

FAUNA OF THE CHILKA LAKE

FISH.

PART I.

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(With 11 text-figures.)

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FISH. (PART I.)

By B. L. CHAUDHURI.

This part contains a systematic treatment of the Sub-orders Selachii and Batoidei of the Order Plagiostomi and of two Sub-orders (Malacopterygii and Ostariophysii) of the Order Teleostei. The total number of specimens examined and recorded in this part is 823, which are found to belong to forty-two species. Of these four are new to science. These forty-two species fall into twenty-five genera belonging to nine different families. The geographical and biological results of my study of the fish fauna of the lake will be discussed on the completion of the systematic notice of the entire collection.

Order PLAGIOSTOMI.

Suborder SELACHII.

Family CARCHARINIDAE.

Genus PHYSODON, Müller and Henle.

Physodon mulleri, Müller and Henle.

1841. *Carcharias (Physodon) mulleri*, Müller and Henle, *Plagiost.*, p. 30, pl. xix, fig. 1.
1878. *Carcharias mulleri*, Day, *Fish. Ind.*, p. 713.
1889. *Carcharias mulleri*, Day, *Faun. Brit. Ind., Fish.*, I, p. 11.
1913. *Physodon mulleri*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 108.

One young specimen (female), 355 mm. in total length, was collected at Rambha in March 1914.

The teeth are not serrated; their cusps are long with broad and somewhat swollen bases, bent towards the angle of the mouth; on the upper jaw there is a small median tooth and there are two small teeth on the symphysis of the lower jaw. The head is broader than deep; the snout is pointed and is about one-third of the distance from the tip of the snout to the fifth gill-cleft; the nostrils are very close to the mouth, their distance from it being only one-fifth of the distance from the tip of the snout to the mouth; the mouth is greatly arched; the eyes, which are lateral, are small and are provided with a nictitating membrane at least on the anterior side; the gill-clefts are wider than the eyes. The second dorsal fin is very small and extends a little further back than the anal fin; there is a distinct pit anterior to the root of the caudal fin. The denticles are very small and numerous.

To judge from the part of the lake in which it was obtained, it is probable that the species is a permanent inhabitant in the main area.

Distribution :—Bengal and China.

Genus **CARCHARINUS**, Blainville.**Carcharinus gangeticus** (Müller and Henle).

1841. *Carcharias (Prinodon) gangeticus*, Müller and Henle, *Plagiost.*, p. 39, pl. xiii.
 1878. *Carcharias gangeticus*. Day, *Fish. Ind.*, p. 715, pl. clxxxvii, fig 1.
 1889. *Carcharias gangeticus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 13.
 1913. *Carcharinus gangeticus*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXI, p. 139.

A specimen was obtained at Satpara in March 1914, the total length of which is 747 mm. The jaw of a young fish was also secured at Rambha in February of the same year. The length and the breadth of this jaw are 68 mm. and 43 mm. respectively. There are 27 rows of teeth in the upper jaw with five teeth in each row and 25 rows in the lower jaw with 6 teeth in each row. There is only one tooth in the middle of each jaw and it is very small. The rest of the teeth are fairly large, generally with long cusps and broad bases, and their margins are serrated; in the end rows, however, the cusps are very short and bent inwards with the bases somewhat swollen.

The species is found in the main area and is probably a permanent inhabitant of the lake.

Distribution:—The species is met with in the seas and estuaries of India, in Japan, the Fiji Islands and at Baghdad. Individuals are known to ascend rivers above tidal influence.

Carcharinus melanopterus (Quoy and Gaimard).

1824. *Carcharias melanopterus*, Quoy and Gaimard, *Voy. Uran. Poiss.*, p. 194, pl. xliii, figs. 1 and 2.
 1878. *Carcharias melanopterus*, Day, *Fish. Ind.*, p. 715, pl. clxxxv, fig. 3.
 1889. *Carcharias melanopterus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 14.
 1913. *Carcharinus melanopterus*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 134.

There is no specimen of this species in the collection. Dr. Jenkins, however, reported (*Rec. Ind. Mus.*, V, p. 135) that he obtained the species at Satpara in December, 1908. Probably it is an occasional visitor to the outer channel when the water becomes brackish.

Distribution:—This species is found in the seas of India and of the Malay Archipelago.

Suborder **BATOIDEI**.Family **PRISTIDAE**.Genus **PRISTIS**, Klein.**Pristis pectinatus**, Latham.

1794. *Pristis pectinatus*, Latham, *Trans. Linn. Soc.*, II, p. 278, pl. xxvi, fig. 2.
 1822. *Squalus pectinatus*, Hamilton Buchanan, *Fish. Gang.*, pp. 5, 361.
 1841. *Pristis pectinatus*, Müller and Henle, *Plagiost.*, p. 109.
 1878. *Pristis pectinatus*, Day, *Fish. Ind.*, p. 811.
 1889. *Pristis pectinatus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 39.
 1909. *Pristis pectinatus*, Annandale, *Mem. Ind. Mus.*, II, p. 7.
 1913. *Pristis pectinatus*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 262.

In the collection there is only one skull with the rostrum, collected in December, 1914 at Nalbano Island. This is the only record we possess of a sawfish in the lake.

The rostrum from the eye to the tip measures 26.5 mm. There are 26 teeth on the right and 23 on the left. The teeth on the left side nearer the head are most irregular. The width of the rostrum in the middle portion is nearly uniform, being 30 mm. At the tip it is only 17 mm. and at the base 50 mm.

This species appears to be only an occasional visitor to the lake.

Distribution:—Tropical and temperate seas, the Red Sea, the Indian Ocean and beyond.

Family TRYGONIDAE.

Genus TRYGON, Cuvier.

Trygon uarnak (Forskål).

1775. *Raia uarnak*, Forskål, *Descript. Anim.*, pp. viii, ix.
 1878. *Trygon uarnak*, Day, *Fish. Ind.*, p. 737 (in part).
 1889. *Trygon uarnak*, Day, *Faun. Brit. Ind., Fish.*, I, p. 53 (in part).
 1909. *Trygon uarnak*, Annandale, *Mem. Ind. Mus.*, II, p. 22, pl. i, figs. 1 and 2; pl. ii, figs. 1 and 1a; pl. iii, fig. 2c.
 1910. *Trygon uarnak*, Gunther, *Sudsee Fische*, III, p. 492.
 1913. *Dasybatus uarnak*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 376.

There is only one young specimen (female) in the collection; it was purchased from a fisherman at Satpara. The dorsal surface is covered with round and black spots on a greyish white ground. The measurements of the specimen are given below:—

Breadth across disk	..	..	..	..	290 mm.
Tip of snout to root of tail	..	..	..	..	264 "
Mouth to vent	..	..	..	..	177 "
Length of tail	..	..	..	..	720 "
Breadth of the mouth	..	..	..	..	25 "
Interorbital space	..	..	..	..	49 "
Length of snout	..	..	..	..	71 "

The species is a permanent inhabitant of the lake, in the shallower parts of which it is common.

Distribution:—Indian Ocean, Red Sea, Gulf of Siam, East Indies.

Trygon pareh, Bleeker.

1851. *Trygon pareh*, Bleeker, *Verhand. Batav. Genoots.*, p. 71, t. xxiv.
 1860. *Trygon ellioti*, Blyth, *Journ. Asiat. Soc. Bengal*, xxix, p. 41.
 1865. *Trygon pareh*, Duméril, *Hist. Nat. Poiss.*, I, p. 590.
 1909. *Trygon alcockii*, Annandale, *Mem. Ind. Mus.*, II, p. 27, text-fig. 3.

This is a medium-sized *Trygon*, the disk of which is slightly broader than long, with the pectoral angles rounded. The snout is pointed and forms nearly a right angle at its extremity. The interorbital distance is contained about one and half times in the length of the snout and four and a half times in the length of the disk, which is moderately flat. Of the four specimens collected a young one has a smooth central dorsal tubercle and another behind it, surrounding which there is a group of

small tubercles indefinitely scattered. In this species the denticles do not form as definite a pattern as in *Trygon gerrardi*. The tail is provided with a single serrated spine, and its dorsal and lateral surfaces are uniformly covered with denticles. The cross-section of the tail anterior to the spine is distinctly flattened, which character marks it off from allied species, in all of which the cross-section in that position is circular. In a young male specimen the tail is more than three and a half times the length of the disk, but in an adult female its length (perhaps mutilated) is only one and a half times that of the disk.

Colour:—The dorsal surface of the disk is dark olive-brown and the dorsal and lateral surfaces of the tail are also brown without markings; the ventral surface (including the base of the tail) is white suffused with pink. The measurements of the four specimens in the collection are given below:—

	Adult ♂, Nalbano, Nov. 1914.	Adult ♀, Balu- gaon, 2-1-15.	Adult ♀ Balu- gaon, 4-1-15.	Young ♂, Balu- gaon, 5-1-15.
	mm.	mm.	mm.	mm.
Breadth of disk	530	582	546	198
Length of disk	512	582	538	190
Distance between the eyes	68	71	66	38
Snout	106	127	117	43
From the broadest part of the disk to the end of the snout.	215	242	221	68
Breadth of mouth	43	51	49	17
Distance between mouth and vent	317	381	320	144
Tail	912	Mutilated	762	594

The adult female from Balugaon collected on the 2nd of February, 1915 is slightly peculiar in the shape of the disk, the angle at the snout being somewhat obtuse; its caudal spine is wanting but perhaps it was lost during life; the tail, which is very short, must have been mutilated, and is, moreover, less flat than in the rest of the specimens.

This species is a permanent inhabitant of the main area, probably breeding in the lake.

Distribution:—R. Hughli, Bay of Bengal, Malay Archipelago.

Trygon imbricata (Schneider).

1801. *Raia imbricata*, Schneider, Bloch's *Ichthyol.*, p. 366.
 1841. *Trygon imbricata*, Müller and Henle, *Plagiost.*, p. 164.
 1841. *Trygon walga*, Müller and Henle, *ibid.*, p. 159, pl. li, fig 1.
 1878. *Trygon imbricata*, Day, *Fish. Ind.*, p. 739.

1889. *Trygon imbricata*, Day, *Faun. Brit. Ind., Fish.*, I, p. 52.
 1900. *Trygon imbricata*, Annandale, *Mem. Ind. Mus.*, II, p. 32, text-fig. 6, pl. iii, fig. 5.
 1913. *Dasybatus imbricatus*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 379.

This small *Trygon* is very common all over the lake-system at all times of the year and breeds in the lake. There are three adult specimens in the collection; one was obtained off Samal Island (22-ix-13), one at Rambha (February, 1914) and the other at Balugaon (5-i-15). Besides these, there are four embryos two of which are small males and the other two still smaller females. The female embryos are slightly longer than broad, whereas in the males the disk is almost as broad as long. The length of the tail in the male embryos is nearly double the length of the disk, whereas in the female embryos the tail is only slightly longer than that of the disk. As the tails in these cases cannot have been mutilated, these proportions are of interest. The localities with the measurements of the embryos are given below. The two younger embryos have the numerous trophonematous filaments still present on all the gill-slits.

Locality and date of collection.		Length of disk in mm.	Breadth of disk in mm.	Length of tail in mm.	Length of umbilical cord in mm.
Barkul, Sept. 1914	♂	60	60	105	U. C. broken, no filaments.
Patsahanipur, 8-iii-14	♂	46	45	60	U. C. 15 mm. with a bulbular yolk sac at the end, no filaments.
Outer Channel, Satpara, 21-iii-14	♀	33	30	40	U. C. 17 mm. with y. s. at the end, numerous filaments entering gill slits.
Ditto	♀	27	24	30	U. C. 13 mm. with y. s. at the end, numerous filaments entering gill slits.

The food of this species consists chiefly of Amphipods and other small Crustacea and of burrowing Molluscs such as *Solen*.

The alimentary canal is remarkably free from parasites.

Distribution :—East Indies.

Genus **HYPLOPHUS**, Müller and Henle.

Hypolophus sephen (Forskål).

1775. *Raia sephen*, Forskål, *Descript. Anim.*, p. 17, no. 16.
 1822. *Raia sancur*, Hamilton-Buchanan, *Fish. Gang.*, pp. 2, 361.
 1841. *Hypolophus sephen*, Müller and Henle, *Plagiost.*, p. 170.
 1878. *Trygon sephen*, Day, *Fish. Ind.*, p. 740, pl. cxcv, fig. 2.
 1889. *Trygon sephen*, Day, *Faun. Brit. Ind., Fish.*, I, p. 50, fig. 21.
 1900. *Hypolophus sephen*, Annandale, *Mem. Ind. Mus.*, II, p. 35, pl. v, fig. 1.
 1913. *Dasybatus sephen*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 384.

This large species of fringe-tailed sting-ray is found everywhere in the lake-system and always in very large numbers in the main area. It breeds in the lake. Together with *Trygon fluviatilis* (H.B.), it has long been known to produce its young in fresh water in India (*Journ. Asiat. Soc. Bengal* (n.s.), VI, p. 497).

The measurements of two embryos are given below; one, a male, is very young, while the other—a female—is almost fully formed. The disk of the younger embryo is much longer than broad, in the advanced embryo it is as broad as long, while in the normal adult it is rather broader than long.

	Embryo ♀. Barkul, Sep- tember 1914.	Embryo ♂. Patshanipur, March 1914.
	mm.	mm.
Length of disk	120	22
Breadth of disk	120	17
Interorbital distance	30	6
Snout ..	30	6
Mouth to vent	100	17
Tail ..	320	33
Umbilical cord	35	12
Yolk sac.	5 × 2	10 × 3
Filament ..	None.	Numerous entering gill-slits.

The food of this species consists chiefly of fish and prawns. In one instance the stomach was found full of weed, which had probably been swallowed for the sake of young molluscs (*Modiola undulata*) attached to it.

The following Cestodes¹ were found in the alimentary canal of specimens taken in the lake:—

Phyllobothrium pammicrum, Shipley and Hornell.

Parataenia medusia, Linton.

Calliobothrium eschrichtii, Van Ben.

The Trematode *Anaporrhutum largum*, Lühe, was found in the body cavity in two cases (Southwell, *op. cit.*, p. 335).

The Ray appears to have no fixed breeding-season.

In fine weather individuals often lie just below the surface of the water gently undulating their pectoral fins.

Distribution:—Indian Ocean, Red Sea, East Indies.

See Southwell, *Rec. Ind. Mus.*, XI, p. 331.

Family MYLIOBATIDAE.

Genus **AETOBATIS**, Blainville.***Actobatis flagellum*** (Schneider).

1801. *Raia flagellum*, Schneider, Bloch's *Ichthvol.*, p. 361, pl. lxxiii.
 1841. *Actobatis flagellum*, Müller and Henle, *Plagiost.*, p. 180.
 1870. *Actobatis narinari*, Gunther, *Cat. Fish. Brit. Mus.*, VIII, p. 402.
 1878. *Actobatis narinari*, Day, *Fish. Ind.*, 743, pl. cxciv, fig 4.
 1880. *Actobatis narinari*, Day, *Faun. Brit. Ind., Fish.*, I, 50.
 1900. *Actobatis flagellum*, Annandale, *Mem. Ind. Mus.*, II, p. 54, text-fig. 10, pl. iv, fig. 5.
 1913. *Actobatus flagellum*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 440.
 1914. *Actobatus flagellum*, Gudger, *Pub. Carn. Inst.* (Washington), CLXXXIII, p. 312.

There is one female specimen in the collection secured by purchase at Barkul. A large number of dead *Actobatis flagellum* were seen lying on the Island of Nalbano by Dr. Annandale in the month of March, 1914. A severed head of the species was brought by Dr. Jenkins from the mouth of the Chilka Lake in December, 1909. In the specimen from Barkul the snout is very long and tapers to a sharp point and is much longer than broad. The eyes are lateral; their dorso-ventral axis is vertical and forms a right angle with the upper surface of the head. The distance from the mouth to vent is contained three times in the width of the disk. The teeth of the lower jaw are strongly curved and the pointed end of the band is seen projecting forward from the mouth. The skin is smooth and of a dark colour and there are no spots.

The measurements of the Barkul specimen are given below:—

Breadth of disk	..	..	..	..	..	494 mm.
Mouth to vent	..	..	..	..	..	165 "
Length of snout	..	..	..	..	..	76 "
Rostral fin	..	..	..	..	..	63 × 2 "
Diameter of eye	..	..	..	..	..	12.6 "
Interorbital space	..	..	..	..	..	63 "
Length of spiracle	..	..	..	..	..	25 "
Ventral fin	..	..	..	..	..	76 × 28 "
Tail	..	..	..	..	..	851 "

The conclusions Dr. Annandale arrived at about this species in 1909 (*Mem. Ind. Mus.*, II, pp. 54-58) have been now widely accepted.

Distribution:—Tropical and semitropical waters of the world.

Actobatis guttata (Bloch and Schneider).

1801. *Raia guttata*, Bloch and Schneider, *Syst. Ichthy.*, pp. 361-364.
 1803. *Raja* No. viii [*Eel tenkee*], Russell, *Vizag. Fish.*, I, p. 5, pl. viii.
 1804. *Raia guttata*, Shaw, *Zool.*, V, p. 285.
 1830. *Actobatis indica*, Swainson, *Fish.*, II, p. 3.
 1849. *Stoudson narinari*, Cantor, *Cat. Mal. Fish.*, p. 1416.
 1865. *Actobatis narinari*, Day, *Fish. Malab.*, p. 280.
 1870. *Actobatis narinari*, Gunther, *Cat. Fish. Brit. Mus.*, VIII, p. 493.

1878. *Aetobatis narinari*, Day, *Fish. Ind.*, p. 743.
 1889. *Aetobatis narinari*, Day, *Faun. Brit. Ind., Fish.*, I, p. 59.
 1909. *Aetobatis guttata*, Annandale, *Mem. Ind. Mus.*, II, pp. 55-56, text-fig. 10.
 1913. *Aetobatis ocellatus*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 442.
 1914. *Aetobatis guttata*, Gudger, *Pub. Carn. Inst.* (Washington), CLXXXIII, p. 313.

Gudger, in his paper on the *History of the Spotted Eagle Ray* on page 313, has shown that the specific name *guttata* was first employed by Bloch and Schneider in 1801. It would therefore have priority over "*ocellata*" of Russell (1803). In any case, however, the latter is inadmissible as it is merely used by Russell in a descriptive sense; the same term (*ocellata*) had been used by him exactly similarly for his *Raja* No. I and *Raja* No. II, as well as for his No. viii, the present species also referred to by him by the local name *Eel tenkee*. He refrained from giving specific names to any of the species of rays he described or figured [see Russell, *Fish. Vizag.*, I, p. v. (Preface)]. Thus the specific name newly proposed by Garman lapses owing to want of priority.

There are three young male specimens in the collection. The snout in all these specimens is comparatively short, conical, bluntly pointed and distinctly retroverted and agrees with Dr. Annandale's figure of 1909 (*op. cit.*, fig. 10 B, p. 55). The dorso-ventral axis of the eye is inclined downwards and inwards and the pupil is visible from below. The distance between the mouth and the vent is contained $2\frac{1}{2}$ times or a little more in the breadth of the disk, and the length of the tail is more than twice the breadth of the disk. The teeth are in a single series, those of the lower jaw meeting at an obtuse angle and slightly projecting out of the mouth. The skin is smooth with slight roughness; there are no denticles. The dorsal surface is of a uniform dark slate-gray colour without any trace of spots.

The measurements of the three specimens are given below.

	Barkul, ♂ (2-i-15).	Barkul, ♂ (3-i-15).	Balugaon, ♂ (4-i-15).
	mm.	mm.	mm.
Breadth of disk ..	398	317	496
Mouth to vent	165	114	190
Length of snout	43	35	51
Rostral fin ..	43 × 40	33 × 35	46 × 46
Diameter of eye ..	9	8	10
Interorbital space ..	56	45	56
Length of spiracle	17	16	17
Ventral fin	67 × 28	51 × 24	72 × 28
Tail	1012	797	1063

This species appears to breed freely in the main area of the lake as young specimens are numerous.

Distribution:—Tropical parts of the Indian Ocean.

Genus **AETOMYLAEUS**, Garman.

Aetomylaeus nichofii (Schneider).

1801. *Raia nichofii*, Schneider, Bloch's *Ichthyol.*, p. 364.
 1878. *Myliobatis nieuhoftii*, Day, *Fish. Ind.*, p. 742.
 1880. *Myliobatis nieuhoftii*, Day, *Faun. Brit. Ind., Fish.*, I, p. 58.
 1900. *Myliobatis nieuhoftii*, Annandale, *Mem. Ind. Mus.*, II, p. 51.
 1913. *Aetomylaeus nichofii*, Garman, *Mem. Mus. Comp. Zool.* (Harvard), XXXVI, p. 436.

No specimen of this species appears to have been collected but many were observed in the course of the survey. Dr. Annandale tells me that the species is very common in February in the shallows near the outer shore of the south end of the main area of the lake, where it moves about in shoals, occasionally leaping out of the water. The back is brown and is banded with five or six narrow bands of lighter colour which are conspicuous in life and can be seen when the fish is several inches below the surface of the water.

The species is a permanent inhabitant in the main area of the lake.

Distribution:—Seas of India, East Indies and Japan.

Order TELEOSTEI.

Suborder MALACOPTERYGII.

Family ELOPSIDAE.

Genus **ELOPS**, Linnaeus.

Elops indicus, Swainson.

(Text-figures 1, 2.)

1803. *Elops saurus* (nec Linné), Russel, *Vizag. Fish.*, II, p. 63, pl. clxxix.
 1839. *Elops (saurus) indicus*, Swainson, *Nat. Hist. Fish. Amph. Rep.*, II, p. 292.
 1846. *Elops saurus*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XIX, p. 358.
 1868. *Elops saurus*, Günther, *Cat. Fish. Brit. Mus.*, VII, p. 470.
 1878. *Elops saurus*, Day, *Fish. Ind.*, p. 649, pl. clxvi, fig. 1.
 1889. *Elops saurus*. Day, *Faun. Brit. Ind., Fish.*, I, p. 401, fig. 125.

There are altogether nine specimens in the collection ; one is from the main area of the lake off Balugaon (6-iii-1914), while the other eight were bought from a fisherman at Rambha on January 1st, 1915.

All these specimens have the lower jaw within the upper jaw and the teeth on the tip of the former entirely exposed (text-figs. 1 and 2) : thus the entire collection falls into the 'saurus group', and not into the 'machnata group' of the genus.

In his revision of the fishes of the genus *Elops* (*Ann. Mag. Nat. Hist.*, (8), III, p. 37) Tate Regan has divided all the species into two main groups:—one, which may be designated the ‘*saurus* group, consists of five species. All have “included” lower jaws and the whole of the praemaxillary band of teeth exposed when the mouth is closed. The other group, which may be termed the “*machnata* group,” consists of two species in both of which the lower jaw is projecting and covers the anterior part of the praemaxillary band of teeth when the mouth is closed.

Tate Regan when reviewing the genus had only one specimen from India before him. It was said to have come from Madras. This specimen he referred to *Elops machnata* (Forskål). Some have been led to suppose, therefore, that all the Indian *Elops* belong to this species, which in reality is a species of the Red Sea (see Jordan and Richardson on the *Fishes of Formosa* in *Mem. Carnegie Mus.*, IV, p. 165).

There is a very valuable specimen in spirit (Registered No. 2641) in the collection of the Indian Museum, purchased from Day; it was the original of figure no. 1 of plate

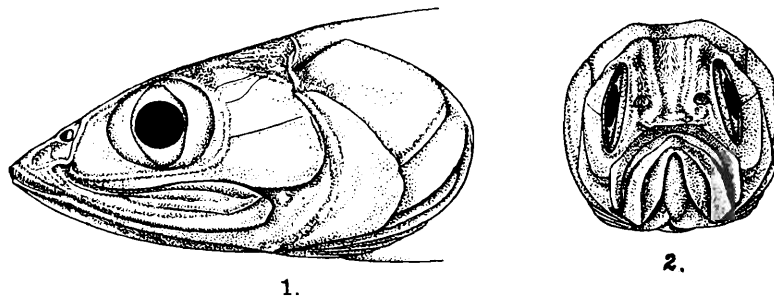


FIG. 1.—*Elops indicus*, Swainson.

Side view of the head, with the mouth closed and the lower jaw included

FIG. 2.—*Elops indicus*, Swainson.

Anterior part of the head seen from the front, slightly below the horizontal line, with the mouth closed; lower jaw is seen included and the anterior part of the intermaxillary teeth exposed.

clxvi in his *Fishes of India*. This specimen was caught by Mr. H. S. Thomas in a brackish-water enclosure at South Canara, and Mr. Thomas alluded to it in his *Rod in India* (Second Edition, p. 214). In this fish as well as in another specimen of *Elops*, also preserved in spirit, that was bought in the Calcutta market by the Curator of the Museum of the Asiatic Society of Bengal in the early sixties, the lower jaw is included inside the upper, so that the whole of the praemaxillary band of teeth is exposed in both the specimens when the mouth is closed. Neither of these specimens, therefore, can belong to *E. machnata* (Forskål), which I have reason to suspect is not an Indian species at all. Professor Weber and Dr. Beaufort in their *Fishes of the Indo-Australian Archipelago* (Vol. II, p. 4) in describing this species (*i.e.*, *E. machnata*) remarked “not seen by us.” Their note a few lines below to the effect that Bean and Weed confirmed the occurrence of *E. machnata* in the Indian Archipelago is not corroborated in the original paper by the latter authors. In this paper, which is on the *Fishes of Java* (*Proc. U. S. Nat. Mus.*, LXII, p. 589), Bean and Weed stated that they had examined

altogether thirty-five specimens belonging to the genus *Elops*, (*viz.*, seven from Java, three from Ashantee, five from the west coast of America, three from Australia, six from the east coast of America, five from the Philippine Islands, five from Hawaii and one from Hong Kong, China). This series indicated to them that it would not bear out the conclusions reached by Tate Regan. In fact, they thought that their Java specimens represented the species described by Bleeker under the name *Elops saurus* (*nec* Linné) and not *E. machnata* (Forskål).

The Chilka series of the genus *Elops* closely agrees with the Indian species represented by Thomas' specimen from South Canara, as well as with Russel's description and figure (*Vizag. Fish.*, II, p. 63, pl. clxxix). The following extract from Russel's description "the jaws are nearly of equal length, long extractile, the under carinate. .the teeth are marginal, small, not close except in the forepart of the lower jaw" clearly shows that in species examined by him the lower jaw was included and the teeth on the praemaxillary exposed. Russel's description of his species is very minute and his figure is excellent. Moreover his vernacular name leaves no doubt about its identity. All these facts make it very clear that Russel's species cannot be *E. machnata* (Forskål). Russel called it *E. saurus*, with the description of which his species agreed very closely. Swainson, however, was first to realize the necessity of the addition of a new name to distinguish the Indian species from the North American one, and therefore named the former *indicus* in his classification of fishes (*Nat. Hist. Fish. Amph. Rep.*, II, p. 292). There was no necessity for Swainson to supply any description, as Russel's description, which he adopted, was very minute and exhaustive. Günther also corroborated Russel's description by saying "the lower jaw scarcely projecting beyond the upper" (*Cat. Fish. Brit. Mus*, VII, p. 470). Day has made this important distinction still more clear with reference to the Indian species by saying that "the under jaw slightly shorter than the upper" (*Fish. Ind.*, II, p. 650). Thus one is compelled to believe that Russel's species of *Elops* as well as Thomas' specimen, drawn and described by Day, belong to one and the same species as the Chilka form, for all of which Swainson's name *indicus* should stand on the grounds of priority. *Elops machnata* (Forskål), which is said to be a species of the Red Sea by Jordan and Richardson (*op. cit.*), is very different from the Chilka specimens because in *E. machnata* the lower jaw is not only decidedly longer than the upper jaw but it completely covers the teeth on the praemaxillary bone when the mouth is shut. Of course in dried and stuffed specimens the lower jaw may get artificially fixed to look longer, hence the necessity of an examination of spirit specimens in which the natural position of the jaws is not at all interfered with. No specific locality for Tate Regan's Madras specimen is given; it is therefore difficult to say whether it is a Red Sea specimen forwarded through Madras, or whether it is an imperfectly mounted stuffed specimen in which the lower jaw was artificially fixed further forward than was natural in the species.

The Chilka form, as has been already shown, falls under the "*saurus* group" in which Tate Regan has proposed as many as five species; with the validity of such a large number of species, founded on slight differences under the *saurus* group of the

genus we are not at present concerned, as the Chilka species differs from all of the new species in proportions, etc. It should, however, be mentioned that Bean and Weed (*op.cit.*), after examining a large number of specimens belonging to the genus from different localities, felt that all these new species proposed by Regan were only closely allied forms. The Chilka species differs considerably from *E. hawaiiensis* and the other new species proposed and described by Tate Regan. It comes nearest on the whole to *E. saurus*, Linn., re-described by Regan in his revision, except in the number of vertebrae. Bean and Weed (*op.cit.*) ascertained the number of vertebrae in different groups according to localities. These figures are interesting and are quoted below:—

East Coast of America (Skeleton)		75½
West Coast of America (Radiograph)		79½
Ashanti, West Africa	Do.	69½
Hawaii ..	Do.	68½
Hong Kong, China	Do.	65½
Philippine Islands	Do. ..	65½
Java	Do.	65½

In the Chilka forms the number of vertebrae is sixty-six, following Tate Regan's method of counting the upwardly directed hypural portion as representing three vertebrae.

For comparison the proportions of measurements of the Chilka specimens are given below. The total length of those collected is from 280 mm. to 340 mm., but the fish is said to grow considerably bigger.

The depth of the body is contained nearly six and a half times in the total length (without caudal), the length of the head four and a half times. The length of the snout is equal to the diameter of the eye as well as to the inter-orbital width, which is contained four and a half times in the length of the head. The maxillary bone extends considerably beyond the eye; the lower jaw is included inside the upper when the mouth is closed. The length of the gular plate is two-thirds of the length of the lower jaw, which is again four-seventh times the length of the head. The number of branchiostegal rays is twenty-eight. The number of the scales in the longitudinal series in the lateral line is one hundred and two, in the transverse series above the lateral line there are fourteen rows of scales, fifteen rows below the lateral line, and there are twelve rows of scales between the lateral line and the ventral fins. The dorsal fin contains twenty-four rays of which eighteen are branched. The anal fin has thirteen branched rays out of a total of sixteen. The length of the pectoral fin is slightly greater than half the length of the head. The depth of the caudal peduncle is a little less than three-eighths of the length of the head. The number of vertebrae is 66.

The fish is found in large numbers during the winter months in the main area of the lake, but probably does not breed in it as there is not a single young specimen in the collection.

Distribution:—The Bay of Bengal and the Arabian Sea, entering the estuaries.

Genus **MEGALOPS**, Lacépède.**Megalops cyprinoides** (Broussonet).

1782. *Clupea cyprinoides*, Broussonet, *Ichthyol.*, Dec. I, tab. ix.
 1803. *Clupea cyprinoides*, Russel, *Vizag. Fish.*, II, p. 81, pl. cciii.
 1803. *Megalops filamentosus*, Lacépède, *Hist. Nat. Poiss.*, V, p. 289.
 1822. *Cyprinodon cundinga*, Hamilton Buchanan, *Fish. Gang.*, p. 154.
 1839. *Megalops cyprinoides*, Swainson, *Nat. Hist. Fish. Amph. Rep.*, II, p. 293.
 1846. *Megalops indicus*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XIX, p. 388, pl. 576.
 1878. *Megalops cyprinoides*, Day, *Fish. Ind.*, p. 650, pl. clix, fig. 3.
 1889. *Megalops cyprinoides*, Day, *Faun. Brit. Ind., Fish.*, I, p. 402, fig. 126.

There are two specimens in the collection; the larger one, 250 mm. in length (without caudal), was collected at Rambha at the end of the year 1914 and the smaller one (190 mm. in length) was caught near Barkul in September, 1914.

The mouth is superior, and the lower jaw, which is very prominent, goes to form a part of the upper profile of the snout. The Chilka specimens do not show any noticeable peculiarity.

This fish occurs in the main area of the lake after the rains and continues there during the winter months.

Distribution:—The Indian and the Pacific Oceans and their estuaries. The fish is often found in brackish waters and is occasionally met with in freshwater ponds.

Family CHANIDAE.

Genus **CHANOS**, Lacépède.**Chanos chanos** (Forskål).

1775. *Mugil chanos*, Forskål, *Descript. Anim.*, p. 74.
 1801. *Mugil salmonesus*, Bloch and Schneider, *Syst. Ichthy.*, p. 121.
 1803. *Chanos arabicus*, Lacépède, *Hist. Nat. Poiss.*, V, p. 396.
 1871. *Chanos chanos*, Klunz, *Fisch. R.M.*, p. 605.
 1878. *Chanos salmonesus*, Day, *Fish. Ind.*, p. 651, pl. clxvi, fig. 2.
 1889. *Chanos salmonesus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 403, fig. 127.

There is no specimen in the collection. The fish is, however, reported to be caught occasionally in the main area during the rains. Its ripe roe, dried and smoked, is sold by the fishermen of Barkul and other villages bordering on the lake.

Distribution:—The Indian and the Pacific Oceans and their estuaries; the Red Sea, the east coast of Africa and Madagascar.

Family CLUPEIDAE.

Subfamily DOROSOMATINAE.

Genus **DOROSOMA**, Rafinesque.**Dorosoma nasus** (Bloch).

1795. *Clupea nasus*, Bloch, *Aus. Fische*, IX, p. 116.
 1803. *Clupea thrissa* (L.), Russel, *Vizag. Fish.*, II, p. 76, pl. cxcvi.
 1803. *Clupea* sp. (*Pedda Kome*), *ibid.*, p. 77, pl. cxcvii.
 1830. *Chatoessus altus*, Gray and Hardwicke, *Ill. Ind. Zool.*, pl. xci, fig. 2.

1848. *Chatoessus nasus*, Cuv. and Valenciennes, *Hist. Nat. Poiss.*, XXI, p. 164.

1878. *Chatoessus nasus*, Day, *Fish. Ind.*, p. 634, pl. clx, fig. 4.

1889. *Chatoessus nasus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 387, fig. 120.

Russel made out two species in this mud-eating fish in which the last ray of the dorsal fin is greatly elongated. In so doing he simply followed the Telegu fishermen who distinguished two different kinds of fish among them by two different names, viz. *Kome* and *Pedda Kome* (*Pedda* = big). Russel has two figures, plate 196 representing *Kome* and plate 197 representing *Pedda Kome*, but neither of these figures show the conspicuous bluish black blotch behind the opercles characteristic of the species (at least in the adult stage). There are sixteen specimens in the Chilka collection, of these seven possess the blotch about three scales deep behind the opercle, measuring in larger specimens 15 mm. \times 6 mm. In full-grown specimens the elongated ray almost reaches the root of the caudal fin, falling short by the breadth of two scales. Among the smaller specimens none have any blotch behind the opercle, and the elongated ray is proportionately shorter. Probably the want of the coloured blotch and the comparative shortness of the elongated ray in the young led the coast fishermen to use two different names for the same fish. Russel noticed a difference in the distance between the nostrils in his two species, but no such difference is noticed in any of the specimens of this collection. The Chilka fishermen have only one name, *Bolangi* (both for the fish with a blotch and for the fish without it. The lengths of the specimens in the collection, together with the lengths of the respective elongated ray, and the presence or absence of the coloured blotch are stated below.

Locality and date.	Number of specimens.	Total length in mm.	Length of the elongated ray in mm.	Presence or absence of a bluish black blotch.
Barkul, Sept. 14	1	171	66	Present. Three scales behind the opercle, 15 \times 6.
Parikud, 28-xi-14	1	169	61	Present.
Patsahanipur, 3-ii-14	2	125	Damaged.	Present.
Off north side of Samal Island, 24-ii-14	1	102	41	Five scales behind opercle, 7 \times 3 mm.
Barkul, 4-i-15	2	96	36	Present.
Off Nalbano, 18-ix-14	1	63	18	Absent.
Barkul, 4-i-15	1	53	9	Do.
Satpara, March 14	1	52	8	Do.
Rambha Bay, 22-vii-14	1	45	9	Do.
Do.	1	44	5	Do.
Do.	2	43	5	Do.
Do.	2	42	4	Do.

The last six specimens have a longitudinal silvery band about half way down.

The fish is found all over the lake throughout the year, probably breeding in it.

Distribution:—Seas of India to the Malay Archipelago, Philippines, Formosa, China, South Arabia and Sokotra.

Dorosoma indicus (Russel).

1803. *Harengus minor indicus*, Russel, *Vizag. Fish.*, II, p. 70, pl. clxxxvi, fig. 1.
 1822. *Clupanodon chakunda*, Hamilton Buchanan, *Fish. Gang.*, p. 246.
 1833. *Clupia mauritiana*, Bennet, *Proc. Zool. Soc.*, p. 32.
 1848. *Chatoessus chakunda*, Cuv. et Val., *Hist. Nat. Poissons*, XXI, p. 111.
 1866. *Dorosoma chakunda*, Bleeker, *Atl. Ichth.*, VI, p. 143, t. 261, figs. 5 & 6.
 1878. *Chatoessus chakunda*, Day, *Fish. Ind.*, p. 632, pl. clx, fig. 3.
 1889. *Chatoessus chakunda*, Day, *Faun. Brit. Ind., Fish.*, I, p. 386.

Of the three specimens in the survey collection two are without the black spot behind the opercle said to be characteristic of the species. One of these is a young specimen measuring 47 mm. from Rambha Bay (22-vii-14), which is without any spot. The specimen from Gopkuda collected on 15-viii-07 measuring 60 mm. is also without the spot. The black spot behind the opercle is very conspicuous in the specimen from Barkul caught about 18-ix-15. Russel's figure (plate clxxxvi, fig. 1 of vol. ii) does not show the spot nor does his description (p. 70) make any mention of it. Russel considered, probably correctly, his fish to be identical with Willoughby's figure 2, tab. i of his *Ichthyological Appendix*—but as he did not describe the fish and Russel was first to supply the description under Willoughby's name—Russel is the real author of the species for which Willoughby supplied the name and a figure. Russel is not quite sure about the local name of the fish and he gives two alternative names “*Kowal* or *Kowarloo*.” Day gives *Muddecru* as its Telugu name. Russel's local names appear to be of the nature of a generic name for small Clupeoids.

The fish occurs throughout the main area after the freshets. There are altogether four specimens in the collection with the Gopkuda one of 1907.

Distribution:—Seas and estuaries of India, Burma, Siam, Malay Archipelago and Philippines.

Subfamily ENGRAULINAE.

Genus ENGRAULIS, Cuvier.

Engraulis annandalei, sp. nov.

(Text-figure 3.)

The dorsal profile is almost straight and the ventral profile is convex from the end of the snout to the origin of the anal fin, from which it is nearly straight to the root of the caudal fin. The shape of the fish is oblong and the body is compressed. The abdominal keel possesses altogether twenty-five scutes beginning from the throat, fifteen of which are preventral and ten behind the root of the ventral fin.

The height (the greatest depth) of the body is 27 %, ¹ the length of the head 18.5 % ;

¹ Measurements are in hundredths of the length without the caudal fin.

the least depth of the caudal peduncle 10 %; the length of the maxillary 25.7 %; the length of the pectoral fin 17 %; the length of the ventral fin 9.4 %; the length of the base of the anal fin 38.5 %; the diameter of the eye 5 % and the length of the snout is 3.5 % of the total length.

The snout is prominent, the maxilla is dilated above the mandibular joint and its posterior tapering portion extends further than the anterior root of the pectoral fin.

The dorsal fin with its two spines and ten rays has an isolated scaly spine anterior to it; there are twenty-five flat scales in front of the dorsal fin, the height of the fin is 17 % of the total length; the origin of the fin is nearer to the end of the snout than to the base of the caudal fin.

The pectoral fin with fourteen rays has a broad appendage attached to the inner side of the root of the fin and is about half its length when it lies flat against the body; the pectoral fin does not reach the root of the ventral fin, and is slightly shorter than the length of the head.

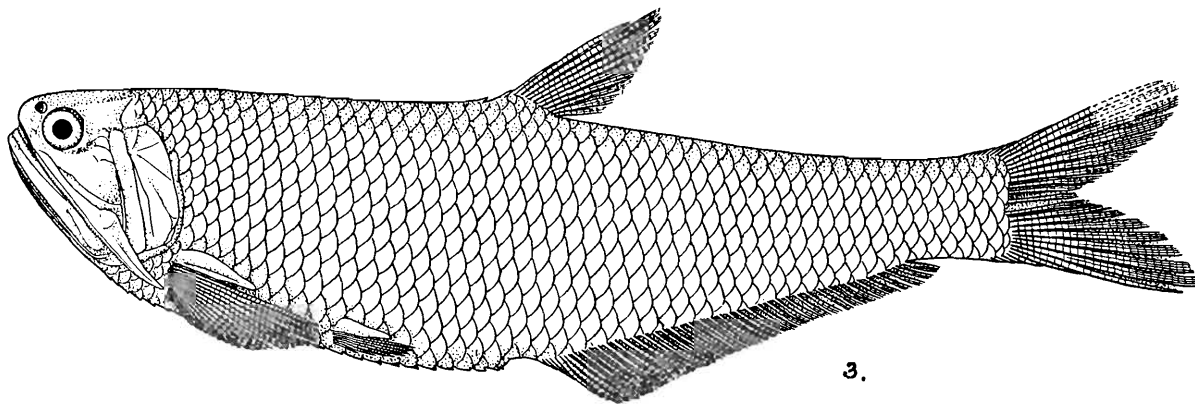


FIG. 3.—*Engraulis annandalei*, Chaudhuri, nat. size.

The ventral fin with its eight rays has also an appendage in its axil which is three-fourths of the length of the fin; the root of the ventral fin is nearer to the origin of the anal fin than the mandibular joint in the proportion of six to seven.

The anal opening is nearer to the base of the caudal fin than the end of the snout in the proportion of seven to eight, and is not reached by the tips of the ventral fins.

The anal fin has forty-three rays with one or two short compact spines. It commences below the posterior rays of the dorsal fin: the length of the base of the fin is contained $2\frac{5}{9}$ times in the total length (without caudal fin).

The scales are thin but not readily deciduous; the number of scales in the lateral line is fifty and across the body in the line of its greatest breadth thirteen. The colour of the body is silvery with the back slightly dark and the fins hyaline.

This new species is closely related to *E. purava* (H.B.) and *E. mystax* (Bl. and Schn.) but in a good many particulars it differs from both. From *E. purava* (H.B.) it differs in being broader—(the height in *E. purava* being about four whereas in the new

species it is only $3\frac{2}{3}$), and in having a slightly shorter head and larger eye. In *E. purava* the origin of the dorsal fin is midway between the snout and the base of the caudal fin or a little nearer to the base of the caudal, but in the new species the origin of the dorsal fin is nearer to the snout than the root of the caudal fin. The maxillary is slightly longer in the new species than it is in *E. purava*. From *E. mystax* (Bl. and Schn.) the new species differs in having a shorter anal fin, a shorter head, a more prominent snout and in having the origin of the dorsal fin nearer to the snout than to the caudal fin. In *E. mystax* the pectoral fin when laid against the body reaches the root of the ventral fin, whereas in the new species there is some distance between the tip of the pectoral fin and the root of the ventral fin. In *E. mystax* the root of the ventral fin is midway between the mandibular joint and the anterior root of the anal fin, but in the new species it is nearer to the anterior root of the anal fin. The new species resembles *Engraulis spinifer*, Cuv. et Val., in having the origin of the dorsal fin nearer to the end of the snout than to the base of the caudal fin, but it differs from it in possessing a larger number of scutes, a longer maxillary and in many other important particulars. It resembles *E. valenciennesi* (Blkr.) in having a longer anal fin and in having the origin of that fin a little before the end of the dorsal fin and also in the maxillary reaching slightly beyond the anterior root of the pectoral fin, but differs from it in not having the dorsal profile convex and in not having the origin of the dorsal fin nearer to the base of the caudal than to the snout, in having the pectoral fins not reaching the root of the ventrals and in having a larger number of scutes.

Type.—A specimen 140 mm. long dredged in shallow water on 18-ix-14 off Nalbano Island. It is numbered F⁸⁷⁸¹ in the Indian Museum register.

Engraulis kempfi, sp. nov.

(Text-figure 4.)

The dorsal profile is almost straight as far as the dorsal fin, behind which it is convex; the ventral profile is convex to the anal opening, posterior to which it is somewhat concave. The body is compressed, and the shape is lanceolate. The anterior abdominal edge is provided with twenty-three scutes beginning from the throat, eight of these scutes are post-ventral.

The height of the body is 28% of the total length, the length of the head 20.5%, the least depth of the caudal peduncle 10%, the length of the maxillary 20.5%, the length of the pectoral fin 19%, the length of the ventral fin 10%, the length of the base of the anal fin 32%, the diameter of the eye 6% and the length of the snout 5% in the total length without the caudal fin.

The snout is prominent with a rostro-frontal projection which is rounded. The maxillary is dilated above the mandibular joint and its posterior tapering portion does not extend beyond the gill-opening.

The dorsal fin has two spines and ten rays with an isolated spine in front and twenty flat scales. The point of origin of the fin is slightly nearer to the snout than to the root of the caudal and its height is 19% of the total length.

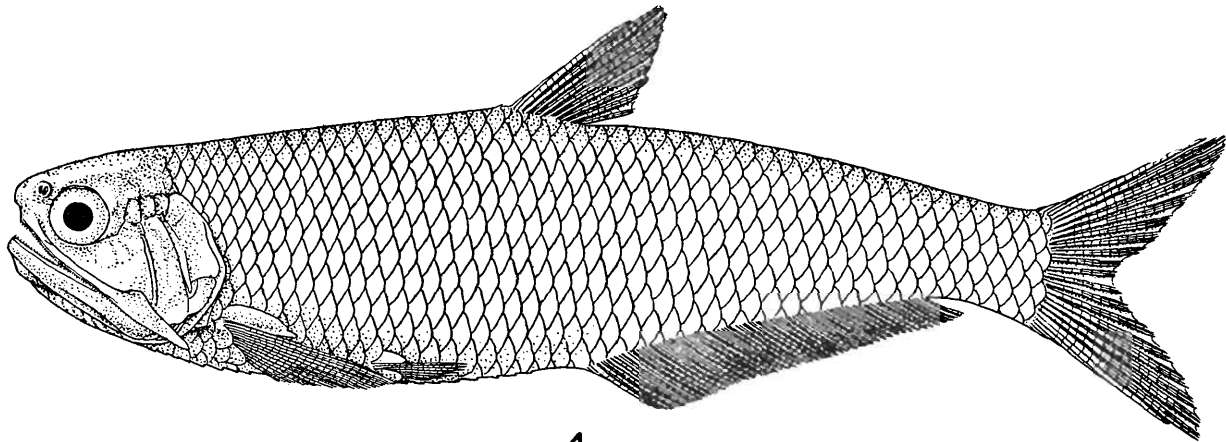
The pectoral fin, which has fourteen rays, reaches beyond the root of the ventral fin, covering almost one-fourth of the length of that fin; there is a broad appendage at the axil of the fin.

The ventral fin, which is also provided with a broad appendage, has eight rays and reaches half the distance that lies between its root and the anal opening. The anal fin has forty rays.

The number of scales in the lateral line is forty-five and there are twelve scales along the line of the greatest breadth.

Colour.—The dorsal side is dark, the middle portion of the body together with the anterior portion of the abdomen silvery, the rest of the body is somewhat pale yellow. The fins are hyaline.

This species differs from *E. annandalei* in having a shorter maxillary which reaches only to the gill-opening, a longer pectoral fin reaching beyond the root of the ventral



4.

FIG. 4.—*Engraulis kempi*, Chaudhuri, $\times 2$.

fin, having a lesser number of scutes, a shorter anal fin, in its shape and both in the dorsal and ventral profile. It resembles *E. valenciennesi* (Blkr.) in having twenty-three scutes and in the pectoral fin reaching the ventrals, but it differs from that species in the dorsal and the ventral profiles, in having longer ventral fins, a shorter maxillary, in having the dorsal fin nearer to the snout and also in proportions.

The *type* specimen, which is 68 mm. in length (without the caudal fin), was caught on 1-iii-14 off Barkul in the main area of the lake and is numbered F $\frac{282}{1}$ in the Indian Museum register.

There are fifteen co-types of which two were secured on 10-iii-14, eight miles N. E. of Patsahanipur, measuring 64 mm. and 61 mm., thirteen at the same place on 6-iii-14 of which three (measuring 59 to 61 mm.) are pale yellow and the rest (measuring from 46 mm. to 56 mm.) reddish-brown.

The species appears to be a permanent inhabitant of the lake, probably breeding in it.

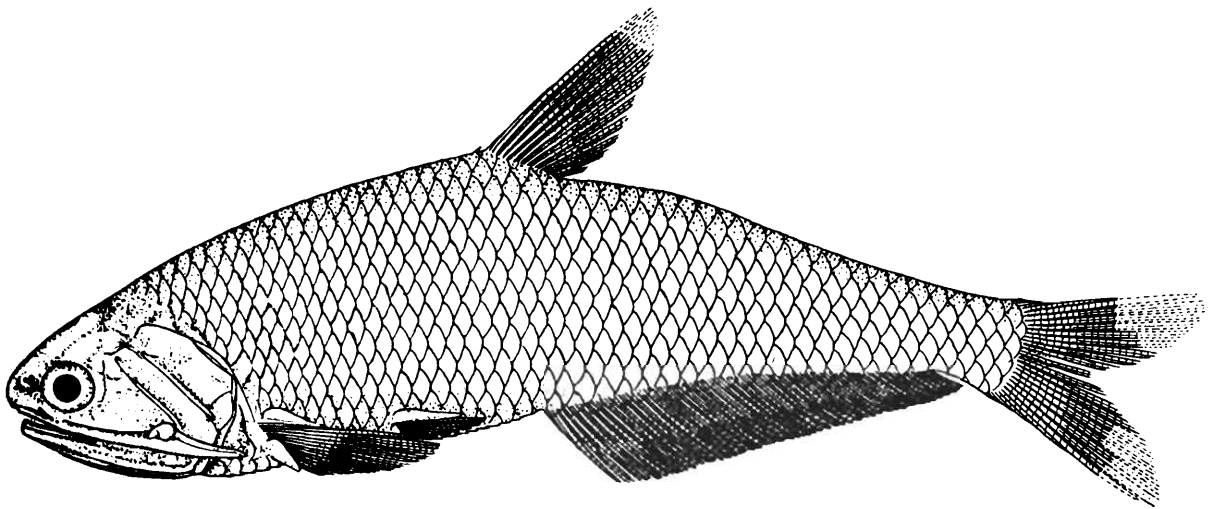
Engraulis rambhae, sp. nov.

(Text-figure 5.)

The dorsal profile is highly convex and the ventral profile is almost straight. The body is compressed. The anterior abdominal edge is provided with twenty-two scutes beginning from the throat, seven of which are post-ventral.

The height of the body is 26% of the total length, the length of the head 24%, the least depth of the caudal peduncle 8%, the length of the maxillary 23%, the length of the pectoral fin 18%, the length of the ventral fin 9%, the length of the base of the anal fin 39%, the diameter of the eye 6% and the length of the snout 4% in the total length without the caudal fin.

The snout is prominent, the maxillary is dilated above the mandibular joint and



5.

FIG. 5.—*Engraulis rambhae*, Chaudhuri, $\times 1\frac{1}{2}$.

its posterior tapering portion extends slightly beyond the gill opening, but does not reach the root of the pectoral fin.

The dorsal fin has one spine and ten rays with an isolated spine just in front, the origin of the fin is nearer to the snout than to the base of the caudal fin.

The pectoral fin has thirteen rays and reaches much beyond the root of the ventral fin, covering nearly three-fourths of that fin. The appendage is small and thin.

The ventral fins have seven rays each, the tips of which are at three scales in front of the anal opening. The appendages at their axil are thin and small.

The anal fin has forty rays, the number of scales in the lateral line is forty-six and in the line of the greatest breadth twelve.

Colour.—The dorsal edge is black; the body is silvery with the upper portion yellowish-brown, the lower half of the posterior part is brown and the fins are hyaline.

The highly convex dorsal profile at once distinguishes this species from the rest of the species in the genus most of which have a more or less straight dorsal profile.

It differs also in the number of scutes and in some of its proportions from the other species.

A specimen measuring 100 mm. was caught in Rambha Bay in March, 1914. It is the *type* of the new species and is entered under number F $\frac{8783}{1}$ in the register of the Indian Museum. There are two co-types, one from the same locality as the type measuring 95 mm., and the other (measuring 53 mm.) from off Nalbano, collected on 6-iii-14.

The species is in all probability a permanent inhabitant in the main area and breeds in the lake.

Engraulis purava (H.B.)

1803. *Clupea* sp. (*Pedda Poorawah*), Russel, *Vizag. Fish.*, II, p. 73, pl. cxc.
 1822. *Clupea purava*, Hamilton Buchanan, *Fish. Gang.*, pp. 238, 382.
 1848. *Engraulis purava*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XXI, p. 65.
 1878. *Engraulis purava*, Day, *Fish. Ind.*, p. 628, pl. clvii, fig. 2.
 1889. *Engraulis purava*, Day, *Faun. Brit. Ind., Fish.*, I, p. 393.

Hamilton Buchanan derived the name of the species from the generic vernacular name quoted by Russel: *Peddah Poorawah*—the great purava. A pair of pear-shaped black markings behind the occiput appears not to have been noticed by Hamilton Buchanan who consequently remarked "No spotting."

There are altogether thirty-four specimens of the species in the collection. This appears to be the prevailing species of the genus in the lake, occurring in all sizes, all over the lake throughout the year. Probably the species breeds in the lake during the rains. The statement below gives the sizes, dates and the different localities in the lake from which specimens were collected.

1 specimen	Off Barnikuda Island ..	6-ix-14,	measuring 85 mm.
3 specimens	Barkul Bay	21-ix-14,	72 mm. to 112 mm.
2	,, Off Breakfast Island ..	17-ii-14,	63 mm. and 65 mm.
1 specimen	Chiriya Island towards Samal	8-ii-14,	80 mm.
22 specimens	Kalupara ghat	16-ix-14,	from 33 mm. to 65 mm.
2	,, Kalidai	8-iii-14,	62 mm and 67 mm.
1 specimen	Nalbano	25-xi-15,	60 mm.
1	,, Patsahanipur ..	7-iii-14,	49 mm.
1	,, Off Samal Island	22-ix-13,	34 mm.

Distribution :—In the seas and the estuaries of Sind and both sides of India, Rangoon, Penang and the Malay Archipelago.

Engraulis mystax (Bl. and Schn.)

1801. *Clupea mystax*, Bloch and Schneider, *Sys. Ichthyol.*, p. 426.
 1849. *Thryssa porova*, Bleeker, *Verh. Bat. Genoots.*, XXII, p. 14.
 1867. *Engraulis mystacoides*, Günther, *Cat. Fish. Brit. Mus.*, VII, 396.
 1878. *Engraulis mystax*, Day, *Fish. Ind.*, p. 625, pl. clvii, fig. 3.
 1889. *Engraulis mystax*, Day, *Faun. Brit. Ind., Fish.*, I, p. 390.
 1897. *Trichosoma porava*, Rutter, *Proc. Acad. Nat. Sc. Philadelphia*, p. 65.

Bleeker described a species under the impossible name *E. porova* (*Ich. Madura*, p. 14)—a name very similar to *E. purava* (H. B.). Bleeker's name had been adopted

by Rutter —by whom *E. mystax* was sunk as a synonym of *E. porova*, Blkr., without any justification. Günther rightly concluded that *E. mystax*, *E. porova* and *E. mystacoides*, Blkr., were names for the same species; he, however, selected *E. mystacoides*, sinking the rest of the names believing *E. mystax* (Bl and Schn.) to be a different species.

There are four specimens in the collection from Rambha Bay, one 80 mm. in length was collected in March 1914, and the rest measuring 66 mm. to 77 mm. were collected on 22-VII-14.

Probably the species is an occasional visitor not breeding in the lake.

Distribution:—Seas and estuaries of India, China, North Celebes, Singapore, Borneo, Sumatra and Java.

Genus *STOLEPHORUS*, Lacépède.

Stolephorus indicus (V. Hasselt).

1803. *Clupea atherinoides*, Russel, *Vizag. Fish.*, II, p. 71, pl. clxxxvii.
 1823. *Engraulis indicus*, Van Hasselt, *Algem. Konst-Letterbode*, p. 229, fig. 2.
 1872. *Stolephorus indicus*, Bleeker, *Atl. Ich.*, VI, p. 127, t. cclix, fig. 2.
 1878. *Engraulis indicus*, Day, *Fish. Ind.*, p. 629, pl. clviii, fig. 3.
 1889. *Engraulis indicus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 394.
 1914. *Anchovia indica*, Alvin Seale, *Philip. Journ. Sc.*, IX D, p. 59.

This is the most common species of the family in the lake. It is gregarious in habit, planctonic, of small size and translucent when alive. There are altogether five hundred and two specimens in the collection, some of which are young. There are two prevailing colours irrespective of age, size and locality, *viz.*,—reddish-brown and pale yellow.

The following table gives the localities, dates of capture, and the sizes. The species occurs throughout the lake and it appears to be a permanent inhabitant breeding in winter (January and February).

7	specimens	Balugaon	..	..	21-vii-13, measuring from 18 mm. to 23 mm. Colour pale yellow.
1	specimen	Off Barnikuda Island	..	17-ii-14,	.. 60 mm. Col. brown.
13	specimens	S.E. of Barkul bungalow	..	1-iii-14,	.. 25 mm. to 35 mm. Col. pale yellow.
288	..	From prawn traps and nets at Barkul	21-ix-14.	..	26 mm. to 56 mm. Col. yellow.
14	..	Breakfast Island	..	17-ii-14.	.. 35 mm. to 40 mm. Col. pale yellow.
1	specimen	Chiriya Island	..	23-ii-14,	.. 38 mm. Col. pale yellow.
3	specimens	S.W. of Kalidai	..	23-ii-14,	.. 36 mm. to 42 mm. Col. pale yellow.
122	..	N.E. of Kalidai	..	5-iii-14.	.. 28 mm. to 47 mm. Col. pale yellow.
10	..	Do. Do.	..	Do.	.. 36 mm. to 47 mm. Col. reddish-brown.
4	..	Do. Do.	..	Do.	.. 12 mm. to 18 mm. Col. yellow.
7	..	Off Nalbano Island	..	6-iii-14.	.. 25 mm. to 42 mm. Col. pale yellow.
1	specimen	S.E. of Patsahanipur	..	28-ii-14,	.. 38 mm. Col. pale yellow.

12	specimens	N.E. of Patsahanipur		3-iii-14, measuring	28 mm. to 45 mm.	Col. pale yellow.
5		Do. Do.		6-iii 14, ..	30 mm. to 35 mm.	Col. pale yellow.
7	..	S.E. Do.		8-iii-14, ..	32 mm. to 36 mm.	Col. reddish-brown.
3	..	Rambha Bay		February, 1914, ..	68, 75 and 86 mm.	Col. brown.
2	..	Do. ..		March, 1914, ..	50 mm. and 53 mm.	Col. brown.
1	specimen	Off Samal Island		22-ix-13, ..	35 mm.	Col. yellow.
1	..	Satpara		..	14 mm.	Col. brown.

Distribution:—In seas (ascending rivers) of India, the Malay Archipelago, Philippines, Formosa, Japan, Samoa and Tahiti.

Stolephorus commersonii, Lacépède.

1803. *Stolephorus commersonii*, Lacépède, *Hist. Nat. Poiss.*, V, p. 382, t. xii, fig. 1.
 1848. *Engraulis brownii*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XXI, p. 41.
 1878. *Engraulis commersonii*, Day, *Fish. Ind.*, p. 629, pl. clviii, fig. 1.
 1889. *Engraulis commersonii*, Day, *Faun. Brit. Ind., Fish.*, I, p. 394.

There are altogether eight specimens in the collection, all of adult size, obtained during the months of February and March, in the main area of the lake. Probably the species is only an occasional visitor during the period of maximum salinity of the water of the lake. It does not appear to have bred in the lake.

1	specimen	Off Barkul Bay		1-iii-14, measuring	37 mm.
1	..	Kalidai		21-ii-14, ..	42 mm.
2	specimens	South of Kalidai		2-iii-14, ..	32 and 37 mm.
2	..	S. W. Do.		March 1914, ..	36 and 42 mm.
2	..	S. E. of Patsahanipur		9-iv-15, ..	35 and 40 mm.

Distribution:—Seas of India, of the Malay Archipelago, Philippines and also of Madagascar.

Stolephorus tri, Bleeker.

1852. *Engraulis tri*, Bleeker, *Verh. Bat. Genoots.*, XXIV, p. 40.
 1872. *Stolephorus tri*, Bleeker, *Atl. Ich.*, VI, p. 128, t. cclxii, fig. 1.
 1878. *Engraulis tri*, Day, *Fish. Ind.*, p. 630, pl. clviii, fig. 6.
 1889. *Engraulis tri*, Day, *Faun. Brit. Ind., Fish.*, I, p. 395.

Only one specimen is in the collection; it is of adult size and was obtained from Rambha Bay in the month of February, 1914. The colour of the body is reddish-brown with a longitudinal silvery band in the middle. Probably an occasional visitor to the lake.

Distribution:—The seas and estuaries (ascending rivers) of India, Malay Archipelago and Philippines.

Subfamily *CLUPEINAE*.

Genus *CLUPEOIDES*, Bleeker.

Clupeoides lile (Cuvier and Valenciennes).

1847. *Meletta lile*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XX, p. 378.
 1850. *Alausa champil*, Cantor, *Journ. As. Soc. Bengal*, XVIII, p. 1284.

1878. *Clupea ilie*. Day, *Fish. Ind.*, p. 638, pl. clxii, fig. 1.

1889. *Clupea ilie*. Day, *Faun. Brit. Ind., Fish.*, I, p. 374.

There are altogether twenty-six specimens in the collection of which only one was obtained in the month of July near Samal Island ; the rest were caught in the main area during the months of February and March, in which period the water of the lake becomes as salt as that of the Bay outside. Probably the species is a seasonal visitor during the season of maximum salinity. It does not breed in the lake, from which it has been previously reported. The following statement will show the different localities from which the specimens were collected and their number and sizes :—

1 specimen	Off Barkul Bungalow	1-iii-14,	measuring 46 mm.
1	„ Do.	3-iii-14,	„ 50 mm.
1	„ Do.	?	„ 53 mm.
4 specimens	N.W. of Breakfast Island	17-ii-14,	„ 48 mm. to 54 mm.
1 specimen	Between Domkuda and Samal I.	18-vii-14,	„ 58 mm.
2 specimens	N.E. of Kalidai	5-iii-14,	„ 45 mm.
1 specimen	N.E. of Patsahanipur	3-iii-14,	„ 53 mm.
1	„ S.E. Do.	6-iii-14,	„ 50 mm.
1	„ N.E. Do.	7-iii-14,	„ 53 mm.
1	„ Two miles S.E. of Patsahanipur	8-iii-14,	„ 54 mm.
4 specimens	Eight miles N.E. Do.	10-iii-14,	„ 42-50 mm.
7	„ Rambha Bay	2-ii-14,	„ 42-62 mm.
1 specimen	Do.	14-ii-14,	„ 54 mm.

Distribution:—In the sea, along the West Coast of India, Ceylon, Burma, Siam, and the Malay Archipelago.

Genus *CLUPEA*, Linnaeus.

Clupea ilisha (Hamilton Buchanan).

1803. *Clupea* sp. (*Palashah*), Russel, *Vizag. Fish.*, II, p. 77, pl. cxcviii.

1822. *Clupanodon ilisha*, Hamilton Buchanan, *Fish. Gang.*, pp. 243, 382, pl. xix, fig. 93.

1878. *Clupea ilisha*, Day, *Fish. Ind.*, p. 640, pl. clxii, fig. 3.

1889. *Clupea ilisha*, Day, *Faun. Brit. Ind., Fish.*, I, p. 376, fig. 115.

There is a specimen in the collection, caught at Barkul in the month of September, 1914, which is 322 mm. in length. Another specimen, 360 mm. in length, which was obtained by netting near Kalidai on the 14th January, 1907, was kept alive for over six hours in an earthen pot. Hence the general belief that *C. ilisha* always dies immediately on capture is not true—at least of the Chilka race.¹ Probably the high salinity of the water in January might have had something to do with the prolongation of life after capture. The occurrence of *C. ilisha* in the lake throughout the year and the fact of its not dying off immediately after capture, as well as the comparative freshness of the water of the lake soon after freshets, should prove to be sufficient inducement to practical pisciculturists to attempt 'stripping' *C. ilisha* in the lake, though it must remain doubtful if the species breeds there.

Distribution:—The coasts of India, including Sind and Burma, passing up the

¹ *Journal Bengal Fisheries* (1907), p. 94, para. 329.

large rivers to breed, the Persian Gulf ascending the Tigris, and the coast of Siam entering lakes.

Suborder *OSTARTIOPHYSI*.

Family *SILURIDAE*.

Subfamily *CLARIINAE*.

Genus *PLOTOSUS*, Lacépède.

Plotosus canius, Hamilton Buchanan.

1803. *Platystacus anguillaris*, Russel, *Vizag. Fish.*, II, p. 51.
 1822. *Plotosus canius*, Hamilton Buchanan, *Fish. Gang.*, pp. 142, 374, pl. xv, fig. 44.
 1878. *Plotosus canius*, Day, *Fish. Ind.*, p. 482, pl. cxii, fig. 3.
 1889. *Plotosus canius*, Day, *Faun. Brit. Ind., Fish.*, I, p. 113, fig. 47.

Russel mentions two specimens, one of which was caught in a river, measuring two feet and seven inches in length, and the other, which was obviously caught in the open sea and was the original for Russel's plate no. clxvi, measuring seven inches in length. The latter was undoubtedly a specimen of *Plotosus anguillaris* (Bloch) which is a marine species, but the former from its size as well as from its estuarine character must have been a specimen of *Plotosus canius*, H.B., which Russel described under the name *P. anguillaris*, Bloch.

There are altogether twenty-eight specimens in the collection from different parts of the lake, obtained throughout the year. Young specimens were mainly obtained after the rains in the outer channel. The following list indicates roughly the distribution of the species in the lake.

2 specimens	Channel north of Arupátuá (south side of Satpara)	10-ix-14, measuring 60 mm. and 28 mm.
2	„ Barkul Point	21-ix-14, „ 256 mm. and 250 mm.
1 specimen	Off Mahosa	12-ix-13, „ 27 mm.
4 specimens	Between Samal Island and Mainland	10-ix-14, „ 76 mm. to 80 mm.
2	„ Satpara	March 1914, „ 283 mm. to 316 mm.
2	„ Off Satpara ..	17-ix-13, „ 42 mm. and 120 mm.
13	„ Serua Nadi (depth 5ft. to 9ft.)	18-ix-14, „ 33 mm. to 68 mm.
2	„ South-eastern corner of the lake	? „ 485 mm. and 496 mm.

In every specimen there is an anal papilla, which is tubular and elongated, immediately behind the vent. It is enclosed from behind by a large spongy and arborescent (dendritic) organ. In very young specimens this arborescent organ appears to look like a gill-book-form of respiratory organ. The whole of it is covered over by the ventral fins, which extend beyond it over-lapping a portion of the anal fin. The ventral fins thus probably protect the organ from mud, on which the fish usually rests, being a bottom fish. The arborescent organ would be soon choked with mud if not thus protected. The function of the organ is evidently respiratory and not sexual as it is found fully formed even in very young specimens.

Distribution:—In the sea, brackish waters and rivers of India, Ceylon, Andaman Islands, the Malay Archipelago and Celebes.

Subfamily *SILURINAE*.

Genus **WALLAGO**, Bleeker.

Wallago attu (Bloch and Schneider).

1801. *Silurus attu*, Bloch and Schneider, *Syst. Ichthyol.*, p. 378.
 1803. *Silurus* sp. (*wallago*), Russel, *Vizag. Fish.*, II, p. 50, pl. clxv.
 1822. *Silurus boalis*, Hamilton Buchanan, *Fish. Gang.*, pp. 154 and 375, pl. xxix, fig. 49.
 1862. *Wallago attu*, Bleeker, *Atl. Ichth.*, II, p. 79, tab. lxxxvi, fig. 1.
 1878. *Wallago attu*, Day, *Fish. Ind.*, p. 479, pl. cxi, fig. 4.
 1889. *Wallago attu*, Day, *Faun. Brit. Ind., Fish.*, I, p. 126, fig. 54.

Only one specimen, comparatively young, measuring 253 mm., was collected, at Barkul in September, 1914. The fleshy and triangular anal papilla lies horizontally in a groove behind the anal opening and the ventral fins extend to the first few rays of the anal fin entirely covering the papilla.

This fish appears to be an occasional visitor to the main area after freshets.

Distribution:—Fresh waters throughout India, Ceylon, Siam and the Malay Archipelago. The fish is occasionally found within tidal influence.

Genus **CALLICHOUS**, Hamilton Buchanan.

Callichrous bimaculatus (Bloch).

1794. *Silurus bimaculatus*, Bloch, *Ausl. Fisch.*, VIII, p. 24.
 1822. *Silurus* (*Callichrous*) *canio*, Hamilton Buchanan, *Fish. Gang.*, pp. 151, 375.
 1842. *Silurus indicus*, McClelland, *Cal. Journ. Nat. Hist.*, II, p. 583.
 1841. *Schilbe pabo*, Sykes, *Trans. Zool. Soc.*, II, p. 367.
 1878. *Callichrous bimaculatus*, Day, *Fish. Ind.*, p. 476, pl. cx, figs. 4 and 5.
 1889. *Callichrous bimaculatus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 131, fig. 57.

One specimen, measuring 231 mm., was obtained at Barkul in the month of September, 1914. Evidently it entered the lake from some river during the floods.

Distribution:—Fresh waters of India, Ceylon, Siam and the Malay Archipelago. The fish has been also found within tidal influence in Burma.

Genus **PANGASIUS**, Cuvier and Valenciennes.

Pangasius pangasius (Cuvier and Valenciennes).

1822. *Pimelodus pangasius*, Hamilton Buchanan, *Fish. Gang.*, pp. 163 and 376, pl. xxxiii, fig. 52.
 1840. *Pangasius buchmanani*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XV, p. 45.
 1878. *Pangasius buchmanani*, Day, *Fish. Ind.*, p. 470, pl. cviii, fig. 5.
 1889. *Pangasius buchmanani*, Day, *Faun. Brit. Ind., Fish.*, I, p. 142, fig. 61.

Two young specimens, measuring 104 mm. and 85 mm. respectively, were collected about eight miles south-east of Kalupara Ghat on the 16th September, 1914. They evidently came to the lake along with the freshets. There is a thick anal papilla

lying alongside the body behind the anal opening. The tips of the ventral fins reach the anterior edge of the anal opening in both specimens.

The species is a flood-time visitor to the lake when the water is almost fresh.

Distribution:—Large rivers and estuaries of India and the Malay Archipelago.

Genus **OSTEOGENEIOSUS**, Bleeker.

Osteogeneiosus militaris (L.)

1758. *Silurus militaris*, Linnaeus, *Syst. Nat.*, Edit. X, p. 305.
 1850. *Arius militaris*, Cantor, *Journ. Asiat. Soc. Bengal*, XVIII, p. 1241.
 1858. *Osteogeneiosus cantoris*, Blyth, *Proc. Asiat. Soc. Bengal*, p. 286.
 1878. *Osteogeneiosus militaris*, Day, *Fish. Ind.*, p. 469, pl. cviii, fig. 4.
 1889. *Osteogeneiosus militaris*, Day, *Faun. Brit. Ind., Fish.*, I, p. 190, fig. 69.

Two adult specimens of the species are in the collection, one measuring 260 mm., from Parikudh, collected on 29-xi-14 and the other measuring 240 mm. from Barkul, obtained on 28-xi-14.

This fish probably is not a permanent inhabitant of the lake, nor does it appear to breed in it. It is a visitor to the main area during the winter months when the water is fairly saltish.

Distribution:—The seas, estuaries and tidal rivers of India and the Malay Archipelago.

Subfamily *BAGRINAE*.

Genus **ARIUS**, Cuvier and Valenciennes.

Arius satparanus, sp. nov.

(Text-figures 6—8.)

The body is elongated and round but compressed in the region of the caudal peduncle.

The measurements in hundredths of the length without the caudal fin are as follows: the length of the head 28.6%, the greatest depth of the body 20%, the length of the snout 12%, the diameter of the eye 4.76%, the length of the pectoral fin 19%, and the length of the ventral fin 14.3%.

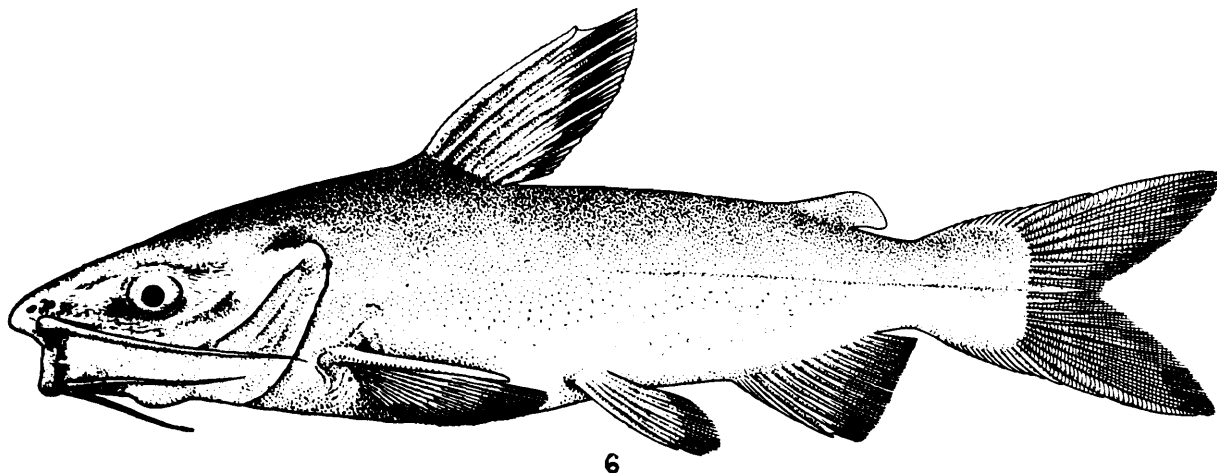
The head is somewhat depressed, and is broader than high. The median fontanel is rather narrow and short, beginning from behind the nostrils to the occipital process, which is granular and rugose. The occipital process continues to the basal bone of the dorsal spine (text-fig. 7). The dorsal profile, from the dorsal spine to the slightly prominent snout, slopes down in a somewhat convex line.

The eye is oval, the vertical diameter being 80% of the length of the horizontal diameter; the orbital margin is not entirely free, being continuous with the skin of the forehead in one-fourth of its upper margin in the middle.¹ The longer diameter of the

¹ "Eyes with free orbital margins" is stated to be one of the generic characters of *Arius*. In the specimen under description one-fourth of the upper margin about the middle of the eye is not free, but is continuous with the skin of the forehead. Instead of founding a new genus or subgenus on this difference, the description for the genus should be modified to allow this species to be included.

eye is contained two and a half times in the length of the snout and three and a half times in the length of the interorbital distance.

The barbels are rather short; the maxillary barbels are three-fourths of the length of the head, the mandibular pair is as long as the interorbital distance and the mental pair is as long as the snout.



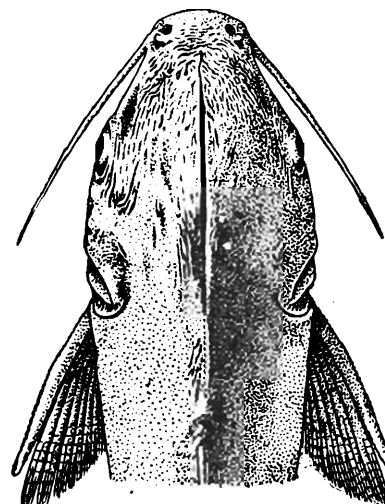
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FIG. 6.—*Arius satparranus*, Chaudhuri, $\times \frac{2}{3}$.

The dorsal fin has one spine and six rays, the spine is feebly serrated behind and granulated in front. The height of the fin is equal to the length of the maxillary barbels and the length of the spine is about 80% of the height of the fin. The base of the adipose dorsal fin is two-thirds of its length and is contained ten and a half times in the distance between the two dorsal fins.

The pectoral fin contains one spine and ten rays and does not reach the ventral fin. The spine is somewhat flattened and is serrated both ways. The ventral fin has six rays, the outer one of which is articulated. It is three-fourths the length of the pectoral, and the vent is just above the middle of the fin when it lies horizontally along the body. The anal fin has nineteen rays, a few of the anterior rays are in front of the vertical line from the origin of the adipose dorsal. The caudal fin is deeply forked with rounded lobes, the upper being slightly longer than the lower portion.

The teeth in the jaws are villiform, in the upper jaw the space covered with these teeth is divided into two equal ellipsoidal areas with a separating line in the middle. In the lower jaw the space is divided into two short and narrow arcuate areas with a broad toothless space in the middle. The palatine teeth are granular and occur in two



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FIG. 7.—*Arius satparranus*, Chaudhuri, $\times \frac{2}{3}$.

Dorsal view of the head.

somewhat oval patches far backward on the roof of the mouth (text-fig. 8). There are fifteen gill-rakers which are short and stiff.

The colour of the fish (in spirit) in the upper part is dark brown tinged with blue; the lower part of the sides and the abdomen are dull white. The margins of the dorsal and caudal fins are black.

The new species resembles *Arius arius* (Ham. Buch.) and also *A. maculatus* (Thunberg) in general appearance, but differs from both in the character of the teeth, the length of the barbels and fins, as well as in the structure of the orbital margin; this margin is not free, but is continuous in the middle with the skin of the forehead above.

Type.—A specimen 210 mm. long, dredged in six and a half feet of water in the channel between Satpara and Barnikuda, on 4-ix-14. It is entered in the Indian Museum register under No. F $\frac{8784}{1}$.

Arius arius (Hamilton Buchanan).

(Text-figure 9.)

1822. *Pimelodus arius*, Hamilton Buchanan, *Fish. Gang.*, pp. 170 and 376.

1878. *Arius buchanani*, Day, *Fish. Ind.*, p. 463, pl. cv, fig. 6.

1889. *Arius buchanani*, Day, *Faun. Brit. Ind., Fish.*, I, p. 181.

One young specimen, measuring 185 mm., obtained on 2-ix-14 in the channel off Satpara, is in the collection. The horizontal diameter of the eye is 22 % in the length of the head, while in the adult it is 18 % to 13 %. The anal papilla has a wide lumen with a thin fimbriated edge. The species is quite distinct from *A. maculata* (Thunberg), which has longer barbels, different proportions, colouration and dentition (text-fig. 9).

Probably this species is a permanent inhabitant of the outer channel.

Distribution:—The estuaries of Bengal, Orissa and Burma.

Arius caelatus, Cuvier and Valenciennes.

(Text-figure 10.)

1840. *Arius caelatus*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XV, p. 66.

1878. *Arius caelatus*, Day, *Fish. Ind.*, p. 459, pl. cv, fig. 5.

1889. *Arius caelatus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 174.

There are two specimens in the collection. One is a young fish measuring 125 mm. caught north of Patsahanipur on 3-iii-14, the other is an adult fish measuring 245 mm. secured off Barkul Point on 27-xi-14. The ventral fins are situated far backwards in both specimens, almost reaching the anal fin, the anal opening being above the middle of the ventral fin. The anal papilla is rather inconspicuous. In the upper jaw the villiform teeth are in a broad arcuate band of almost uniform breadth, occupying only the middle half of the whole jaw and without any dividing line or empty space in the middle. They are very unlike the villiform teeth of the lower jaw—which are situated in two divided horn-shaped areas with a smooth space in the middle of the jaw, with their broad ends towards the middle. The teeth on the palate are also villiform. They occur in two triangular patches not very far from

the upper jaw, the bases of these triangular areas being turned towards the upper jaw, with the apices towards the centre of the upper palate (text-fig. 10).

The species appears to be a permanent inhabitant in the main area of the lake, probably breeding in it.

Distribution:—In seas, rivers, and brackish waters of Bombay, Madras, Orissa, Bengal, Burma, Siam and the Malay Archipelago.

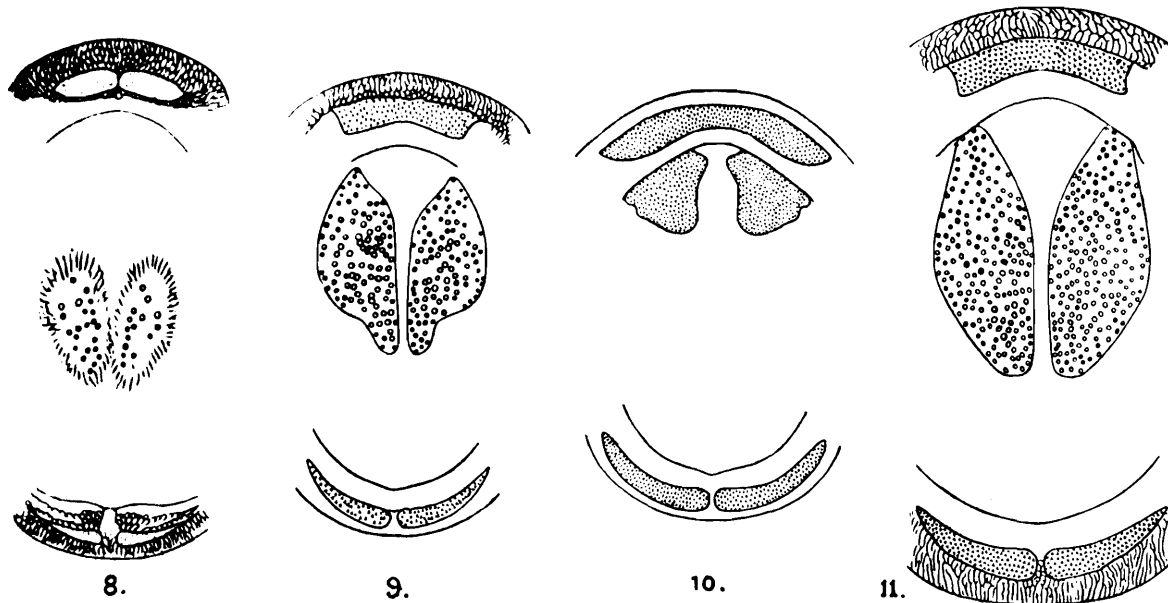


FIG. 8.—*Arius satparanus*, Chaudhuri.
Teeth of upper jaw, palate and lower jaw.
FIG. 9.—*Arius arius* (Hamilton Buchanan).
Teeth of upper jaw, palate and lower jaw.
FIG. 10.—*Arius cœlatus*, Cuvier and Valenciennes.
Teeth of upper jaw, palate and lower jaw.
FIG. 11.—*Arius falcarius*, Richardson.
Teeth of upper jaw, palate and lower jaw.

***Arius falcarius*, Richardson.**

(Text-figure 11.)

1844. *Arius falcarius*, Richardson, *Zool. Voy. Sulph. Fish*, p. 134, pl. 62, figs. 7-9.
1846. *Arius falcarius*, Richardson, *Rep. Ichthy. Sea. Chin. Jap.*, p. 284.
1866. *Arius falcarius*, Günther and Playfare, *Fish. Zanzib.*, p. 114.
1878. *Arius falcarius*, Day, *Fish. Ind.*, p. 463, pl. cvi, fig. 5.
1889. *Arius falcarius*, Day, *Faun. Brit. Ind., Fish.*, I, p. 182.

There is one adult specimen in the collection measuring 384 mm., captured near Barkuda Island inside the lake on 6-ix-14, in five and a half feet of water.

The villiform band of teeth in the upper jaw is equally wide throughout and does not reach the angles of the jaw, nor is there a dividing line in the middle. The palatine teeth are in two elongated patches, close and running parallel to the middle line—the anterior teeth are granular and the posterior globular. The villiform teeth in the lower jaw are divided by a smooth mesial line into two elongated arcuate

bands, broad towards the mesial line and tapering to a point towards the angle of the jaw, the two taken together being much longer than the band of teeth in the upper jaw (text-fig. 11).

Probably a casual visitor to the lake.

Distribution:—Seas of India and China, and East Africa. A variety of this species occurs in Africa.

Genus **MACRONES**, Duméril.

Macrones cavasius (Hamilton Buchanan).

1822. *Pimelodus cavasius*. Hamilton Buchanan, *Fish. Gang.*, pp. 203 and 379, pl. xi, fig. 67.
 1841. *Pimelodus seengtee*, Sykes, *Trans. Zool. Soc.*, II, p. 374, t. lxvi, fig. 2.
 1865. *Hypselobagras cavasius*, Day, *Fish. Malab.*, p. 188.
 1878. *Macrones cavasius*, Day, *Fish. Ind.*, p. 447, pl. c, fig. 1.
 1889. *Macrones cavasius*, Day, *Faun. Brit. Ind., Fish.*, I, p. 155.

One specimen from Barkul secured in September, 1914, measuring 85 mm., is in the collection. It evidently entered the lake from neighbouring fresh waters during the floods and is only a chance visitor when the water is entirely fresh.

Distribution:—In fresh waters of Sind, Southern India, Bengal, Assam and Burma.

Macrones gulio (Hamilton Buchanan).

1822. *Pimelodus gulio*, Hamilton Buchanan, *Fish. Gang.*, pp. 201 and 379, pl. xxiii, fig. 66.
 1849. *Bagrus abbreviatus*, Cantor, *Journ. Asiat. Soc. Bengal*, XVIII, p. 1236.
 1878. *Macrones gulio*, Day, *Fish. Ind.*, p. 445, pl. xcix, fig. 2.
 1889. *Macrones gulio*, Day, *Faun. Brit. Ind., Fish.*, I, p. 151, fig. 64.

There are altogether forty-five specimens of this species in the collection, from different parts of the lake; they are of all sizes as shown in the list given below. In all the specimens no anal papilla proper is found, but in its place, that is at a distance of one diameter of the eye behind the vent, there is a pore edged with a thick fimbriated muscular margin. The ventral fins almost reach the anal fin. The colouration of the pectoral, ventral, anal and caudal fins is very variable, in some they are black all over, in others the superior sides of the paired fins are quite white, in still others only the tips of some of these fins are black and the rest white; sometimes the tips of the anal or the ends of the caudal fins only are black.

The fish is a permanent inhabitant of the lake and breeds freely in it. It is more numerous in the outer channel and probably is replaced by *Macrones vittatus* (Bloch.) in the north-east corner of the main area where freshwater channels enter the lake.

The following list of the catch will roughly show the distribution of the species in the lake:—

1	specimen	Off mouth of Barkul Bay	18-ix-14, measuring 45 mm.
1	„	Nalbano Island ..	.. 25-xi-14, „ 58 mm.
1	„	Parikudh	28-ix-14, „ 81 mm.

8	specimens	Rambha	..	..	..	19-xi-14, measuring 87 to 123 mm.
2	..	Rambha Bay	..	..	February, 1914,	.. 79 mm. and 85 mm.
23	..	Satpara	..	..	March, 1914,	.. 44 mm. to 85 mm.
3	..	Do.	..	..	September, 1913.	.. 22 mm., 24 mm. and 26 mm.
1	specimen	South-eastern corner of the lake	..	..	..	.. 170 mm.
2	specimens	South end of the lake	..	..	21-31-vii-13,	.. 89 mm. and 111 mm.

Distribution:—Seas, estuaries and tidal waters of Sind, Bombay, Madras, Orissa, Bengal, Assam and Burma; also of Ceylon and the Malay Archipelago.

Macrones vittatus (Bloch).

1785. *Silurus vittatus*, Bloch, *Aust. Fisch.*, t. cccxxi, fig. 2.
 1801. *Silurus vittatus*, Bloch and Schneider, *Syst. Ichthy.*, p. 387.
 1822. *Pimelodus carcio*, Hamilton Buchanan, *Fish. Gang.*, pp. 181 and 377.
 1842. *Pimelodus indicus*, McClelland, *Cal. Journ. Nat. Hist.*, II, p. 584.
 1849. *Bagrus affinis*, Jerdon, *Mad. Journ. Lit. Sc.*, XV, p. 338.
 1878. *Macrones vittatus*, Day, *Fish. Ind.*, p. 448, pl. xcvi, fig. 3, and pl. xcix, fig. 4.
 1889. *Macrones vittatus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 157.

There are altogether thirty-five specimens of this species in the collection all from the main area of the lake. The species appears to be restricted more to the western edge and the north-western corner of the lake as the distribution list given below will show:—

7	specimens	Off Barnikuda	..	..	..	6-ix-14, measuring 40 mm to 60 mm.
11	..	Near Barnikuda (inside lake)	..	..	..	6-ix-14, .. 55 mm. to 70 mm.
5	..	Barkul (Prawn traps)	..	..	..	21-ix-14, .. 44 mm. to 80 mm.
3	..	Off Kalupara ghat (1½ miles)	..	..	..	15-ix-14, .. 37 mm. to 57 mm.
9	..	About eight miles south-east of Kalupara ghat	..	..	..	16-ix-14, .. 38 mm. to 58 mm.

This freshwater *Macrones* in all probability breeds in the lake after the rains. It is not a casual visitor like the other freshwater *Macrones*, i.e., *Macrones cavasius* (H.B.), of which there is only one specimen in the collection.

In the specimens of *M. vittatus* the ventral fin reaches the anal fin and the anal papilla is more often present than not. The tips of the caudal fin are black and the rest of the fin white. It is a much smaller fish than *Macrones gulio* (H.B.) which is the most numerous *Macrones* in the lake.

Distribution:—Throughout the fresh waters of India, Ceylon, Siam and Tranquebar.

Family CYPRINIDAE.

Subfamily CYPRININAE.

Genus CIRRHINA, Cuvier.

Cirrhina latia (Hamilton Buchanan).

1822. *Cyprinus latius*, Hamilton Buchanan, *Fish. Gang.*, pp. 345 and 393.
 1822. *Cyprinus gohama*, id., *ibid.*, pp. 346 and 393.
 1838. *Barbus diplochilus*, Heckle, *Fische aus Kasmir*, p. 53, t. x, fig. 1.

1839. *Gonorhynchus fimbriatus*, McClelland, *Asiat. Researches*, XIX, pp. 282 and 375, pl. xliii, fig. 3 B.
 1839. *Gonorhynchus macrosomus*, *id.*, *ibid.*, pp. 282 and 372, pl. xliii, fig. 7 B.
 1839. *Gonorhynchus gohama*, *id.*, *ibid.*, p. 283, pl. xliii, fig. 6 B.
 1839. *Gonorhynchus brevis*, *id.*, *ibid.*, p. 373.
 1841. *Chondrostoma wattanah*, Sykes, *Trans. Zool. Soc.*, II, p. 360, pl. lxii, fig. 4.
 1872. *Crossocheilus barbatulus*, Beavan, *Proc. Zool. Soc.*, p. 152, fig. 2.
 1878. *Cirrhina latia*, Day, *Fish. Ind.*, p. 548, pl. cxxx, fig. 4.
 1889. *Cirrhina latia*, Day, *Faun. Brit. Ind., Fish.*, I, p. 279.

There is only one specimen, secured on 4-i-15 at Barkul and measuring 89 mm. The maxillary barbels are wanting. This is a strictly freshwater species. Its occurrence in the lake, especially in the beginning of January (when the water is very salt) is most extraordinary. This must have been one of those rare occasions on which a freshwater fish had entered the lake through one of the numerous streams or flood overflows and had survived at the edge of the lake at a place where the inflow drainage water had enabled it to shift for a time.

Distribution :—Fresh waters along the foot of the Himalayas, and of the United Provinces, Punjab, Sind, Deccan, Orissa, Bengal and Assam.

Genus BARBUS, Cuvier.

Barbus sophore (Hamilton Buchanan).

1822. *Cyprinus sophore*, Hamilton Buchanan, *Fish. Gang.*, pp. 310 and 389, pl. xix, fig. 86.
 1839. *Cyprinus sophore*, McClelland, *Asiat. Researches*, XIX, pp. 285 and 382.
 1842. *Cyprinus sophore*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XVI, p. 388.
 1844. *Leuciscus stigma*, *id.*, *ibid.*, XVII, p. 93, pl. cccclxxxix.
 1844. *Leuciscus duvaucelii*, *id.*, *ibid.*, XVII, p. 95, pl. ccccxci.
 1844. *Leuciscus sulphureus*, *id.*, *ibid.*, XVII, p. 96.
 1849. *Systemus sophore*, Jerdon, *Madr. Journ. Lit. Sc.*, XV, p. 316.
 1867. *Puntius modestus*, Kner, *Novara Fische*, p. 348, t. xv, fig. 3.
 1868. *Puntius stigma*, Day, *Proc. Zool. Soc.*, p. 198.
 1868. *Barbus sophore*, Gunther, *Cat. Fish. Brit. Mus.*, VII, p. 152.
 1869. *Barbus (Puntius) stigma*, Day, *Proc. Zool. Soc.*, p. 375.
 1878. *Barbus stigma*, Day, *Fish. Ind.*, p. 579, pl. cxli, fig. 5.
 1889. *Barbus stigma*, Day, *Faun. Brit. Ind., Fish.*, I, p. 329.

There are altogether forty-six specimens of various sizes in the collection obtained at different times of the year in the main area of the lake. The largest number was obtained after the floods.

Hamilton Buchanan gave the name "*Cyprinus sophore*" to this fish, the specific name being derived, as he says, from its Sanskrit equivalent; he found this fish to be a "beautiful little fish," "very common in ponds" in Bengal. He definitely stated in the text that the fish so named by him was represented by figure 86 of plate xix of his illustrations that were published along with the text of his work on the *Fishes of the Ganges*.

In the introductory remarks in English there were two or more 'printer's mistakes. In the first para. of his introductory remark he stated that there were only

two black spots, "one at the end of the tail (caudal peduncle) and another at the root of the dorsal fin"—a few lines below in the second para. he says "besides the five spots mentioned in the specific character" (p. 310). This *five* is obviously a misprint for *two*. In the third para. he makes another obvious mistake by stating "there are four tendrils, so very minute, as often to be scarcely perceptible" (p. 311). The figure in the illustration which he specially refers to in the text does not show any trace of barbels whatever, nor in his *Index Methodicus* (synoptical table, 42) which follows the introductory remarks in English, and which contains brief scientific descriptions in Latin of all the species,—do the barbels find any place (p. 389). Therefore the statement as to four minute barbels must also be regarded as a mistake or oversight. McClelland, Cuvier, Valenciennes, and Günther all took up this position and decided that the species *C. sophore* described by Hamilton Buchanan was the little *Barbus* without barbels so common in the ponds of Bengal. Day, however, disputed this point, and he thought that by the name *C. sophore* Hamilton Buchanan described a *Barbus* with four barbels and the name should be restricted to some fish which must have four barbels even if it had no resemblance to the figure nor any reference to other portions of his description. In going over the collection of fish in the Museum of the Asiatic Society of Bengal, Day came across one "bleached" specimen of a small *Barbus* with four barbels, but without any name or label for locality or donor. This Day at once concluded to be a typical specimen of *C. sophore* in spite of its long barbels and colourless condition,¹ and when twelve other small *Barbus* (some of which were undoubtedly young—their lengths without the caudal fin varying from 24 mm. to 58 mm.) similar to the bleached specimen came to the Museum from the Khasia Hills, forwarded by Mr. R. Bevan,² Day at once concluded that the bleached fish without a label must have come from the Khasia Hills! He also concluded that this was the *Cyprinus sophore* of Hamilton Buchanan. In arriving at this conclusion Day entirely disregarded the fact that Hamilton Buchanan's *C. sophore* was "very common in ponds" in Bengal. The Khasia species has rather long barbels and the colouration and proportions are different; it is a comparatively rare species and even according to Day is to be found only in "Assam and Khasia Hills" (*Faun. Brit. Ind., Fish.*, I, p. 309). Thus disregarding the conclusions of Cuvier, McClelland, Günther and others, Day wanted to apply the name *sophore* to a very rare species of *Barbus* from Assam, a species with four long barbels and of a very different colouration from that given by Hamilton Buchanan for his *sophore*.

There is another specimen in the collection of the Indian Museum³ purchased from Day on the 8th September, 1879, which is labelled "*Barbus sophore* (H.B.)" in Day's own handwriting. The locality of this specimen is given by Day as Basein, Burma. It has only two maxillary barbels and is without any dark

¹ This specimen is in the collection of the Indian Museum numbered No. F ⁵⁴⁵⁴₁ in the register of the Museum. Its total length without the caudal fin is 86 mm.

² These specimens are numbered F ⁵⁴⁵⁴₁ to F ⁵⁵⁰²₁ in the register of the Indian Museum.

³ This specimen is numbered 2734 in the register of the Indian Museum.

spots and measures 117 mm. in length without the caudal fin. This specimen also cannot be said to have anything to do with "the beautiful little fish very common in ponds" to which Hamilton Buchanan gave the name. Thus Day used the name "*sophore*" of Hamilton Buchanan for two very different fishes—one from the Khasia Hills and the other from Burma. Hamilton Buchanan in his work *The Fishes of the Ganges* described only those he came across, in his statistical survey of the Bengal Districts, in the Ganges and its tributary streams, except "a few he observed in the rivers of the south of India" (see his Introduction, p. vii); the names of these, however, have no number prefixed to them in the synoptical table. There is no record that Hamilton Buchanan received any collection from the Khasia Hills or Burma. Day, moreover, had adopted for the Bengal fish the name *Barbus stigma*. This name was invented by Cuvier and Valenciennes for a small *Barbus* from Mysore which is a local race of *Barbus sophore* of Hamilton Buchanan, as defined by him in Latin in the synoptical table No. 42 (p. 389) supported by figure 86 of plate xix of his *Illustrations*, as well as by the detailed description in English in which unfortunately two obvious mistakes occur. These mistakes were duly corrected by McClelland and Günther long before Day thought it necessary to take advantage of one of them to change the prior name of a very common species of fish occurring everywhere in ponds in Bengal and to adopt a much later name invented for the local race of the same fish found in Mysore.

The following list gives the distribution of the fish in the lake:—

6 specimens	Barkul	13-xi-12,	measuring	19 mm. to 56 mm.
2	" "	1-ii-13,	"	40 mm. and 41 mm.
32	" "	21-ix-14,	"	39 mm. to 51 mm.
2	" Off Barkul	25-i-14,	"	40 mm. and 48 mm.
1 specimen	Off Nalbano	18-ix-14.	"	37 mm.
2 specimens	Nalbano	25-xi-14,	"	33 mm. and 42 mm.
1 specimen	Rambha Bay	February, 1914,	"	43 mm.

The specimens collected during the dry months have the black spots very conspicuous and bright, but do not show any trace of longitudinal coloured bands, nor are their fins tinted pink. On the other hand the specimens collected after the floods are found to have one or other of the two black spots indistinct or wanting, and most of them show coloured longitudinal bands and the ends of the ventral fins are pink. In some, however, no coloured bands are visible—and in these the upper half of the body is dark brown and the lower half dull silvery.

Distribution:—Fresh waters of India and also in tidal rivers from Sind to Burma including Assam.

Barbus ticto (Hamilton Buchanan).

1822. *Cyprinus ticto*, Hamilton Buchanan. *Fish. Gang.*, pp. 314 and 389, pl. viii, fig. 87.
 1839. *Systemus ticto*, McClelland, *Asiat. Researches*, XIX, p. 382.
 1841. *Rohtee ticto*, Sykes, *Trans. Zool. Soc.*, p. 365.
 1849. *Systemus ticto*, Jerdon, *Madr. Journ. Lit. Sc.*, XV, p. 318.
 1849. *Systemus tripunctatus*, *id.*, *ibid.*, XV, p. 316.

1878. *Barbus ticto*, Day, *Fish. Ind.*, p. 576, pl. cxliv, fig. 7.

1889. *Barbus ticto*, Day, *Faun. Brit. Ind., Fish.*, I, p. 325.

There are three specimens of this species in the collection obtained from different parts of the main area at different periods of the year as stated below:—

1	specimen	Off Barkul	..	..	25-i-14,	measuring	27 mm.
1	..	Rambha Bay	..	March,	1914,	..	31 mm.
1	..	Between Samalkuda and Barkuda	15-xi-14,	..		..	19 mm.

In the first two specimens the anterior black blotch is less conspicuous and the third specimen is dark brown all over.

The species is a permanent inhabitant of the main area throughout the year and breeds in it.

Distribution:—Fresh waters of India and Ceylon, extending to brackish waters.

Barbus vittatus, Day.

1865. *Puntius vittatus*, Day, *Proc. Zool. Soc.*, p. 303.

1865. *Puntius vittatus*, Day, *Fish. Malab.*, p. 215, pl. xiii.

1867. *Puntius sophore*, Kner, *Novara Fische*, p. 347.

1878. *Barbus vittatus*, Day, *Fish. Ind.*, p. 582, pl. cxliv, fig. 2.

1889. *Barbus vittatus*, Day, *Faun. Brit. Ind., Fish.*, I, p. 333.

There are three specimens in the collection measuring from 20 mm. to 22 mm. ; they were obtained at Satpara on 17-iii-14. In all these specimens the anterior black spot is altogether wanting. The inferior black spot is anterior to the anal fin and is not at its base.

The species appears to be confined to the outer channel. The specimens were collected in the middle of March in water as salt as that of the Bay outside.

Distribution:—Madras, Malabar, Cutch and Ceylon.