppell, 1835-40, *Neue Wirbel, Fische*, p. 51. Bleeker, 1845, *Nat. & Geneesk. Arch. Ned. Ind.*, (3) 2: 518. Bleeker, 1852, *Makreel, Vissch. p. 82, Verh. Batar. Gen.*, 24.

*Equula caballa* Bleeker (nec. C. & V.) 1850, *Fauna Midd. en Oost-Java*, p. 9 *verh. Batav. Gen.*, 23.

*Leiognathus gomorah* Bleeker, 1863, *Ned. Tijdschr. Dierk.*, 1 : 235.

*Leiognathus splendens* Bleeker, 1863, *Ned. Tijdschr. Dierk.*, 1 : 270. Bleeker, 1865, *Ibid.*, 2 : 231 Jordan & Seale, 1905, *Proc. U. S. Nat. Mus.*, 28 : 776. Smith & Seale, 1906, *Proc. Biol. Soc. Wash.*, 18 : 77. Evermann & Seale, 1906 (1907), *Bull. Bur. Fish.*, 26 : 67. Jordan, and Richardson, 1907, *Bull. Bur. Fish.*, 27 : 254. Seale, 1910, *Ibid.*, 5, Sec. D : 273. Fowler 1918, *Copeia*, p. 63. Fowler, 1927, *Proc. Acad. Nat. Sci. Philad.*, 79 : 273 Weber and de Beaufort, 1931, *Fish. Indo-Austr. Archipelago*, 6 : 324-326. Herre, 1933, *J. Pan Pac. Res. Inst.*, 8 : 3; 1934, *Fish. 1931 Philippine Exped., Fishes 1940 - 41 Exped.*, 1953, *U. S. Fish & Wildl. Ser. Res. Rep.* 20 : 295. Munro, 1955, *The Marine and Freshwater fishes of Ceylon*, p. 145. Misra, 1959, *Rec. Ind. Mus.* 57 : 258. Marshall, 1964, *Fishes of the Great Barrier Reef and Coastal waters of Queensland*, p. 242. Tiews & Caeses-Borja, 1965, *Philippine J. Fish.*, 7 : 59-85. Munro, 1967, *The Fishes of New Guinea*, p. 240.

*Eubleekeria (Leiognathus) splendens* Fowler, 1904, *Journ. Acad. Nat. Sci. Philad.*, (2) 12 : 516.

*Leiognathus philippinus* Fowler, 1918, *Proc. Acad. nat. Sci. Philad.*, 70 : 15, fig. 7 Fowler, 1927, *Ibid.*, 79 : 273.

*Leiognathus equula* Fowler & Bean (nec. Forskal), 1922, *Proc. U. S. Nat. Mus.*, 62 : 22.

*Material:* 18 specimens in the size range 62.5-81 mm S. L. (82-103 mm T. L.) from the Gulf of Mannar (Loc. Kilakarai) in the vicinity of Mandapam and 50 specimens from the Arabian Sea (Karwar, Mangalore, Calicut, Vizhinjam) and Bay of Bengal (Gopalpur, Visakhapatnam, Kakinada, Madras, and Tuticorin) in the size range 33-101 mm S. L. (43-130 mm T. L.).

*Description:* D. VIII, 16; A. III, 14. Compressed, dorsal profile more convex than ventral, the former with a notch above the eye. Height 1.75-2.05, head 2.94-3.37 in S. L. (2.24-2.61 and 3.78-4.33 in T. L. respectively), eye 2.33-3.14 in head. Interorbital space flat, bounded by two ridges which continue posteriorly as outer edges of nuchal spine. The median portion of the nuchal spine is elevated, nearly

2 in head. Two small spines on each side, on top of head opposite front border of eye, the outer more prominent than the inner which is opposite the ridge bounding the interorbital space. Mouth when protracted, forms a tube directed downwards, gape of mouth below lower border of eye, maxilla reaching the front border of eye. Lower margin of lower jaw very slightly concave. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth small, numerous; gill rakers in six specimens 82 to 108 mm. T. L. on left outermost arch (21)+(0-1)+(5-7), total 26 to 29; gill rakers long, with pointed tips, each with a double row of about 12 small, lateral spines. Scale prominent, all over the body, including breast but absent on head. Lateral line convex from the beginning but less convex than dorsal profile. Lateral line extends beyond end of soft dorsal and anal fins but stops short of base of caudal fin. Dorsal and anal spines strong, laterally compressed, second dorsal spine 2.06-2.76 in height of body, 4.09-5.16 in S. L. and 5.29-6.33 in T. L., second anal spine 2.37-3.28 in height of body, the third and fourth dorsal spines and the third anal spine serrated anteriorly for about half length from base. Pectorals 3.68-4.56 in S.L. and 4.77-5.73 in T.L. Ventrals 5.40-6.92 in S.L., 6.80-9.80 in T.L. with an axillary scale and reach very near the origin of anal fin. Caudal deeply forked, lobes rounded, with hind margins convex. Colour silvery, abdomen more silvery than back which is greyish silvery, with faint grey vertical zig-zag marks above the lateral line in adults. In juveniles, these zig-zag lines are not seen but instead, a few blotches are seen. Tip of snout dotted grey as also base of pectoral. Membrane between 2nd and 6th dorsal spines jet black in the distal half. The membrane between the following spines, soft dorsal, membrane between anal spines, soft anal and caudal lobes yellow. Tips of caudal lobes dusky. Pectorals faint yellow. Ventrals hyaline.

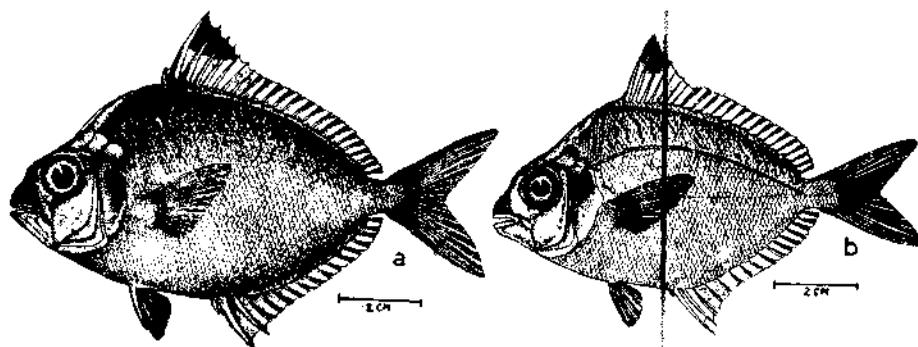


Fig. 1 A. *Leiognathus splendens* (Cuvier) and b. *L. jonesi* James.

*Distribution:* Red Sea, Madagascar, Mauritius, India, Sri Lanka, Andaman Islands, Siam, China, Formosa, Philippines, Indo-Australian Archipelago, Queensland, Fiji Islands—in sea, entering rivers.

Along the Indian Coast, it has been recorded from several localities both on the east and west coasts. Juveniles (30 mm T. L.) have been found to enter the estuaries.

#### 6. *Leiognathus jonesi* James (Plate 1 D, Fig. 1 b)

*Leiognathus* sp. James & Badrudeen, 1969, *J. mar. biol. Ass. India*, 10 : 107-113 (1968).

*Leiognathus jonesi* James 1971, *Ibid.*, 11 : (1970) 316-319.

*Material:* 50 specimens in the size range 35-95 mm S. L. (44-121 mm T.L.) from Palk Bay and Gulf of Mannar in the vicinity of Mandapam.

*Description:* D. VIII, 16; A. III, 14. Compressed, dorsal profile more convex than ventral, the former almost forming a straight line opposite front border of eye to origin of dorsal fin. Height 1.77-1.96, head 2.95-3.94 in S.L., (2.25-2.54 and 2.36-5.00 in T. L. respectively), eye 2.25-3.00 in head. Interorbital space flat, bounded by two ridges which continue posteriorly as outer edges of nuchal spine and joins the outer ridge posteriorly on either side. The median portion of the nuchal spine is elevated slightly, more than  $1\frac{1}{2}$  in head. Two small spines on top of head, opposite front border of eye, the outer more prominent than the inner, which is opposite the ridge bounding the interorbital space. Mouth when protracted forms a tube directed downwards, gape of mouth below lower border of eye, maxilla reaching the front border of eye. Lower margin of lower jaw almost straight. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth-small, numerous; gill rakers in 10 specimens 35-99 mm S. L. (46-126 mm T.L.) on left, outermost arch (21-24)+0+(5-7), total 27-30, gill rakers long with pointed tips, each with a double row of about 18 small lateral spines. Scales prominent, all over the body, including breast but absent on head. Lateral line scales 40-53 total, 35-45 upto end of soft dorsal, lateral transverse rows (11-13)+(22-26). First part of lateral line straight, followed by a convex portion which is less convex than dorsal profile. Lateral line extends beyond end of soft dorsal and anal fins but stops short of base of caudal fin. Dorsal and anal spines weak, laterally compressed, second dorsal spine 2.19-2.68 in height of body, 4.08-5.26 in S. L., and 5.15-6.74 in T. L., second anal spine 2.60-3.54 in height of body, the third and fourth dorsal spines and the third anal spine serrated anteriorly for about half length from base. Pectorals 3.53-4.52 in S. L. and 4.56-5.72 in T. L. Ventrals 4.08-7.47 in S. L. 5.38-9.65 in T. L. with an axillary scale and do not reach origin of anal fin. Caudal deeply forked, lobes round, with the hind margins convex.

Colour generally silvery, abdomen more silvery than back which has a background of brown with close-set grey zig-zag lines. End of snout dotted grey, axil of pectorals black, membrane between second and sixth dorsal spines grey in the distal half which may be very faint at times.

*Distribution:* In the Indian seas, the species has so far been collected from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam, Tuticorin and Andaman Islands. It is abundant in the Palk Bay and the Gulf of Mannar, especially off Mandapam in the Palk Bay, upto about 10 fathoms depth where about ninety per cent of the catches of silver-bellies is constituted by this species.

*Remarks:* *L. jonesi* superficially resembles *L. splendens* in the general shape of the body, blotch on the spinous dorsal fin and other body marks (fig. 1) but differs from *L. splendens* in a number of characters the following characters being most important (Table 2).

TABLE 2. Differences between *L. jonesi* and *L. splendens*

Character	<i>L. jonesi</i>	<i>L. splendens</i>
1. Blotch on spinous dorsal membrane	Grey	Jet black
2. Dorsal and anal spines	Weak	Strong

Munro (1964, 1967) described a new species of silverbelly, *Leiognathus rapsoni* from the New Guinea region. According to him, it comes closest to *L. splendens* but distinguished it from *L. splendens* in a number of characters, the most important

of these being the presence of 5 rows of scales on the preopercle of *L. rapsoni* which are absent in *L. splendens*. The present observations show that *L. rapsoni* resembles *L. jonesi* more closely than it does *L. splendens* especially in the general shape of the body, colouration and nature of spines. But *L. jonesi* differs from *L. rapsoni* mainly in the following characters (Table 3).

While strict comparison of body proportion of the two species is not possible due to differences in the number of specimens examined and size range, available information shows that body is narrower in *L. rapsoni* (1.9-2.1 in S. L.) than in *L. jonesi* (1.77 - 1.96 in S.L.). Extensive collections of silver-bellies examined by the author

TABLE 3. Differences between *L. jonesi* and *L. rapsoni*

Character	<i>L. jonesi</i>	<i>L. rapsoni</i>
Scales on the cheek	Absent	Present
Lateral line scales	40-53	51-55
Lateral transverse scales	(11-13)+(22-26)	8+20
Gill rakers	(5-7)+0+(21-24)	3-5)+(21-23)

from several localities along the Indian Coast did not so far indicate the occurrence of *L. rapsoni* in the Indian seas. The results also show that occurrence of *L. splendens* along the Indian Coast is widespread while that of *L. jonesi* is limited to the Palk Bay and Gulf of Mannar regions.

#### 7. *Leiognathus dussumieri* (Valenciennes) (Plate I F)

*Equula dussumieri* Valenciennes, in Cuvier and Valenciennes, 1835, *Hist. nat. Poiss.*; 10 : 77, Bleeker, 1853, *Verh. Batav. Gen.*, 25 : 46. Günther, 1860, *Cat. Brit. Mus.*, 2 : 500. Kner, 1865-67, *Novara Exp. Fische*, p. 167. Playfair, 1868, *Proc. Zool. Soc. London*, p. 10. Day, 1878, *Fish. India*, p. 239. Günther, 1880, *Challenger Exp. Zool.*, 6 : 52. Meyer, 1885, *An. Soc. Espana Hist. Nat. Madrid*, 14 : 26. Sauvage, 1891, *Poiss. Madagascar*, 518. Weber, 1894, *Zool. Ergebn. Reise Nied. Ost. Indien Hft.*, 2 : 409. Pellegrin, 1914, *Bull. Soc. Zool.* 39 : 225.

*Leiognathus dussumieri* Bleeker, 1875, *Poiss. Madagascar*, p. 98. Smith & Seale, 1906, *Proc. Biol. Soc. Washington*, 19 : 77; Jordan & Seale, 1907, *Bull. U. S. Bur. Fish.*, 26 : 15. Evermann and Seale, 1907, *Ibid.*, 26 : 67. Seale & Bean, 1908, *Proc. U. S. Nat. Mus.*, 33 : 242. Regan, 1920, *Ann. Mag. Nat. Hist.*, 9 (5) : 420. Fowler, 1928, *Mem. Bern. P. Bishop Mus.*, 10 : 153. Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6 : 326-327. Herre, 1940-41, *Fishes Exped.* Herre, 1953, *U. S. Fish & Wildl. Serv. Res. Rep.*, 20 : 291-292. Munro, 1955, *The Marine and Freshwater fishes of Ceylon*, p. 145. Tiews & Capces-Borja, 1965, *Philippine J. Fish.*, 7 : 59-85. James & Badrudeen, 1969, *J. mar. biol. Ass. India*, 10 : 107-113 (1968).

? *Leiognathus ensiferus*, Jordan & Richardson, (nec Cuvier & Valenciennes), (1907) 1908, *Bull. U. S. Bur. Fish.*, 27 : p. 252.

**Material:** 50 specimens in the size range 39.5-88.5 mm. S. L. (49-113 mm T. L.) from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam.

**Description:** D. VIII, 16; A. III, 14. Oblong, compressed, dorsal and ventral profiles equally convex, occipital profile rising with a gentle concavity to dorsal profile. Snout pointed. Height 2.02-2.28, head 2.89-3.35 in S. L., (2.58-2.87 and 3.70-4.23 in T. L. respectively), eye 2.47-3.78 in head. Interorbital space flat, bounded by two ridges which continue posteriorly as outer edges of nuchal spine. The median portion of the nuchal spine is elevated, about 2.15 in head. Two small spines on top of head, opposite front border of eye, the outer more prominent than the inner, which is opposite the ridge bounding the interorbital space. Mouth when protracted directed downwards, gape of mouth opposite lower margin of eye, and tip of maxilla extending slightly beyond the front margin of eye. Lower jaw slightly concave. Preopercle with an obtuse angle, its lower margin finely serrate.

Teeth small, numerous, gill rakers in 10 specimens 61-110.5 mm S.L. (78-141 mm T.L.) on left outermost arch (15-17) + (0-1) + (4-6), total 20-22; gill rakers short and stout each with a double row of about 15 small spines. Scales small, all over the body including the breast. Lateral line begins with a concavity and runs less convex to dorsal profile extends beyond end of soft dorsal and anal fins but stops short of base of caudal. Dorsal and anal spines strong, laterally compressed, second dorsal spine 1.76-2.65 in height of body, 3.88-5.65 in S. L. and 4.88-7.15 in T.L., the third and fourth dorsal spines and third anal spine serrated anteriorly for about half length from base. Pectorals 4.10-4.94 in S. L., 5.26-6.15 in T. L. Ventrals about twice in head, with an axillary scale, almost reaching the origin of anal. Caudal deeply forked.

Colour brownish silvery, back brown and abdomen silvery, fins yellowish (often blue-green due to settlement of algae which colour becomes prominent on preservation in formalin). Sides of body with grey, wavy vertical lines descending from the back; they are absent in some specimens, perhaps fading away after death.

*Distribution:* Madagascar, India including Andaman Islands, Philippines, Indo-Australian Archipelago.

*Remarks:* Weber and de Beaufort (1931) comment that "this species has most likely a wider distribution in the Archipelago, but is probably often confounded with *Leiognathus equulus* (Forsskal) or *L. fasciatus* Lacépède from which it is readily distinguished by the kind of squamation of the breast, a point overlooked by the authors". However, their own figure of *L. dussumieri* (fig. 67, p. 312) does not represent this species but appears similar to *L. equulus* except that scales on breast are shown clearly, a point they have emphasised as the main difference between *L. dussumieri* and *L. equulus*, the former with and the latter without scales on the breast. The steep rise of the dorsal profile behind occiput and its greater convexity compared to the ventral profile seen in their figure of *L. dussumieri* are very characteristic of *L. equulus*. No such steep rise of the dorsal profile behind occiput is found in *L. dussumieri* where the convexity of the dorsal and ventral profiles are more or less equal. The original figure of *Equula dussumieri* given by Valenciennes (1835, p. 77, pl. 283) and of *Leiognathus dussumieri* by Weber and de Beaufort (1931, p. 312, fig 67) reproduced in Plate II D, E illustrate the above characters clearly. The measurements and body proportions arrived at from the two figures and syntypes of *L. dussumieri* are given in Tables 4 and 5.

TABLE 4. *Measurements of syntypes of L. dussumieri and those arrived from figures of the same after Valenciennes (Equula dussumieri) and Weber & de Beaufort (Leiognathus dussumieri)*

Character	Measurements (mm)			
	Syntypes After Valenciennes		After Weber & de Beaufort	
	A. 6720	A. 6721	Figure ( <i>Equula dussumieri</i> )	Figure ( <i>Leiognathus dussumieri</i> )
Standard length	106	95	10.0	81.0
Fork length	116	105	10.5	88.0
Total length	135	122	11.5	100.0
Head length	35	30	3.5	27.0
Depth of body	49	45	4.5	46.0
Length of pectoral	24	21	1.5	18.0
Eye diameter	11	10	1.0	8.0
Snout	13	10	1.0	8.0
Length of second dorsal spine	15	20	1.5	18.0
Length of second anal spine	—	—	1.2	14.0

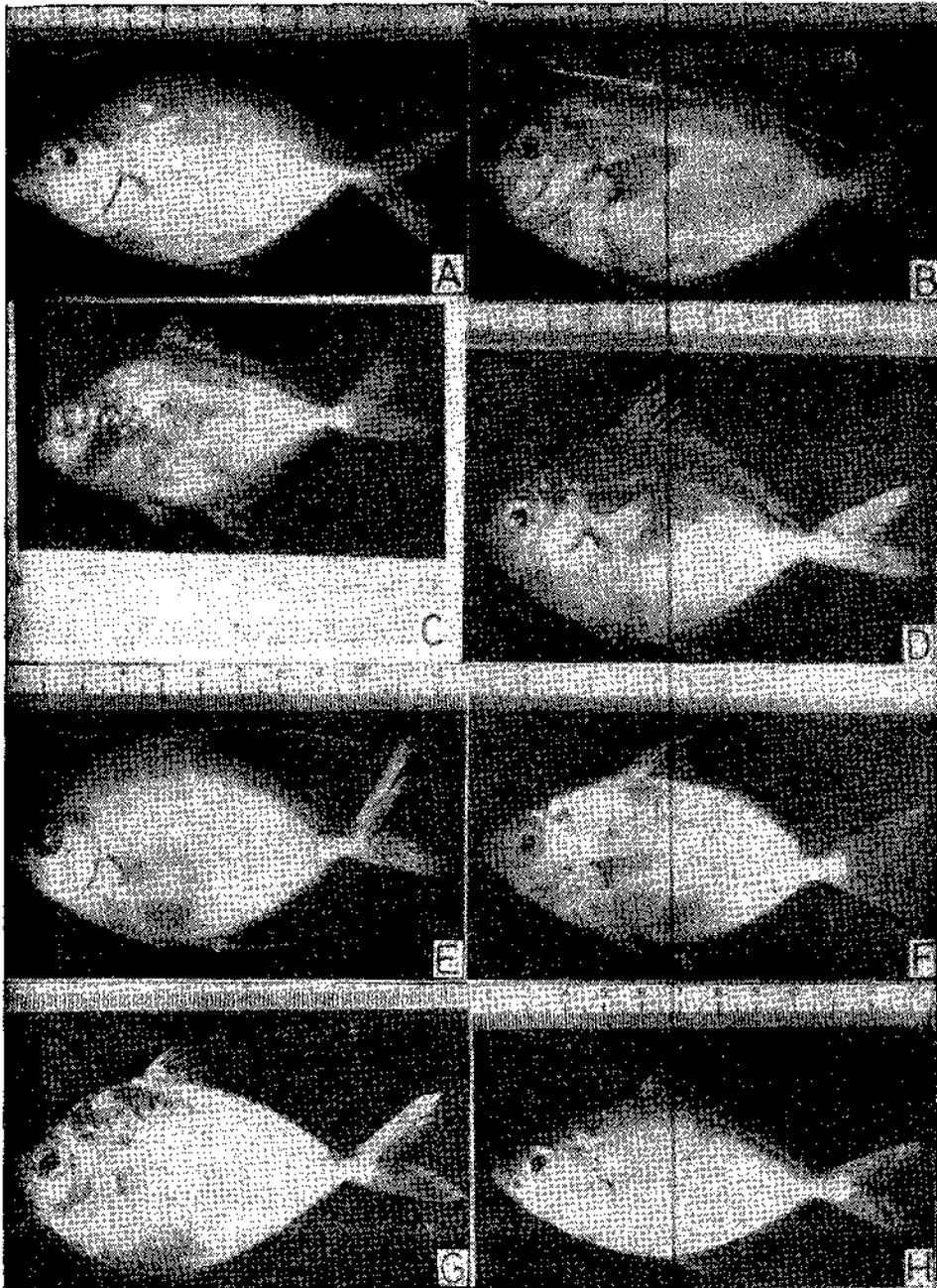


Plate I. A. *Leiognathus fasciatus*, B. *L. equulus*, C. *L. splendens*, D. *L. jonesi*, E. *L. smithursti*, F. *L. dassumieri*, G. *L. bindus* and H. *L. daura*.

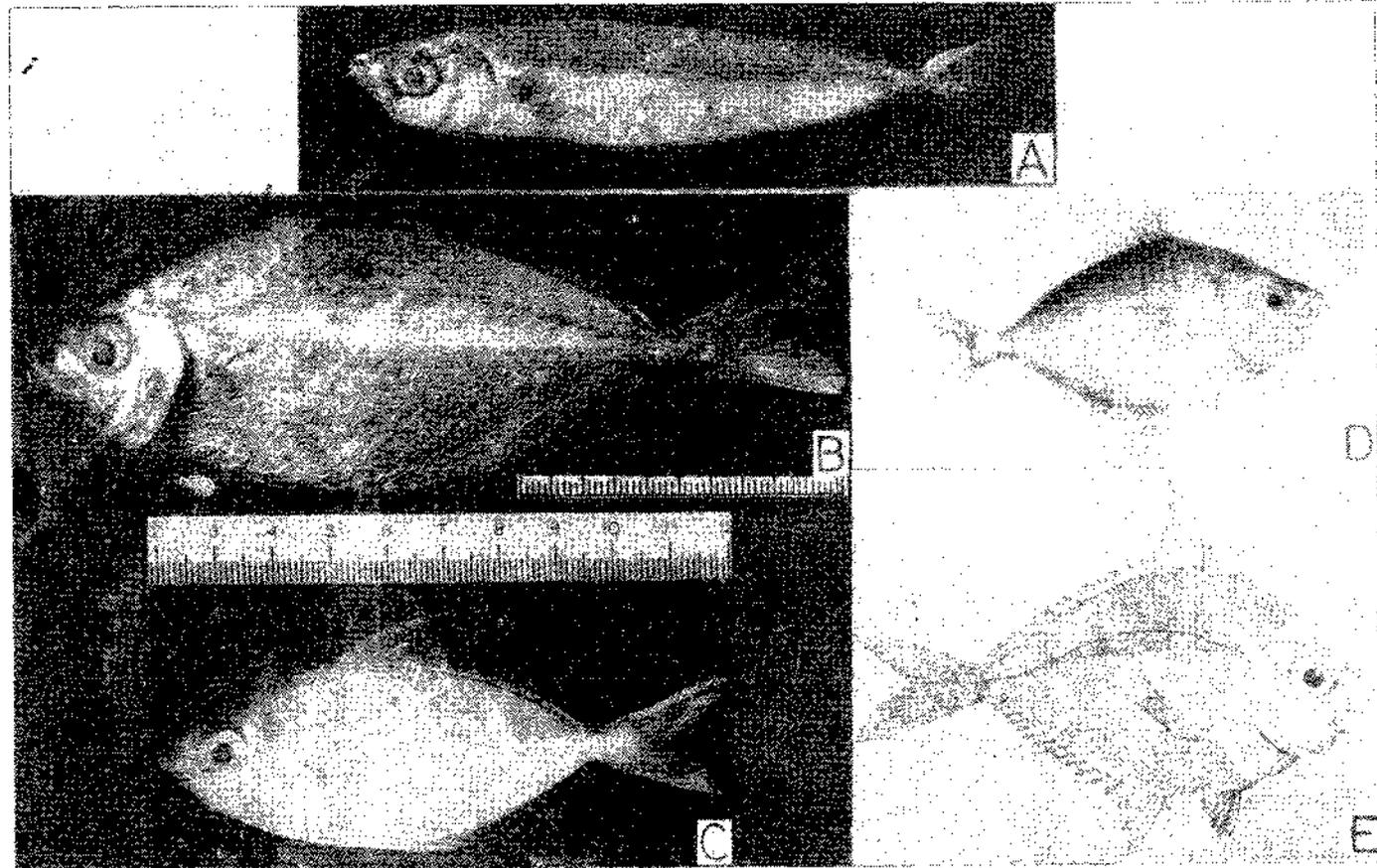


Plate II A. *Leiognathus elongata*, Holotype, BMNH, 1872, 4.6.108; B. *Equula leuciscus*, Holotype BMNH, 1858, 4. 21, 243; C. *Leiognathus leuciscus*; D. *E. dussumieri* (after Cuvier & Valenciennes, 1835) and E. *L. dussumieri* (after Weber & de Beaufort, 1931).

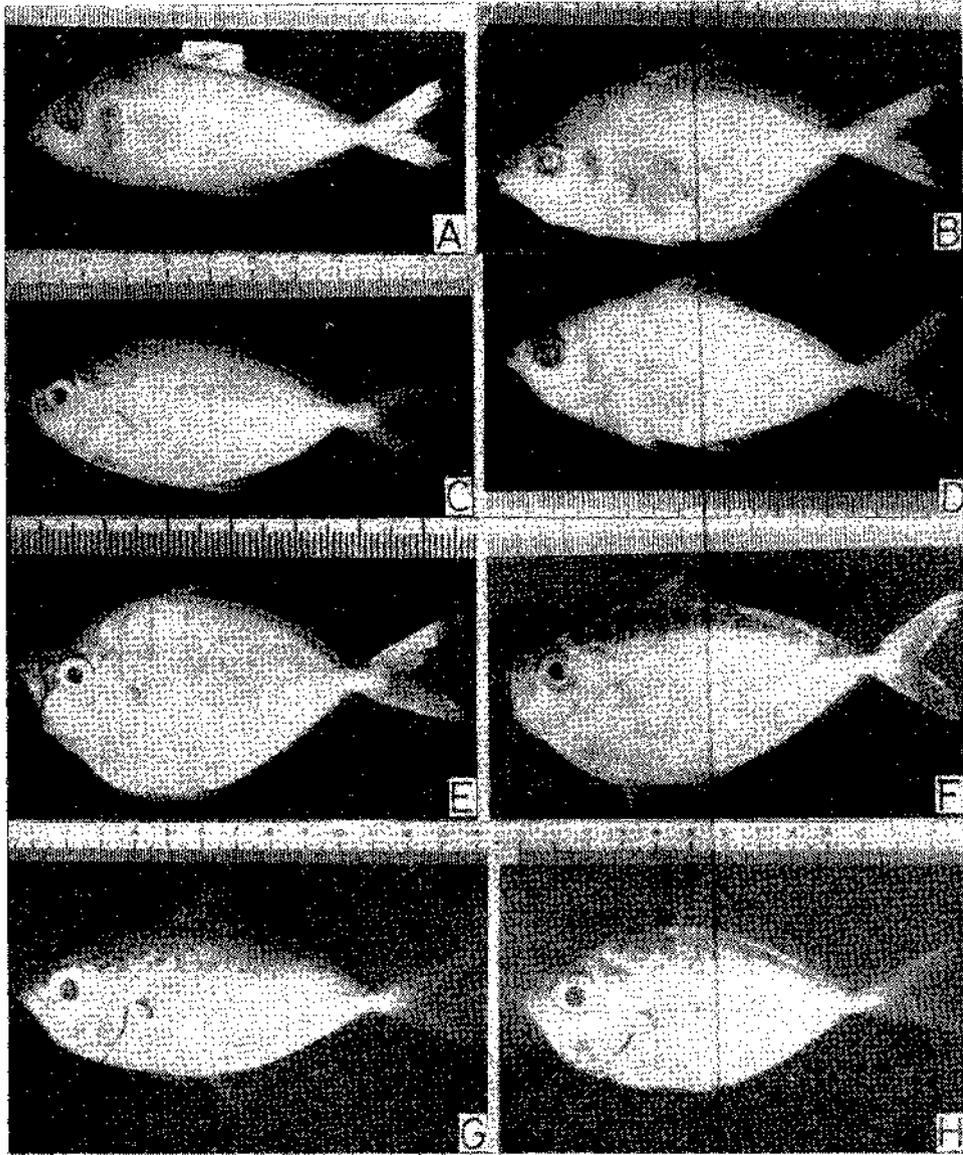


Plate III A. *Leiognathus bleekeri*, B. *L. brevirostris*, C. *L. berbis*, D. *L. lineolatus*, E. *Secutor nigrifrons*, F. *S. insidiator*, G. *Gazza minuta* and H. *G. achlamys*.

TABLE 5. *Body proportions of syntypes of L. dussumieri and from figures of the same after Valenciennes, figure and text after Weber & de Beaufort*

Character	After Valenciennes		Syntypes (figure)	After Weber & de Beaufort	
	A.6720	A.6721		figure	Text
Head in standard length	3.02	3.16	2.85	3.00	3.4-3.7
Head in total length	3.31	4.06	3.28	3.70	4.0-4.2
Depth in standard length	2.16	2.11	2.22	1.76	1.8-1.9
Depth in total length	2.75	2.71	2.55	2.17	2.2-2.3
Eye in head length	3.18	3.00	3.50	3.37	3.0
Length of second dorsal spine in depth of body	3.26	2.25	3.00	2.55	Less than $\frac{1}{2}$ depth of body.

As may be seen from Tables 4 and 5 the body proportions of *L. dussumieri* given in text by Weber and de Beaufort do not agree with those arrived at from their figure and both of these do not agree with those arrived at from the syntypes and the figure after Valenciennes. The character, depth in standard length, total length shows a marked difference in material dealt by Valenciennes and Weber and de Beaufort. It may therefore be concluded that *L. dussumieri* described and figured by Weber and de Beaufort differs from the original description of the species by Valenciennes. Further, it may also be pointed out that the present author's observations on *L. dussumieri* including the various body proportions are in agreement with those of Valenciennes.

It has also been stated by Weber and de Beaufort that *L. dussumieri* is confounded with *L. fasciatus*. Though there is some superficial similarity in colour between these two species (in the form of vertical lines or bands, which are also different on closer examination). *L. dussumieri* has altogether a different shape of body compared to *L. fasciatus*, possesses prominent scales on breast and its second dorsal spine is not filiform or as long as in *L. fasciatus*. *L. dussumieri* thus stands quite distinct from *L. equulus* and *L. fasciatus*.

Day (1876) described that the breast and chest of *L. dussumieri* are scale-less which is evidently an error. The figure (Pl. 52, fig. 2) given by him as *L. dussumieri* does not appear to be typical of the species. Instead, his figure (Pl. 51C, fig. 3) of *L. lineolatus* which was rightly doubted by Weber and de Beaufort (1931) in their treatment of the synonymy for *L. lineolatus* is actually of *L. dussumieri*. During the course of the present study it was observed that in *L. dussumieri* the variation in depth against length seems to be great, resulting in deep bodied and narrow bodied fish. Perhaps Day's figures of *L. dussumieri* and *L. lineolatus* represent the deep bodied and narrow bodied individuals of *L. dussumieri* respectively.

Though Munro (1955) reproduced Day's figure of *L. dussumieri*, his description of the species is different from that of Day who stated that the dorsal and ventral profiles are equally convex and that scales are absent on the breast. Munro's figure of *L. lineolatus* which is also after Day, is referable to *L. dussumieri* for the reasons explained above.

#### 8. *Leiognathus bindus* (Valenciennes) (Plate I G)

*Equula bindus* Valenciennes 1835, in Cuvier & Valenciennes, *Hist. nat. Poiss.*, 10 : 78. Cantor, 1850, *Journ. Asiat. Soc. Bengal*, 18 : 1130; Günther 1860, *Cat. Brit. Mus.*, 2 : 501. Bleeker, 1861, *Versl. Akad. Amsterdam*, 12 : 75; Day, 1876, *Fish. India*, p. 240. Duncker, 1904, *Die Fische der malayischen Halbinsel. Aus. Mitteilungen aus den Naturhistorischen Museum*, 21 : 157-158. Weber, 1913, *Siboga Exp. Fische*, p. 268.

*Equula hindoides* Bleeker, 1852, *Nat. Tijdsch. Ned. Indië*, 1 : 377; Bleeker, 1852, *Makreeel. Vissch.*, p. 83, *Verh. Batav. Gen.*, 24; Kner, 1865-1867, *Novara Exp. Fische*, p. 168.

*Leiognathus virgatus* Fowler, 1904, *Ann. Acad. Nat. Sci. Philad.*, 12 : 515, pl. 15 (lower figure-right hand side) Evermann & Stead, 1907, *Bull. U.S. Bur. Fish.*, 26 : 67; Fowler, 1927, *Proc. Acad. Nat. Sci. Philad.*, 79 : 273; Marshall, 1964, *Fishes of the Great Barrier Reef and coastal waters of Queensland*, p. 242.

*Leiognathus hindus* Wesermöller & Matott, 1931, *Fish. Indo-Austr. Archip.*, 6 : 334-335; Herre, 1934, *Fishes 1931 Philippine Exped.*, p. 36; Herre, *Fishes 1936-37 and 1940-41 Exped.*, Herre, 1953, *U.S. Fish and Wildl. Serv. Res. Rep.*, 20 : 290-291; Munro, 1955, *The Marine and Freshwater fishes of Ceylon*, p. 246; Tiews & Coeces-Borja, 1965, *Philippine J. Fish.*, 7 : 59-85; Balan, 1968, *Indo-Pac. Fish.*, 10 A : 118-134 (1963); James & Badrudeen, 1969, *J. mar. biol. Ass. India*, 10 : 367-373 (1968).

*Equulites hindus* Munro, 1957, *The fishes of New Guinea*, p. 240.

**Material:** 50 specimens, 69.5 to 82.0 mm in S.L. (77 to 106 mm T. L.) from Mandapam (Gulf of Mannar).

**Description:** D VIII, A IV, P 14. Oval, compressed, ventral profile more convex than the dorsal, the occipital region showing a slight concavity and gradual rise to dorsal profile. Snout pointed. Height 1.80-1.92, head 3.21-3.50 in S. L. (1.89-2.50 and 3.96-4.50) : 1 : 1, respectively, eye 2.41-3.08 in head. Interorbital space concave, bounded by two ridges which continue posteriorly as outer edges of the nuchal spine. The median portion of the nuchal spine is elevated as a ridge, nearly twice in head. Two dorsal spines on top of head, opposite front border of eye, equally prominent, the inner opposite the ridge forming the outer border of interorbital space. Mouth when protruded forms almost a horizontal tube, gape of mouth above the lower margin of eye, and the tip of maxilla just reaches the front border of eye. Lips thin and narrow. Mandible slightly concave. Preopercle with an obtuse angle, its outer margin finely serrate. Teeth small, numerous; gill rakers in 10 specimens, 0.9 to 0.875 mm, S. L. (84.0 to 112.0 mm T. L.) on left outermost arch (16-17) + 1 + 0.50 + 1 + 0.50 (total 22-24); gill rakers long and pointed, blade-like, smaller spines irregularly arranged on inner surface. Scales small, all over the body including the breast. First part of the lateral line straight, later running less convex to dorsal profile and extends to base of caudal fin. Dorsal and anal spines weak, laterally compressed, the second dorsal spine 2.71 to 3.24 in depth of body, 4.89 to 6.12 in S. L. and 6.28 to 7.33 in T. L., the third and fourth dorsal spines and the third anal spine serrated anteriorly for about half length from base. Pectorals 4.08 to 5.53 in S. L. and 5.26 to 6.50 in T. L. Ventrals 8.05 to 11.15 in S. L. and 10.22 to 14.31 in T. L. with axillary scales, their tips ending far in front of origin of anal. Caudal deeply forked. Body silvery, abdomen more silvery than back, the latter with a zig-zag pattern of grey marks commencing immediately behind head and extending to end of soft dorsal, laterally extending down to less than half height. Tip of snout and with dots, extending on to top snout, all over the head and ventral half of body. The black dots midlaterally tend to be arranged in rows at the posterior end. A few of them may be found on the bases of caudal rays also. Spinous dorsal base at half height, above which the membrane between 2nd to 5th spines bears a brown orange blotch, turning yellow on preservation in formalin. Soft dorsal orange grey. Pectorals, ventrals and anal colourless. Inner side of pectoral base black. Caudal, especially its posterior margins dusky.

**Distribution:** India, Sri Lanka, China, Formosa, Philippines and the Indo-Australian Archipelago.

*Remarks:* *Leiognathus virgatus* of Fowler has been commented upon and compared with *L. bindoides* of Bleeker by Weber and de Beaufort (1931). The two species should be synonymised with *L. bindus*. The orange coloured blotch edged below by black is very characteristic of the species, found even in juveniles.

#### 9. *Leiognathus daura* (Cuvier) (Plate I H)

*Equula daura* Cuvier, 1829, *Regne Anim.*, 2 : 212. Cantor, 1850, *Journ. Asiat. Soc., Bengal*, 18 : 1132. Günther, 1860, *Cat. Brit. Mus.*, 2 : 502. Day, 1876, *Fish. India*, p. 240. Steindachner, 1902, *Denkschr. Akad. Wien.*, 71 : 144. Duncker, 1904, *Die Fische der Malayischen Halbinsel. Aus. Mitteilungen aus den Naturhistorischen Museum*, 21 : 157-158. de Beaufort, 1913, *Bijdr. Dierk. Leiden.*, p. 120.

*Equula doer* Valenciennes in Cuvier & Valenciennes 1835, *Hist. nat. Poiss.*, 10 : 83. Bleeker, 1852, *Nat. Tijdschr. Ned. Indie*, 3 : 57. Bleeker, 1852, *Makreel. Vissch. Verh. Batav. gen.*, p. 81.

*Equula brevirostris* Bleeker, 1845, *Nat. & Genesck. Arch. Ned. Indie* (3) 2 : 518 (*nec* Cuvier & Valenciennes).

*Equula gerreoides* Bleeker, 1851, *Nat. Tijdschr. Ned. Indie*, 1 : 371. Bleeker, 1852, *Makreel. Vissch. Verh. Batav. Gen.*, 24 : 81. Day, 1870, *Proc. Zool. Soc. London*, p. 960. Devis, 1884, *Proc. Linn. Soc. N. S. Wales*, 9 : 545.

*Leiognathus gerreoides* Bleeker, 1865, *Ned. Tijdschr. Dierk.*, 2 : 174. Bean & Weed, 1912, *Proc. U. S. Nat. Mus.*, 42 : 609.

*Leiognathus daura* Jordan & Starks, 1917, *Ann. Carnegie Mus.*, 11 : 444. Fowler, 1927, *Proc. Acad. Nat. Sci. Philad.*, 79 : 273. Weber & de Beaufort, 1931, *Fish Indo-Austr. Archip.*, 6 : 332-334. Umali, 1934, *Philippine J. Sci.* 54 : 370. Herre, *Fishes*, 1936-37 *Exped. Umali*, 1936, *Edible fishes, Manila*, p. 125, fig. 84; 1953, *U. S. Fish & Wildl. Ser. Res. Rep.*, 20 : 291. Munro, 1955, *The Marine and Freshwater fishes of Ceylon*, p. 146. Flews & Caecce-Borja, 1965, *Philippine J. Fish.* 7 : 59-85.

*Material:* 50 specimens, 59.5 to 113.0 mm S.L. (74.0 to 141.0 mm T.L.) from the Pakk Bay and the Gulf of Mannar in the vicinity of Mandapam.

*Description:* D. VIII, 16; A. III, 14. Elongated, compressed, dorsal and ventral profiles equally convex, the former gently rising from the occipital region with a concavity. Snout somewhat blunt. Height 2.02 to 2.47, head 3.30 to 3.64 in S.L. (2.50-3.06 and 4.11 to 4.56 in T. L. respectively), eye 2.78 to 3.70 in head. Interorbital space flat, bounded by two ridges which continue as the outer edges of the nuchal spine. The median portion is elevated as a ridge, nearly twice in head. Two small spines on top of head, opposite the front border of eye, the outer more prominent than the inner which is opposite the ridge bounding the interorbital space. Mouth when protracted forms a downwardly directed tube, the gape of mouth opposite lower one third of eye and the posterior tip of maxilla ends far in front of the front border of eye. Mouth small, with thick, broad lips. Lower margin of lower jaw very slightly concave. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth small, numerous. Gill rakers in 10 specimens 58.0 to 104.5 mm S. L. (72.0 to 132.0 mm T.L.) on left outer most arch, (13-15) + 1 + (5-6), total 19-22; gill rakers long, those at extremities bent towards angle of arch, each with a double row of about 18 spines on inner surface. Scales small, all over the body, absent on breast. First part of lateral line with a concavity, later running less convex than dorsal profile, extending posteriorly to base of caudal fin. Dorsal and anal spines weak, compressed, second dorsal spine 2.05-2.57 in height of body, 4.52-5.33 in S. L., 5.70-6.61 in T. L. Third and fourth dorsal spines and third anal spine serrated anteriorly for about half length from base. Pectorals 4.64-5.52 in

S. L. and 5.81-6.94 in T. L. Ventrals 6.61-8.28 in S. L. and 6.29-10.20 in T. L. with axillary scales, their tips ending far in front of origin of anal. Caudal deeply forked.

Back grey, abdomen silvery, black dots all over ventral half of body. Golden hue along lateral and dorsal half of body and on head. Tip of snout black. A deep black patch from posterior margin of second dorsal spine to anterior margin of sixth dorsal spine. Pectorals colourless. Inner side of pectoral base grey. A broad yellow band over the lateral line from posterior margin of eye to caudal base. The band which is distinct in fresh condition, disappears gradually and on preservation in formalin. Soft dorsal yellow with a black edge. Anal golden yellow from second spine onwards along the distal half of fin, last five rays appearing hyaline. Ventrals colourless.

*Distribution.* South Asia to India including Andaman Islands, Sri Lanka, Siam, Indo-Australian Archipelago, Queensland.

*Remarks:* Weber and de Beaufort (1931) on examination and comparison of *Equula gerruoides* Bleeker with *L. daura* concluded that the former is synonymous with the latter. However, their explanation that the black spot of *daura* may fade as is also known from *L. spinulosus* with reference to Bleeker's description of *gerruoides* as having "dorsali spinosa ... picea versus fuscescens vel aurantiaca" does not appear to be sound, as in the present study the deep black blotch on the spinous dorsal of *L. daura* as well as of *L. spinulosus* are found to be permanent even on preservation and very little change in intensity of the colour occurs even on long preservation.

#### 10. *Leiognathus leuciscus* (Günther) (Plate II C)

*Equula leuciscus* Günther, *Catalogue of Fishes Brit. Mus.*, 2 : 503, Meyer, 1885, *An. Soc. Esp. Hist. Nat. Madrid*, 14 : 26.

*Leiognathus leuciscus* Bleeker, 1885, *Ned. Indisch. Dierk.*, 2 : 290. Jordan & Seale, 1905, *Proc. U. S. Nat. Mus.*, 28 : 77-7. Fowler & Bean, 1922, *Proc. U. S. Nat. Mus.*, 62 : 23. Weber & de Beaufort, 1931, *Fish. Indo-Aust. Archip.*, 6 : 327-328. Herre, 1933, *J. Pan. Pacific Res., Inst.*, 8 : 8-13. *Fishes*, 1931, *Philippine Exped.*, p. 37. Villalobid, 1937, *Philippine J. Sci.*, 63 : 21. Herre, *Fishes*, 1940-41, *Exped.*, 1953, *U. S. Fish & Wildl. Ser. Res. Rep.*, 20 : 24. Tiews & Cuevas Borja, 1965, *Philippine J. Fish.*, 7 : 59-85. James, 1968, *J. mar. Biol. Ass. India*, 9 : 300-302. James & Badrudeen, 1969, *J. mar. Biol. Ass. India*, 10 : 107-117 (1968).

*Material:* 36 specimens 65.5 to 95.5 mm S. L. (82.0 to 117.0 mm T. L.) from the Palk Bay and Gulf of Mannar in the vicinity of Mandapam.

*Description:* D, VII, 7; A, III, 14. Oblong, head 3.44-3.85; height 2.31 to 2.68 in S. L. (3.81-4.78 and 2.91-3.53 in T. L., respectively); eye 2.68-3.35 in head, equal to snout which is equal to interorbital space. Scales fairly prominent, deciduous and diaphanous, covering the entire body. Lateral line gently convex, extends beyond soft dorsal and anal fins, becoming indistinct at the end of its course. Second dorsal spine filiform, upper half of which is flexible, extending beyond middle of soft portion and also exceeding height of body below its origin in large specimens (above 79 mm S. L.). In smaller specimens (below 79 mm S. L.) it does not reach middle of soft portion and is only more than half height of body below its origin. Third dorsal spine also long but only half the length or more of the preceding. Second anal spine also filiform, its distal one-third flexible and is less

than one half length of second dorsal spine, extending upto origin of 7th anal ray in large specimens (above 79 mm. S. L.). Pectoral 6.26-7.38 and ventral 9.78-12.25 in T. L. Gill rakers (on left outermost arch) in 10 specimens (71.5 to 90.0 mm S. L.) (9-11)+1+(4-5), total 14-17. They are well developed, each with a row of small, sharp spines on either side.

Back greyish, with a combination of irregular, semicircular and angulated lines, all the marks brown or grey in colour. Abdomen silvery. Margin of snout grey. Membrane between dorsal spines yellow at mid-height which is continued along edge of soft dorsal and superimposed with light grey. Anal with similar colour as the dorsal. Posterior portions of caudal lobes yellowish with light grey edges.

*Distribution:* Formosa, Philippines, India.

*Remarks:* Fowler and Bean (1922) consider that *Leiognathus edwardsi* and *L. stercorarius* both of Evermann and Seale may be synonymous to *L. leuciscus*. They state that the prolonged second dorsal spine is variable in this species. Jordan and Seale (1905) also indicate that the second dorsal spine in three of their specimens was a little shorter than indicated in Günther's description. In the present study the length of the second dorsal spine has been found to exceed height of body and reaching beyond middle of soft dorsal fin in specimens above 79 mm S.L. and exceed only half height of body and not reaching middle of soft dorsal fin in specimens below 79 mm S. L.

The species resembles closely *L. berbis* and *L. lineolatus*, all of which have an almost similar shape of body and colour pattern but can be distinguished from both by the elongate and flexible nature of the second dorsal and second anal spines. These spines, however, are frequently seen in broken condition.

The data on type of *Equula leuciscus* is given in Table 6 and the photograph in Pl. II B.

TABLE 6. *Data on type of Equula leuciscus* (BMNH, 1858, 4, 21, 243 ex Amboina)

Character	Measurement (mm)	Character	Measurement (mm)
Standard length	104.1	Dorsal spines 2nd	7.9 (tip dam.)
Fork length	118.1	3rd	6.7 (tip dam.)
Total length	132.8 (tip dam.)	Predorsal	46.4
Head	28.4	Pectoral length	18.8
Depth	44.1	Caudal length	28.4 (tip dam.)
Snout	9.3	Posterior limit of extension of lateral line	below base of antepenultimate dorsal ray.
Eye diameter	9.0	Scales on chest	Nil
Interorbital	9.7	Colour	Light brown above mid lateral line, silver below. No bars or stripes or spots.

## II. *Leiognathus blochii* (Valenciennes) (Plate III A)

*Equula blochii* Valenciennes, in Cuvier and Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 84. Bleeker, 1853, *Nalez. Ichth. Fauna Bengalen*, p. 46. *Verh. Batav. Gen.* 25. Day, 1876, *Fish. India*, p. 241.

*Zeus notatus* Bloch (MS), Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 84.

*Leiognathus (Eubleekeria) sp. nov.* Steadler, 1904, *Trans. Acad. Nat. Sci. Philadelphia*, 12 (2) : 516, pl. 14 (flower figure to right).

*Leiognathus bhuchii* Seale, 1904, *Trop. Zool. J. Sci.*, 5 Sec. D : 273. Chaudhuri, 1923, *Mem. Ind. Mus.*, 5 : 732. Weber & de Beaufort, 1931, *Fish Indo-Austr. Archip.*, 6 : 328-332. Tiews & Caeces-Borja, 1965, *Philippine Fish*, 7 : 59-85.

*Leiognathus bhuchii* Herre, 1927, *Fishes 1936-37 and 1940-41 Exped.: U. S. Fish & Wildl. Serv. Res. Rep.*, 20 : 291.

**Material:** 10 specimens, 701 to 793 mm S. L. (87.0 to 96.0 mm T. L.) from Karwar and Mangalore (west coast of India).

**Description:** D.VIII, 06; A.III, 4. Elongate, compressed, dorsal and ventral profiles of equal convexity, the former showing an almost an even curvature from tip of snout to origin of dorsal fin. Snout pointed. Height 2.39-2.68, head 3.09-3.67 in S. L. (2.98-3.35 and 3.9-4.90 in T. L. respectively). Eye 2.50-3.28 in head. Interorbital space flat, divided into two lateral cavities by the elevation of the premaxillary shaft, bounded by two ridges which continue as outer edges of the nuchal spine. The median portion of the nuchal spine elevated, especially its anterior end, forming a notch on top of head. First nuchal spine is about 1.75 in head. Two small spines on top of head opposite front border of eye, the outer more prominent than the inner, the ridge forming the boundary of the interorbital space arising between them. Mouth when protruded forms a tube directed downwards, gape of mouth opposite lower third of eye, tip of maxilla surpassing front border of eye. Mouth small, lips narrow and thin. Lower jaw strongly concave. Preopercle with an obtuse angle and finely serrated lower margin. Teeth small, numerous; gill rakers in 10 specimens, 50.0 to 84.0 mm S. L. (60.0 to 101.0 mm T. L.) on left outermost arch (14-15)+(0-1)+(4-6)+(4-9) (19-21); gill rakers short and stout each with a double row of about 16 small spines. Scales small, all over the body, including the breast. First part of lateral line shows concavity, later running less convex to dorsal profile, extending posteriorly upto the base of caudal fin. Dorsal and anal spines of moderate strength, compressed; second dorsal spine 1.63-2.18 in height of body, 4.23-5.55 in S. L. and 5.64-6.86 in T. L., the third and fourth dorsal spines anal spine serrated anteriorly for about half the length from the base. Second anal and the third spine conspicuous, especially in small specimens, 1.5 to 2.0 in head. Pectorals 4.19-5.36 in S. L. and 5.22-6.70 in T. L. Ventrals 6.52-8.82 in S. L. and 8.50-10.67 in T. L., situated low scales their tips not reaching origin of anal. Caudal deeply forked.

Colour silvery, upper part more silvery than back which has black irregular marks extending down to about half level. In fish about 72.0 mm S. L. (83.0 mm T. L.) the lower marks disappear and the upper marks coalesce to form a broad, irregular black band above the dorsal profile, upto the end of soft dorsal. In front, it is continuous with the light brown blotch on the nape which becomes darker on preservation to brownish. The blotch covers a large area from about the posterior half length of the nuchal spine (which is also pigmented) to origin of dorsal fin. Tip of snout dotted black. Fine black dots on the ventral half of body and top of head. The membrane from about half level to tips of spines between second to seventh dorsal spines black. Soft dorsal, anal and caudal fins are yellowish with grey edges. Ventrals and pectorals colourless. Inner side of pectoral base dotted black. The gill opening area covered by the edge of lower half of operculum also dotted black.

*Distribution:* Philippines, India (Bombay, Malabar, Madras, Calcutta, Akyah, Sunderbans, Chilka lake).

*Remarks:* *L. blochii* and *L. brevirostris* were dealt with separately by Valenciennes (1835). Day (1876) gave separate descriptions of the species but commented in the account of *L. brevirostris* that they may be varieties of a single species. He chiefly distinguished them on the presence (in *L. blochii*) or absence (in *L. brevirostris*) of scales on breast. Though it is often difficult to verify this character in many other species of this family, it is indeed the most important difference between the two species, and easy to make out as the scales on breast in *L. blochii* are very conspicuous. The present author had opportunity to examine one specimen of *L. blochii*, 63 mm. S. L. collected by Day from Bombay and deposited in the Zoological Survey of India, Calcutta (Reg. No. 46) in which the scales on chest are quite conspicuous and clearly discernible. While the light brown patch surrounded by a dark edge on nape is very characteristic of both the species, they differ in several respects, the most important of which are given in Table 7.

TABLE 7. Important differences between *L. blochii* and *L. brevirostris*

Character	<i>L. blochii</i>	<i>L. brevirostris</i>
Scales on breast	Present	Absent
Shape of body	Narrow and long	Broad and short
Blotch on spinous dorsal	Jet black	Grey or absent
Colour marks on back	Back grey, with close-set grey zig-zag lines and yellow hue	Back brown with few washed grey bands
Yellow patch on breast	Absent	Present

Munro (1955) synonymised *L. blochii* with *L. brevirostris* without attributing any reasons but as explained above, the species are quite distinct. Weber and de Beaufort (1931) commented that they lack it in their collections from Borneo and that Bleeker did not know the species from the Archipelago, although Seale (1910) stated that *L. blochii* is a common food fish of Borneo, also recorded from Philippines. They quoted Day's descriptions for both the species although they were in possession of material of *L. brevirostris* with the comment that their specimens agree very well with Day's description (after examining a specimen of *L. brevirostris* collected by Day) but preferred to repeat Day's description as their specimens were young.

*Leiognathus spilans* of Fowler (1904) described on a single specimen of 1.5-1.6 inch according to Fowler himself may prove to be the young of *L. blochii* (Valenciennes). He describes that it has an indistinct brown saddle-like blotch in front of spinous dorsal on the back. However, the drawing appears diagrammatic, with the depth of body greater in proportion to length for *L. blochii*.

Day mentioned *L. blochii* and *L. brevirostris* from the seas and estuaries of India but in present study the latter species was found in the sea as well as estuaries and backwaters at several places whereas the former was collected so far, only from the sea.

## 12. *Leiognathus brevirostris* (Valenciennes) (Plate III B)

*Equula brevirostris* Valenciennes in Cuvier and Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 83. Day, 1876, *Fish. India*, p. 241.

*Leiognathus brevirostris* Weber & de Beaufort, 1931, *Fish Indo Austr. Archip.*, 6 : 330-331. Herre, 1936, *Philippine J. Sci.*, 59 : 36; 1953, *U. S. Fish & Wildl. Serv. Res. Rep.*, 20 : 291. Munro, 1955 (in part), *Marine and Freshwater fishes of Ceylon*, p. 146. Tiews & Cances-Borja, 1965, *Philippine J. Fish.*, 7 : 59-85. James & Badrudeen, 1969, *J. Mar. Biol. Ass. India* 10: 107-113 (1968).

*Material:* 50 specimens, 46.0 to 95.0 mm S. L. (57.0 to 120.00 mm T. L.) from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam.

*Description:* D. VIII, 16; A. III, 14. Oval, compressed, dorsal and ventral profiles more or less equally convex, the former showing a distinct notch at the commencement of the nuchal spine. Snout pointed. Height 2.03-2.30, head 2.82-3.34 in S.L., (2.60-3.00) and 3.56-4.30 in T.L., respectively, eye 2.70-4.00 in head. Interorbital space flat but the premaxillary shaft divides it into two lateral cavities by its elevation. The ridges which form the boundaries for interorbital space commence with an inward curvature (especially in large specimens) and posteriorly also show an inward curving and become continuous with the nuchal spine. The median portion of the nuchal spine is elevated, especially its anterior end, forming a notch in the dorsal profile. The nuchal spine is 2.0 to 2.5 in head, smaller in large specimens. Two small spines on top of head opposite from border of eye, the outer spine more prominent than the inner with which the ridge bounding the interorbital space is almost continuous. Mouth when pretracted forms a downwardly directed tube, the gaps at mouth opposite or immediately below lower margin of eye, and the tip of maxilla ending far in front of front border of eye. Mouth big, lips broad and thick. Lower margin of lower jaw strongly concave. Preopercle with an obtuse angle, its outer margin finely serrate. Teeth small, numerous; gill rakers in 10 specimens 88.0-88.5 mm S. L. (72.0 to 111.0 mm T. L.) on left outermost arch (14-17) = 10 (1-3) = 23; total 19-23; gill rakers long and stiff, each with a double row of about 8-10 spines. Scales small, all over the body, except on breast. First part of anal base concave, later runs less convex to dorsal profile, extending posteriorly up to base of caudal fin. Dorsal and anal spines weak, compressed, second dorsal spine 1.79-2.39 in height of body, 3.93-5.19 in S. L., and 4.88-6.37 in T. L. Third and fourth dorsal spines and the third anal spine serrated anteriorly for about half length from the base. Pectorals 4.00-5.70 in S. L., and 4.96-7.10 in T. L. Ventrals 5.92-7.63 in S. L., 7.40-10.42 in T. L., with axillary scales and do not reach the origin of anal fin. Caudal deeply forked.

The colour of this species was only very briefly given by earlier authors and their accounts also lack important details. Therefore, the following description based on a wide size range of fresh and preserved specimens is given below:

Silvery, back less silvery than abdomen. In large specimens about 104 mm S. L. (129 mm T.L.) back with irregular zig-zag grey lines which extend on the sides to little below the lateral line, anteriorly to below origin of dorsal fin and posteriorly to end of soft dorsal. In smaller specimens (70 mm S. L., 85 mm T. L.) instead of the lines, about eight vertical non-silvery bands descend to the same level as in the large specimens. A non-silvery area or blotch on nape from about the origin to tip of nuchal spine. Within the area, a small, paler semicircular area is present on each side, prominent in small specimens (below about 85 mm S. L.) but diffuse in large specimens (above 85 mm S. L.). A small pale area is present, immediately behind the soft dorsal. A conspicuous, diffuse golden yellow patch on abdomen about mid-way between origin of ventrals and anal and away from ventral profile. The patch fades off with time. Tip of snout dotted black. Spinous dorsal membrane golden at midheight, continued on to margin of soft dorsal with a dusky edge. Pectorals and ventrals colourless but pectoral axil faint golden. Membrane between second and third anal spines golden, continued on to margin of soft anal. In some specimens the membrane is creamy white at tips of spines and soft anal margin orange in colour. Posterior margin of lower caudal lobe and part of its ventral margin golden. The upper caudal lobe and its posterior margin grey. Inner side

of pectoral base dotted deep black. The edge of lower half of gill opening covered by the opercular margin is also dotted black and continuous with that on inner side of pectoral base. In specimens, 68 mm. T. L. and above it was observed that all colours except the yellow patch on breast, black colour on snout and the blotch on the nape disappear. Some colour variation with size is also noticeable in this species.

*Distribution:* Seas of India to China.

*Remarks:* Remarks pertinent to *L. brevirostris* in conjunction with *L. blochii* are given under the latter species.

According to Day, "*Equula nuchalis* Temminck and Schlegel is very similar but the dorsal and anal spines appear to be usually shorter but this again is subject to considerable variation".

Many earlier authors have described a black blotch on the spinous dorsal of this species as in *L. blochii*. Present observations show that it is either very faint or absent in many cases. However, the young ones (upto 60 mm T.L.) are characteristic with a grey blotch on spinous dorsal.

In the original description by Valenciennes (1835) the species was described as having black blotches, short, less truncated snout, mouth forming a short tube, spines are shorter and less stronger. Colour bright silvery, back a little rosy, the transverse blotches or lines slightly apparent. Its fins are yellowish.

It is striking to note that this description does not mention the brown blotch on nape, yellow spot on the breast and the black blotch on spinous dorsal (which is not present in adults but stated to be present by many authors). The absence of scales on the breast was also not specifically mentioned based on which character Day (1876) chiefly distinguished the species from *L. blochii*.

During the present study, slight differences were noticed between *L. brevirostris* occurring in the Palk Bay and the Gulf of Mannar. The most important of these are the lesser depth, distinct notch on top of head, dull silvery colour, less prominent blotch on nape in specimens from the Palk Bay when compared to those from the Gulf of Mannar. These differences, however, are not considered at present to constitute a case for specific differentiation.

### 13. *Leiognathus berbis* (Valenciennes) (Plate III C)

*Scomber equula* Var. b. Forsskal, 1775, *Descr. Animal*, p. 85.

*Equula berbis* Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 85. Klunzinger, 1884, *Fische Roth. Meer*, p. 107.

*Equula oblonga* Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.* 10 : 85. Bleeker, 1852, *Makreel. Visschen*, p. 84, *Verh. Batav. Gen.*, 24. Gunther, 1860, *Cat. Brit. Mus.*, 2 : 502, Day, 1865, *Fish Malabar*, p. 106. Klunzinger, 1871, *Abh. Zool. Botan. Ges. Wien.*, 21 : 467. Day, 1876, *Fish. India*, p. 243. Weber, 1913, *Siboga Exp. Fische*, p. 268. de Beaufort, 1913, *Bijdr. Dierk. Leiden*, p. 120.

*Equula gracilis* Bleeker, 1854, *Nat. Tijdschr. Ned. Indie*, 7 : 249.

*Leiognathus oblongus* Bleeker, 1863, *Ned. Tijdschr. Dierk.*, 1 : 270.

? *Leiognathus moretoniensis* Ogilby, 1912, *Mem. Qld. Mus.*, 1: 59. Marshall, 1964, *The Fishes of the Great Barrier Reef and coastal waters of Queensland*, pp. 241-242.

*Leiognathus berbis* Fowler, 1928, *Mem. Bern. P. Bish. Mus.*, 10: p. 153. Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6: 336-337. Herre, *Fishes 1940-41 Philippine Exped.* 1953, *U. S. Fish & Wildl. Serv. Res. Rep.* 20: 290. Tiews & Caeces-Borja, 1965, *Philippine J. Fish.*, 7: 59-85.

? *Equulites moretoniensis* Whitley, 1932, *Mem. Qld. Mus.*, 10 (2): 108, pl. 14, fig. 2.

**Material:** 50 specimens, 65-90 mm. S. L. (89-110 mm. T. L.) from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam.

**Description:** D. VIII, 16; A. III, 14. Elongate, compressed, dorsal and ventral profile equally convex. Occipital profile continued to dorsal profile with a distinct notch. Snout pointed. Height 2.32-2.82, head 3.11-3.97 in S. L., (2.87-3.33 and 3.92-4.44 in T. L. respectively), eye 2.40-3.45 in head. Interorbital space flat, bounded by two ridges which continue as the outer edges of the nuchal spine. Central portion of the nuchal spine elevated, slightly more than 2.0 in head length. Two small spines on top of head opposite the front border of eye, the outer more prominent than the inner, opposite which the ridge bounding the interorbital space commences. Mouth when protracted forms a downward directed tube, gap of mouth opposite lower one-third of eye and tip of maxilla just reaching the front border of eye. Mouth small, lips narrow and thick. Lower margin of lower jaw slightly concave. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth small, numerous, gill rakers in 10 specimens 58.5-82.0 mm S.L. (73.0-101.1 mm T. L.) on left outermost arch (10-13)+(0-1)+(4-6) total 16-19; gill rakes long and sharp, well developed, each with a double row of sharp inward directed spines. Scale small all over the body including the breast. First part of lateral line with concavity, later running less convex to dorsal profile, extending posteriorly to caudal base where it has the course above the median line. Dorsal and anal spines weak, the second dorsal spine 1.32-2.00 in height of body, 3.33-5.29 in S. L. and 4.20-6.59 in T. L. The third and fourth dorsal spines and the third anal spine serrated along the anterior side for about half length from base. Pectorals 4.20-5.77 in S.L. 5.13-6.62 in T. L. Ventrals 7.19-9.50 in S. L. and 8.30-11.67 in T. L. with axillary scales, their tips not reaching the origin of anal. Caudal small, deeply forked.

Colour silvery, abdomen more so than the back, which has light grey, crowded zig-zag marks or patches extending on the sides to slightly below the lateral line, commencing anteriorly immediately behind the head and extending posteriorly up to upper angle of caudal base. There is a tendency for these marks to be arranged serially in large specimens (85.0 mm S. L.; 103.0 mm T. L.). In small specimens (60.0 mm S. L., 74.0 mm. T. L.) these marks are fewer, complete or incomplete irregular circles, not forming rows, more or less confined to back above the lateral line. Snout thickly dotted black, small black dots scattered all over the abdomen and head. Dorsal, pectorals and ventrals colourless. Inner side of pectoral base dotted black as also the lower half of edge of gill opening covered by the opercular flap. Caudal dusky, especially the uppermost and lowermost rays and the edges of lobes.

**Distribution:** Red Sea, Zanzibar, India, Indo-Australian Archipelago and Philippine.

**Remarks:** Valenciennes (1835) described in detail *Equula oblonga* which he remarked corresponds in form to that of Forsskal's specimen (*E. berbis*) if it did no

have the spots. These spots indeed are present in *E. berbis* (*L. berbis*) and could only be an omission by Forsskal. *E. oblonga* (*L. berbis*) according to the original description, among other characters, has a rostro-occipital curvature uniform with that of the back without an indent or concavity. The height of the second dorsal spine does not surpass half the height of body below it and the upper half of each side is dotted with black, round or oval, unequal and irregular marks.

*Equulites moretoniensis* Whitley (= *Leiognathus moretoniensis* Ogilby) appears from the description and figure (pl. 39, fig. 251) given by Marshall (1964) as *L. berbis* but remains to be confirmed on examination of material. It is therefore included here as a doubtful synonym of *L. berbis*.

#### 14. *Leiognathus lineolatus* (Valenciennes) (Plate II D)

*Equula lineolata* Valenciennes in Cuvier and Valenciennes, 1833, *Hist. nat. Poiss.*, 10 : 86. Bleeker, 1852, *Makreel. Vissch.* p. 83, *Verh. Batav. Gen.*, 24. Bleeker, 1852, *Nat. Tijds. Ned. Indie*, 3 : 445. Günther, 1860, *Cat. Brit. Mus.*, 2 : 502. De Vis, 1884, *Proc. Linn. Soc., N. S. Wales*, 9 : 545. Nyström, 1887, *Bihang Akad. Stockholm*, 13 : 36. Perugia, 1889, *Ann. Mus. Civ. Genova*, 7 (2) : 274. Weber, 1913, *Siboga Exp. Fische*, p. 268.

*Leiognathus lineolatus* Bleeker, 1865, *Ned. Tijdschr. Dierk.*, 2 : 190. Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6 : 337-338. Herre, 1936, *Philippine J. Sci.*, 59 : 366. *Fishes 1940-41 Exped.* 1953, *U. S. Fish & Wildl. Serv. Res. Rep.*, 20 : 294. Munro, 1955, *The Marine and Fresh water fishes of Ceylon*, pp. 146-147. Misra, 1959, *Rec. Ind. Mus.*, 57 : 257. Tiews & Caeces Borja, 1965, *Philippine J. Fish.*, 7 : 59-85. James & Badrudeen, 1969 *J. mar. biol. Ass. India.*, 10 : 107-113 (1968).

? *Equula novaehollandiae* Steindachner, 1879, *Denschr. Akad. Wiss. Wien.*, 41 (1) : 11.

? *Leiognathus vermiculatus* Fowler, 1904, *Proc. Acad. nat. Sci. Philad.*, 12 (2) : 513, pl. 15 (lower figure on left). Fowler, 1927, *Proc. Acad. nat. Sci. Philad.*, 79 : 273.

*Leiognathus lineolatus* Jordan, Tanaka & Snyder, 1913, *Journ. Coll. Sci. Univ. Tokyo*, 33 : 131.

*Equulites novaehollandiae* Munro, 1960, *Fish. News letter* (Augst); 19 (6) : 20, fig. 866. Munro, 1967, *The fishes of New Guinea*, p. 240.

*Material*: 50 specimens, 39-78 mm S. L. (49-95 mm T. L.) from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam.

*Description*: D. VIII, 16; A. III, 14. Elongate, compressed, dorsal and ventral profiles equally convex, the rostro-occipital profile rising to dorsal profile in almost a straight line. Height 2.38-2.98, head 3.27-3.73 in S. L. (2.91-3.23 and 3.95-4.56 in T. L. respectively), eye 2.44-3.43 in head. Interorbital space divided into two lateral concavities by the premaxillary shaft. The outer edges of the interorbital space continue as the same for the nuchal spine. The median portion of the nuchal spine raised, slightly more than 2.0 in head length. Two small spines on the top of head, the outer more prominent than the inner, opposite which the ridge bounding the interorbital space commences. Mouth when protracted forms a tube directed downwards, the gape of mouth opposite lower one third of eye and tip of maxilla just reaches the front border of eye. Mouth small, lips narrow and thick. Lower jaw slightly concave. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth small, numerous; gill rakers in 10 specimens, 38.5-89.0 mm S. L. (46.0-108.0 mm T.L.) on left outermost arch (11-12) + 1 + (4-5), total, 16-18; gill rakers short but pointed at tips with about 10 spines in a row on either side. Scales small, all over the body including the breast where they are large. First part of lateral line with a concavity, later running less convex to dorsal profile,

extending posteriorly to caudal base. Dorsal and anal spines weak, second dorsal spine 1.27-1.80 in height of body, 3.08-4.93 in S. L. and 3.88-6.07 in T. L. The third and fourth dorsal spines and the third anal spine serrated anteriorly for some distance from the base. Pectorals 4.82-6.08 in S.L. and 5.82-7.36 in T.L. Ventrals 6.73-8.63 in S. L. and 8.27-10.00 in T. L. with axillary scales and their tips do not reach the origin of anal. Caudal small, deeply forked.

Colour silvery, abdomen more so than the back which has few grey irregular marks from behind head to upper angle of caudal base. Laterally, they extend down to a little below the lateral line, the lowermost marks in the form of about nine round or irregular blotches arranged in a row. Some of the marks may be diffuse, irregular semicircles or circles. The ventral half of body with fine black dots. Tip of snout dotted black. Dorsals, pectorals and ventrals colourless. Inner side of pectoral base dotted black as also the edge of lower half of gill opening covered by opercular flap. The upper and lowermost caudal rays dusky as also the margins of caudal lobes.

*Distribution*: Madagascar, India, Indo-Australian Archipelago, Japan, Philippines and Queensland.

*Remarks*: Day's description and figure (Pl. 51C, fig. 3) of this species must be referred to *L. dussumieri* as already stated in remarks under *L. dussumieri*. Fowler (1904) gave an elaborate description of *L. vermiculatus* the name derived from the colour marks simulating the tracks of worms. He commented that this species is closely related to *L. lineolata* Valenciennes but that the original description of the latter is imperfect. He also commented that the figure given by Day does not agree with his specimen, especially in the vertical dark bars on back. This is because Day's figure of *L. lineolatus* is referable to *L. dussumieri*. Fowler's impression (from earlier accounts) that the body of *L. lineolata* is more elongate must have resulted due to the large size of his own specimen (4¼") where the body depth should be more, making the fish appear less elongate. Examination of Fowler's figure suggests that it is *L. lineolatus* but its deeper body should be related to the age of the fish. While the general colour pattern in his figure agrees with that of *L. lineolatus* the colour on snout appears rather unnatural.

As remarked by Fowler (1904), the original description of *L. lineolatus* by Valenciennes needs comment. The description lacks many details of body proportions and colour. The only important characters mentioned are the second dorsal spine is more than half height of body and the back with many small vertical lines and spots. Günther (1860) and Tiews & Caeces - Borja (1965) state that in this species, the second dorsal spine equals half height of body but in the present study it is found to be much more than half height of body. The small vertical lines and spots on the back perhaps could be better described as irregular grey marks or lines and grey blotches or spots, the lowermost of these being prominent, forming a somewhat horizontal row. Munro (1955) in the key to species characterised *L. lineolatus* as having dark irregular spots on the back (also mentioned by Weber & de Beaufort) which is true to the species but in his description (p. 147) refers to vertical zig-zag lines passing down the back (characteristic of *L. dussumieri*). His figure of *L. lineolatus* (Pl. 27, fig. 424) which is after Day is therefore referable to *L. dussumieri*.

*Equula novaehollandiae* Steindachner which Munro (1960, 1967) placed under the genus *Equulites* (= *Leiognathus*) appears from the description and figure as

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*L. lineolatus*. Munro (1967) in his key distinguished *E. novaehollandiae* from *Equulites berbis* (= *L. berbis*) based on elongation of second dorsal and anal spines but no comparison has been made with *L. lineolatus* where these spines are longer than in *L. berbis*. Therefore, *E. novaehollandiae* is included here as a doubtful synonym of *L. lineolatus*.

#### Genus *secutor* Gistel

*Zeus* Bloch, 1787, *Ausl. Fische*, 3: 41.

*Leioagnathus* (in part) Lacepede 1803, *Hist. nat. Poiss.*, 4: 443; and many authors Chanda Hamilton Buchanan, 1822, *Fish. Ganges* p. 106, 371.

*Equula* (in part) Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10: 98; and many authors.

*Secutor* Gistel, 1848, *Nat. Thierry. ix-Pisces*, genotype *sparus insidiator* Bloch.

*Devximentum* (in part) Foler, 1904, *Journ. Acad. nat. Sci. Philad.*, (2) 12: 517.

Body oval and compressed, dorsal and ventral profiles subequal, ventral more convex than the dorsal. A concavity on top of head in occipital region. Snout pointed. The post orbital ridges continue as outer edges of nuchal spine, the median portion of which is but slightly elevated. Only one postnasal spine opposite front border of eye, the postorbital ridge commencing from it. Mouth small, oblique, when protracted forms a tube directed upwards. Lips broad and thin, lower lip broader and smaller than the upper, which is like a loop over the lower. Lower margin of lower jaw slightly concave, at right angles to mouth opening. Preopercle with an obtuse angle, its lower margin finely serrate. Five branchiostegals. Gill membranes attached to isthmus. Gill rakers small, with lateral spines. Pseudo-branchiae present. Teeth minute, numerous, in a villiform band, palate toothless. Scales small, diaphanous and deciduous, cover the body except the head. Lateral line runs less convex to dorsal profile of body, extends to almost the base of caudal. Dorsal and anal spines weak, compressed, second to fifth dorsal spines and third anal spine showing sculpture along their posterior margins, almost for the entire length. Dorsal with VIII spines and 16 rays, anal with III spines and 14 rays, the second dorsal and second anal spines being the longest. Soft dorsal and anal with a basal scaly sheath. Pectorals short, ventrals with one spine and five rays and an axillary scale-like process. Caudal deeply forked.

*Distribution*: South Arabia, Madagascar, Seychelles, Delagoa Bay, Natal coast, India, Sri Lanka, Indo-Australian Archipelago, China, Hong-kong, Formosa, Philippines, Australia, Tahiti. In sea and estuaries, entering rivers.

#### KEY TO SPECIES

Depth 1.57-1.74 in standard length ..... *Secutor ruconius* (Hamilton-Buchanan)  
Depth 1.93-2.16 in standard length ..... *Secutor insidiator* (Bloch)

#### 1. *Secutor ruconius* (Hamilton-Buchanan) (Plate III E)

*Chanda ruconius* Hamilton-Buchanan, 1822, *Fish. Ganges* p. 106, 371, pl. 12, fig. 35.

*Equula ruconius* Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10: 79. ?Bleeker, 1853, *Nalez. Ichth. Jauna Bengalen en Hindostan*, 25: 96. ?Day, 1876, *Fish. India*, p. 242 (nec. Day, 1869, *Proc. Zool. Soc. London*, p. 302). Duicker, 1904, *Mitth. Naturh. Mus., Hamburg*, 21, : 157.

*Equula interrupta* Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10: 102. Bleeker, 1852, *Makreel. Vissch., Verh. Batav. Gen.*, 24: 85. Günther, 1860, *Cat. Brit. Mus.*, 2: 504. Kner, 1865-1867, *Novara Exp. Fische*, p. 169. Macleay, 1881, *Descr. Cat. Austral. Fish.*, 1: 185. Weber, 1913, *Siboga Exp. Fische*, p. 269.

*Leiognathus interruptus* Bleeker, 1865, *Ned. Tijdschr. Dierk.*, 2: 290.

*Equula ruconia* Jordan & Seale (1906) 1907, *Bull., Bur. Fish.*, 26: 15. Seale, 1910, *Philippine J. Sci.*, 5: Sec. D: 272. Borodin, 1930, *Bull., Vanderbilt Marine Mus.*, 1 art. 2, p. 49.

*Deveximentum ruconius* Fowler, 1918, *Copeia*, No. 58, p. 63.

*Leiognathus ruconius* Weber & de Beaufort, 1931, *Fish. Indo-Austr. Archip.*, 6: 317-318. Herre 1936-37 and 1940-41 *Expeds. Umali*, 1936, *Edible fishes, Manila*, p. 125, fig. 85; 1937, *Philippine J. Sci.*, 63: 235. Herre, 1953, *U. S. Fish. & Wildl. Serv., Res. Rep.*, 20: 294-295. Misra, 1959, *Rec. Ind. Mus.*, 57: 258. Tiews & Caeces-Borja, 1965, *Philippine J. Fish.*, 7: 59-85.

*Secutor ruconius* Fowler, 1927, *Proc. Acad. nat. Sci. Philad.*, 79: 273. Smith, 1949, *The Sea Fishes of Southern Africa*, p. 243. Munro, 1955, *The Marine and Freshwater fishes of Ceylon*, pp. 144-145. Marshall, 1964, *Fishes of the Great Barrier Reef and coastal waters of Queensland* p. 241. Munro, 1967, *The fishes of New Guinea*, p. 239.

**Material:** 50 specimens, 44-63.5 mm S. L. (57-80 mm T. L.) from the Palk Bay and Gulf of Mannar, in the vicinity of Mandapam.

**Description:** D. VIII, 16; A. III, 14. Body oval in shape, compressed, dorsal profile rising from snout with a concavity and is less convex than the ventral profile. Snout pointed. Height 1.57-1.74, head 3.26-3.90 in S. L. (2.00-2.20 and 3.86-4.87 in T. L. respectively), eye 2.45-3.30 in head. Interorbital space concave, bounded by two ridges which continue as the outer edges of nuchal spine. The median portion is elevated, about 2 in head. One small spine on head, immediately above eye and opposite its front border from where the ridge bounding the interorbital space commences. Mouth when protracted forms a tube directed upwards, gape of mouth opposite middle of eye and the tip of maxilla far in front of the front border of eye. Mouth small, lips broad and thin, lower lip smaller and broader than upper which is like a ring over the lower. Lower margin of lower jaw slightly concave, at right angles to mouth slit. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth numerous, very small, in a villiform band, gill rakers in 10 specimens, 35-66.5 mm S. L. (44-84 mm T. L.) on left outermost arch (14-20) + (0-1) + (3-5), total 18-25; gill rakers long, delicate, sharp and bent at tips, each with about 22 small spines. Scales small, all over the body, including the breast. Lateral line convex from the beginning, runs less convex to dorsal profile and extends to base of caudal. Dorsal and anal spines compressed, weak, second dorsal spine 3.15-3.89 in height of body, 5.35-6.47 in S. L. and 6.70-8.12 in T. L., second to fifth dorsal spines and third anal spine show sculpture along their posterior margins almost for the entire length. Pectorals 4.00-4.75 in S. L. and 5.15-5.9 in T. L. Ventrals 9.27-13.87 in S. L. and 11.64-17.50 in T. L., with axillary scales, and their tips do not reach the origin of anal. Caudal deeply forked. Colour of body silvery, with about 10 black or grey vertical bands on the back extending to a little below the lateral line, anteriorly commencing below tip of nuchal spine and posteriorly extending upto end of soft dorsal. Abdomen with black pigment dots. A prominent black curved band from the lower margin of eye to posterior angle of lower jaw. Membrane between second to fifth dorsal spines black in the upper one-third portion. Soft dorsal, pectorals, ventrals, anal and caudal colourless. Inner side of base of pectoral black. Black spots are present along edge of lower half of gill opening from anterior base of pectoral.

*Distribution:* South Arabia, India, Sri Lanka, Malaysia, China, Formosa, Philippines, Indo-Australian Archipelago, Australia, (Port Essington). In sea and estuaries, entering rivers.

*Remarks:* Weber and de Beaufort (1931) commented that *Equula ruconius* Bleeker (1853) is a different species from *Chanda ruconius* Hamilton-Buchanan = *Equula interrupta* of Cuvier & Valenciennes, Day, and Bleeker (1852) but treated it as a doubtful synonym of *S. ruconius*. *Equula ruconius* Day (1869) has been erroneously referred to this species as stated by Day himself and placed under *Equula edentula* (= *Leiognathus equula*) by Day (1878, p. 239).

## 2. *Secutor insidiator* (Bloch) (Plate III F)

*Zeus insidiator* Bloch 1787, *Aust. Fische*, 3 : 41, pl. 192, figs. 2-3. Bloch and Schneider, 1801, *Syst. ichth.*, p. 95. Lacépède, 1803, *Hist. nat. Poiss.*, 4 : 572, 574.

*Equula insidiatrix* Valenciennes in Cuvier and Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 98. Bleeker, 1845, *Nat. & Geneesk. Arch. Ned. Indie*, 2 (3) : 518 (name only). Cantor, 1850, *Journ. Asiat. Soc. Bengal*, 18 : 1133. Bleeker, 1852, *Makreel. Vissch.*, p. 84, *Verh. Batav. Gen.*, 24. Günther, 1860, *Cat. Brit. Mus.*, 2 : 504. Kner, 1865-1867, *Novara Exp., Fische*, p. 169. Jouan, 1867, *Mem. Soc. Sci. Nat. Cherbourg* 3 (2) : p. 166. Day, 1878, *Fish. India*, p. 242. Weber, 1913, *Siboga Exp. Fische*, 268.

*Leiognathus insidiator* Bleeker, 1865, *Ned. Tijdschr. Dierk.*, 2 : 290. Bean and Weed, 1912, *Proc. U. S. Nat. Mus.*, 42 : 604 (name only). Barnard, 1925-1927, *Ann. S. Afr. Mus.*, 21 : 625. Weber and de Beaufort (1931), *Fish. Indo-Austr. Archip.*, 6 : 316-317. Herre, 1933, *J. Pan. Pacif. Res. Inst.* 8 : 8; *Fishes 1936-37 Exped. Umali*, 1936, *Edible fishes, Manila*, p. 126, fig. 86; 1937, *Philippine J. Sci.* 63 : 234. Herre, 1953, *U. S. Fish. & Wildl. Ser. Res., Rep.*, 20 : 59-85.

*De veximentum insidiator* Fowler, 1904, *Journ. Acad. Nat. Sci. Philad.*, 12 (2) : 517. Fowler, 1918, *Copeia*, 58 : 63.

*Equula insidiator* Jordan & Seale, 1905, *Proc. U. S. Nat. Mus.*, 28 : 777. Jordan & Seale, (1906) 1907, *Bull. U. S. Bur. Fish.*, 26 : 15. Jordan & Seale, (1905) 1907, *Proc. Davenport Acad. Sci.*, 10 : 8. Jordan & Richardson, 1908, *Bull. U. S. Bur. Fish.*, 27 : 252.

*Leiognathus insidiatrix* Jordan & Starks, 1917, *Ann. Carnegie Mus.*, 11 : 444.

*Secutor insidiator* Fowler, 1927, *Proc. Acad. Nat. Sci. Philad.*, 79 : 273. Fowler, 1928, *Fish. Oceania, Mem. Bern. P. Bishop. Mus.*, 10 : 154. Smith, 1949, *The Sea Fishes of Southern Africa*, p. 243. Munro, 1955, *The Marine and freshwater fishes of Ceylon*, p. 145. Smith & Smith, 1963, *Fishes of Seychelles*, p. 25.

*Material:* 37 specimens, 62.5 to 84.0 mm. S. L. (76.0 to 105.0 mm T. L.) from the Palk Bay and Gulf of Mannar in the vicinity of Mandapam collected during the years 1965 to 1967.

*Description:* D. VIII, 16; A. III, 14. Body oval and elongated, compressed, the dorsal profile showing a concavity on top of head and is less convex than ventral profile. Snout pointed. Height 1.93-2.16, head 3.46-3.91 in S. L. (2.39-2.64 and 4.29-4.88 in T. L. respectively); eye 2.62-3.50 in head. Interorbital space concave, the two ridges bounding it continuing as the outer edges of nuchal spine, the median portion of which is not raised above their level and is about 2 in head. One small spine on head, immediately above the eye and opposite its front border, opposite which the ridge bounding the interorbital space commences. Mouth when protracted forms a tube directed upwards, gape of mouth opposite about

middle of eye and the tip of maxilla far in front of the front border of eye. Mouth small, lips broad and thin, lower lip broader and smaller than the upper which is like a loop over the lower. Lower margin of lower jaw slightly concave, at right angles to mouth slit. Preopercle with an obtuse angle, its lower margin finely serrate. Teeth minute, numerous, in a villiform band; gill rakers in 10 specimens, 62-83.5 mm S.L. (76-104 mm T.L.) on left outermost arch (18-20) + (0-1) + (6-8) total 25-28, gill rakers long and pointed, each with about 34 small, sharp spines on either side. Scales small, all over the body including the breast. Lateral line shows a slight concavity at first, later running slightly less convex to dorsal profile, extending posteriorly almost to base of caudal. Dorsal and anal spines weak, compressed, second dorsal spine 2.87-3.54 in height of body, 5.92-6.92 in S. L. and 7.44-8.58 in T. L. Second to fifth dorsal spines and the third anal spine showing sculpture along the posterior margin almost for the entire length. Pectorals 4.00-4.67 in S. L. and 5.07-5.87 in T. L. Ventrals 9.93-12.67 in S. L. and 10.57-16.00 in T. L. with axillary scales, their tips not reaching the origin of anal. Caudal deeply forked. Colour silvery, back with about 10 broken, black, vertical bands (formed of patches) from behind head to end of soft dorsal, laterally extending to a little below lateral line. Abdomen with black pigment spots. Snout margin grey. A black curved band from lower margin of eye to posterior angle of lower jaw. Spinous dorsal membrane between 2 to 6 spines black at the upper one-third portion. Soft dorsal, pectorals, ventrals and anal colourless. Caudal dusky along posterior margins of lobes. Innerside of pectoral base dotted black from where a line of black pigment spots runs down along edge of lower half of gill opening covered by the opercular flap. A line of black pigment spots runs from the upper angle of pectoral base to opposite end of soft dorsal along the median line of the side of the body.

*Distribution:* South African Coast, Madagascar, Seychelles, Delagoa Bay, Natal Coast, India, Sri Lanka, Tonkin, Hongkong, Philippines, Indo-Australian Archipelago, Tahiti.

#### Genus *Gazza* Rüppell

*Gazza* Rüppell, 1835, *Neue Wirbelth. Fische*, p. 3.

*Scomber* Bloch, 1777, (nec Forsskal, 1775) *Ichthyol.*, Tab. 429, fig. 2.

*Zeus* Forster, 1844, (nec Bloch, MS 1835), *Descr. Animal. Curav. hichtenstein*, p. 288

*Equula* (in part) Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10: 88.

*Leiognathus* (*Gazza*) Bleeker, 1879, *Maurice Verh. Akad. Amsterdam*, p. 19.

Oblong, compressed, dorsal and ventral profiles equally convex, the rostrum-occipital profile almost a straight line, continuing into dorsal profile. Snout pointed. Interorbital space divided into two concavities by the premaxillary shaft and bounded by two bony ridges which form the outer margins of the nuchal spine. Two small spines on top of head, immediately above the eye and opposite its front margin, the outer larger than the inner. Mouth when protracted, forms a horizontal tube, lips thick and broad. Lower margin of lower jaw straight. Lower margin of preopercle finely serrate. Caniniform teeth present in both jaws, situated at the symphysis in upper jaw and on the sides in lower jaw. Gill rakers prominent and well developed. Scales small, all over the body, including the breast. Lateral line extends to base of caudal. Dorsal with 8 spines and 16 rays and anal with 3 spines and 14 rays. The spines weak, compressed, the third and fourth dorsal spines and third anal spine serrated along the anterior margin to a short distance from base. Ventrals with axillary scales. Caudal deeply forked.

*Distribution:* Red Sea, east coast of Africa, Indian Ocean, Philippines, North Australia to Society Islands.

## KEY TO SPECIES

1. Depth 2.27-3.14 in standard length.....*Gazza minuta* (Bloch)
2. Depth 1.98-2.20 in standard length.....*Gazza ahlamys* (Jordan & Starks)

1. *Gazza minuta* (Bloch) (Plate III G)

- Scomber minutus* Bloch, 1797, *Ichthyol.*, p. 110, Tab. 429, fig. 2.
- Zeus argentarius* (Forster) Bloch & Schneider, 1801, *Syst. Ichth.*, p. 196. Forster, 1844, *Descr. Animal. Curav. Lichtenstein*, p. 288.
- Gazza equulaeformis* Rüppell, 1835, *Neue Wirbelth. Fische*, p. 4. Cantor, 1850, *Journ. Asiat. Soc. Bengal*, 18 : 1135. Bleeker, 1853, *Nat. Tijdschr. Ned. Ind.* 4 : 261. Klunzinger, 1871, *Abh. Zool. bot. Ges. Wien.*, 21 : 468. Günther, 1876, *Fische Sudsee*, p. 144. Klunzinger, 1884, *Fische Roth. Meer.*, 108. Day, 1878, *Fish. India*, p. 244. Jordan & Evermann, 1902, *Proc. U. S. Nat. Mus.*, 25 : 338. Gilchrist & Thompson, 1908, *Ann. South Afric. Mus.*, 6 : 189. Fowler, 1928, *Mem. Bern. P. Bishop. Mus.*, 10 : 154.
- Equula minuta* Valenciennes in Cuvier & Valenciennes, 1835, *Hist. nat. Poiss.*, 10 : 88.
- Equula dentex* Valenciennes in Cuvier & Valenciennes, *Hist. nat. Poiss.*, 10 : 91. Kner, 1865-67, *Novara Exp. Fische*, p. 170.
- Gazza equuliformis* Bleeker, 1845, *Nat. & geneesk. Arch. Ned. Ind.*, 2 (3) : 518.
- Gazza minuta* Bleeker, 1851, *Nat. Tijdschr. Ned. Ind.*, 2 : 213; 1852, *Makreel. Vissch.* p. 85, *Verh. Batav. Gen.*, 24; 1853, *Nat. Tijdschr. Ned. Ind.*, 4 : 259. Day, 1878, *Fish. India*, p. 244. Fowler, 1904, *Journ. Acad. nat. Sci. Philad.*, 12 (2) : 517. Jordan & Seale, 1905, *Proc. U. S. Nat. Mus.*, 28 : 777. Smith & Seale, 1906, *Proc. Biol. Soc., Washington*, 19 : 77. Evermann & Seale, (1906) 1907, *Bull. Bur. Fish.*, 26 : 69. Jordan & Seale, 1907, *Bull. U. S. Bur. Fish.*, 26 : 15. Jordan & Richardson, 1908, *Bull. U. S. Bur. Fish.*, 27 : 254. Seale, 1910, *Philippine J. Sci.*, 5, Sec. D : 272. Jordan & Starks, 1917, *Ann. Carnegie Mus.*, 11 : 444. Fowler, 1918, *Copeia*, 58 : 63. Barnard, 1925-27, *Ann. S. Afr. Mus.*, 21 : 626. Fowler, 1927, *Proc. Acad. Nat. Sci. Philad.*, 79 : 273. Fowler, 1928, *Mem. Bern. P. Bishop. Mus.*, 10 : 154. Weber & de Beaufort, 1931, *The Fishes of the Indo-Austr. Archip.*, 6 : 339-341. Herre, 1933, *J. Pan. Pacif. Res. Inst.*, 8 : 38; 1934, *Fishes 1931 Philippine Exped.*, p. 37. Smith, 1949, *The Sea Fishes of Southern Africa*, p. 244. Herre, 1953, *U. S. Fish & Wildl. Ser. Res. Rep.*, 20 : 289-290. Munro, 1955, *The Marine and freshwater fishes of Ceylon*, p. 147. Misra, 1959, *Rec. Ind. Mus.* 57 : 258-259. Smith & Smith, 1963, *Fishes of Seychelles*, p. 251. Tiews & Caeces-Borja, 1965, *Philippine J. Fish.*, 17 : 59-85. Munro, 1967, *The Fishes of New Guinea*, p. 238.
- Gazza tapeinosoma* Bleeker, 1853, *Nat. Tijdschr. Ned. Ind.*, 4 : 260. Fowler, 1904, *J. Acad. nat. Sci., Philad.*, 2 (12) : 517. Evermann & Seale, (1906) 1907, *Bull. Bur. Fish.*, 26 : 69.
- Gazza argentaria* Bleeker, 1863, *Ned. Tijdschr. Dierk.*, 1 : 242 (name only). Klunzinger, 1871, *Abh. Zool. bot. Ges. Wien.*, 21 : 467. Günther, 1876, *Fische Sudsee*, p. 144. Klunzinger, 1884, *Fische Roth. Meer.*, p. 108. Day, 1888, *Fish. India, Suppl.*, p. 790. Weber, 1913, *Siboga Exp. Fische*, p. 270. Fowler and Bean, 1923, *Proc. U. S. Nat. Mus.*, 62 : 24.
- Leiognathus (Gazza) minutus* Bleeker, 1879, *Verh. Akad. Amsterdam* p. 19.

*Material:* 50 specimens, 46.5-114.5 mm S. L. (58-141 mm T. L.) from the Palk Bay and Gulf of Mannar in the vicinity of Mandapam.

*Description:* D. VIII, 16; A. III, 14. Oblong, compressed, dorsal and ventral profiles equally convex, the rostrum-occipital profile almost a straight line continued into the dorsal profile. Snout pointed. Height 2.27-3.14, head 2.85-3.19 in S. L. (2.77-3.20 and 3.50-4.00 in T. L. respectively), eye 2.43-3.04 in head. Interorbital space divided into two concavities by the premaxillary shaft, bounded by two ridges

which form the outer edges of nuchal spine. The median portion of nuchal spine not elevated, about 4 in head. Two small spines on top of head, immediately above the eye and opposite its front margin, the outer larger than the inner. The ridge forming the outer boundary of interorbital space arises opposite these spines. Mouth when protracted forms a horizontal tube, gape of mouth opposite lower margin of eye and the tip of maxilla reaches front border of eye. Mouth large, lips thick and broad. Lower margin of lower jaw straight. Preopercle with an obtuse angle, its lower margin finely serrate. Caniniform teeth in upper and lower jaws, in the former at the symphysis and in the latter on the sides. Gill rakers in 10 specimens, 62.5-106 mm S.L. (77-134 mm T.L.) on left outermost arch (14-16)+(0-1)+(3-6), total 18-21; gill rakers curved and bent at tips, the spines on inner surface of each gill raker are also curved. Scales small, all over the body, including the breast. Lateral line convex from the origin and is parallel to dorsal profile, extending posteriorly to the base of the caudal fin. Dorsal and anal spines weak, compressed, second dorsal spine 2.00-2.45 in height of body, 4.87-6.00 in S. L. and 6.06-7.40 in T. L., the third and fourth dorsal spines and third anal spine serrated along the anterior margin to a short distance from base and all the dorsal spines and second and third anal spines bear sculpture along their posterior margins almost for the entire length. Pectorals 4.62-6.34 in S. L., and 5.72-7.71 in T. L.; ventrals 6.40-8.78 in S. L. and 7.84-11.14 in T. L. with axillary scales, their tips not reaching origin of anal. Caudal deeply forked. Colour silvery, back greyish, black dots spread all over the head and ventral half of body. Snout margin dotted black. Edge of the ventral half of opercular flap with fine black dots which in large specimens may coalesce and form a dark band. Spinous dorsal membrane black at the edge and the first few spines also bear black pigment spots. Soft dorsal and anal edged grey, anal spines with black dots. Pectorals and ventrals colourless. Inner side of pectoral base with black dots. Posterior edges of caudal dusky. A band of five black dots present from the anterior end of pectoral base to caudal base on each side.

*Distribution:* Red Sea, Zanzibar, Mossambique, Delagoa Bay, Natal Coast, Madagascar, Bourbon, Mauritius, Seychelles, India including Andamans and Minicoy Islands, Sri Lanka, Siam, Formosa, Philippines, Indo-Australian Archipelago, Australia (Queensland), New Guinea, Solomon Islands, New Britain, Tahiti, Tanna, Rarotonga.

*Remarks:* Although Bleeker (1853) recognised three separate species, viz., *G. minuta* Cuv. Val., & *G. equulaeformis* Rüppell, and *G. tapeinosoma* Bleeker (= *Zeus argentarius* (Forster) Bloch & Schneider = *G. argentaria* (Günther) based on height of body, length of second dorsal and anal spines and size of the canines, according to Weber & de Beaufort (1931) the validity of these characters was doubted by Klunzinger (1871, 1884) and commented upon by Weber (1913) that the three species should be united. This view was supported by Jordan & Starks (1917), Barnard (1927) and others.

## 2. *Gazza achlamys* Jordan & Starks (Plate III H)

*Gazza achlamys* Jordan & Starks, 1917, *Ann. Car. Mus.*, 11 : 446, pl. 45. Herre, 1934, *Fishes 1931 Philippine Exped.*, p. 37. Herre, 1953, *U. S. Fish & Wildl. Serv. Res. Rep.* 20 : 289. Munro, 1955, *The Marine and Freshwater fishes of Ceylon, Canberra*, p. 147. Tiews & Caeces-Borja, 1965, *Philippine J. Fish.*, 7 (1): 59-85. Munro, 1967, *The fishes of New Guinea*, p. 238.

*Material:* 29 specimens, 37-135 mm S. L. (45-163 mm T. L.) from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam.

TABLE 8. *Distinctive features between G. minuta and G. achlamys*

Character	<i>G. minuta</i>	<i>G. achlamys</i>
Serrations on lower margin of preopercle	Fine	Coarse
Teeth	Large	Small
Dorsal spines	Weak	Strong
Scales	Present on body except a triangular space between pectorals and anal base.	Absent anterior to a line from front of soft dorsal to behind the pectoral base and thence to front of anal especially along the back.
Depth of body	Narrow	Broad

*Description:* D. VIII, 16; A. III, 14. Oblong, compressed, dorsal and ventral profiles of equal convexity, the former showing a slight concavity over the front border of eye. Snout pointed. Height 1.98–2.20, head 2.68–3.09 in S. L. (2.49–2.76 and 3.36–3.81 in T. L. respectively), eye 2.64–3.50 in head. Interorbital space divided into two concavities by the premaxillary shaft and bounded by two ridges which form its outer boundaries and continue as the edges of nuchal spine. The median portion of the nuchal spine slightly elevated, about 4 in head. Two small spines on head, immediately above the eye and opposite its front border, the outer larger than the inner. The ridge forming the border of interorbital space arises opposite three spines. Mouth when protracted forms a horizontal tube, the gape of mouth opposite lower border of eye and the tip of maxilla just reaching the front border of eye. Mouth large, lips broad and thick. Lower margin of lower jaw with a very slight concavity. Preopercle with an obtuse angle, its lower margin finely serrate. Caniniform teeth present at the symphysis in upper jaw and on the sides in lower jaw. Gill rakers in 10 specimens, 50.5 to 124 mm S. L. (60 to 152 mm T.L.) on left outer-most arch (12–16)+(0–1)+(3–5), total 15 to 22; gill rakers long and stout, with short strong spines spread on the inner surface. Scales small, all over the body, including the breast. Lateral line convex from the origin and runs parallel to dorsal profile and extends posteriorly upto the base of caudal fin. Dorsal and anal spines weak, compressed, second dorsal spine 2.28 to 2.90 in height of body, 4.62 to 6.25 in S. L. and 5.76–7.83 in T. L., the third and fourth dorsal spines and the third anal spine serrated along their anterior margins for some length from base and all the dorsal spines except the first; the second and third anal spines have sculpture along their posterior margin almost for the entire length. Pectorals 4.68 to 7.52 in S. L., 5.85 to 6.77 in T. L. Ventrals 4.93 to 7.37 in S. L. and 7.62 to 9.13 in T. L. with axillary scales and their tips do not reach the origin of anal. Caudal deeply forked. Colour silvery, back greyish. Black dots all over the ventral half of body and head. Snout tip grey. Edge of the ventral half of opercular flap with black dots, which form a band in large specimens. The membrane of spinous dorsal black at its distal portion and the first few spines also bear black pigment spots. Edge of the soft dorsal grey. Pectorals, ventrals and anal colourless but ventrals of large specimens bear black pigment spots. The inner side of base of pectoral black and a band of pigment spots present along edge of ventral half of gill opening covered by opercular flap. Caudal dusky at posterior margins. A band of black spots runs from anterior end of pectoral base to caudal base.

*Distribution:* India, Sri Lanka, Philippines.

*Remarks:* Day (1878) listed two species, *Gazza minuta* and *G. equulaeformis*, the latter of which has been considered synonymous to the former by later workers.

Weber and de Beaufort (1931) reported only single species, *G. minuta* under the genus *Gayza* from Indo-Australian Archipelago. Later workers have not reported *G. achlamys* although many other species of the family have been mentioned by them. But Munro (1955) reported both *G. minuta* and *G. achlamys* from Ceylon and Tiews and Caeces-Borja (1965) from Philippines. The species is now reported from India, in addition to *G. minuta* already known to occur in Indian Seas. As the species seems to be not given enough recognition hitherto, it is considered useful to set out in Table VIII the distinctive features between *G. minuta* and *G. achlamys* including those vividly given by the authors of the latter species (Jordan & Starks, 1917) with whom the present author is in agreement on examination of a large amount of material of both the species.