

REVISION OF THE INDO-BURMANESE GENUS
SALMOSTOMA SWAINSON (*PISCES*, *CYPRINIDAE*)
WITH DESCRIPTION OF A NEW SUBSPECIES

BY

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Salmostoma is the right name for 11 Indian and Burmanese species formerly ascribed to *Chela*. The range of *S. ph. phulo* is restricted to Ganges and Brahmaputra; in Mahannadi drainage lives a new subspecies, *S. ph. orissaensis*, with fewer scales, whilst the South Indian specimens identified till now with *S. phulo* belong to a distinct species, *S. novacula* (Val.). *S. argentea* is a synonym of *S. acinaces*. *S. sardinella* lives also in Ganges and Mahannadi drainages, where it was confounded till now with *S. untrahi*.

As shown by Fowler [3] and accepted by Smith [6] and Silas [5], the generic name *Chela* Hamilton, 1822 must be restricted to the very small Oriental white minnows with rather deep body, few scales and comparatively anterior ventrals, which were previously ascribed to *Laubuca* or *Cachius*; by this nomenclatorial change, the Indochinese and Indonesian species of "*Chela*" were ascribed to *Oxygaster*, whilst the status of the 10 Indian and Burmanese species included by Day [2] in *Chela* remained doubtful. Most Indian ichthyologists continued to use the name *Chela* in the same acceptance as Day, while some recent ones adopted the name *Oxygaster*. But in the true *Oxygaster* the abdominal keel below the pectoral base is hardened, the head is oblique as to the body axis and a muscular mass covered by scales extends on the head dorsal face to front of eyes. The only Indian species having these characters is "*Chela*" *gora*, for which the new generic name *Pseudoxygaster* Banaresecu, 1967 was recently proposed. The remaining Indian and Burmanese "*Chelae*" belong to a distinct genus, for which the older available name is *Salmostoma* Swainson, 1839 (type: *Cyprinus bacaila* Hamilton); *Salmophasia* Swainson, 1839 and *Securricula* Günther, 1868 are synonyms of *Salmostoma*.

Salmostoma is closer to *Chela* s. str., differing from it in its more elongated body (although *Ch. dadiburjori* too is elongated), bigger size, gently curved lateral line and more posterior ventral fins.

The last revision of the species here ascribed to *Salmostoma* is that of Day [2] who recognizes 9 species; it is unfortunate that he did not mention the number of gill rakers. All nine species were recorded by subsequent authors in faunistic lists, without description are data on variability. Silas [4] describes a new species "*Chela*" *horai* and keys all known Indian species of the genus; but the characters used in this key are from Day, not from his own investigations.

MATERIAL

About 150 specimens were examined; they belong to the following collections: B.M.N.H. (British Museum); C.N.H.M. (Chicago Nat. History Museum); H.Z.S. (Zoologisches Institut u. Museum, Hamburg); I.B.T.S. (Institutul de Biologie "Tr. Săvulescu", Bucharest), M.N.H.N. (Muséum National d'Histoire Naturelle, Paris); N.M.W. (Naturhistorisches Museum, Wien); R.M.N.H. (Rijksmuseum van Natuurlijke Historie, Leiden); S.M.F. (Senckenberg Museum, Frankfurt a. M.); S.U. (Stanford University); U.S.N.M. (United States National Museum, Washington); Z.S.I. (Zoological Survey of India, Calcutta).

SYSTEMATIC ACCOUNT

1. *Salmostoma bacaila* (Hamilton-Buchanan, 1822). Fig. 1.

Synonyms: *Cyprinus b.*, H.-B., 1822; *Chela b.* auct.; *Opsarius b. & O. leucerus* Mc Clelland, 1839.

Specimens examined:

I.B.T.S. 1136, Barakur R., Bihar, Ganges drainage, 9 spec., 60.0—98.0 mm, received from Z.S.I.

I.B.T.S. 1523, Bolan, Indus dr., W. Pakistan, 3 spec., 46.0—66.0 mm.

C.M.H.M. 2352, Calcutta, Ganges-Brahmaputra dr., 5 sp., 61—90 mm.

R.M.N.H. 5074, Bengal, Ganges-Brahmaputra dr., 2 spec., 55—80.5 mm.

S.U. 41115, Bistrampur, 3 spec., 87.0—111.5 mm.

B.M.N.H. 1889. 2. 1. 1462, Orissa, Mahannadi dr., 1 spec., 61.3 mm (labelled *Chela gora*).

B.M.N.H. 1932. 2. 20.23, Chhanawar Farm, Punjab, Indus dr., 2 spec., 60.5—73.0 mm (labelled *Ch. gora*).

S.M.F. 8927 three specimens, 77.0—109.0 mm

D 3/7; A 3/11—14; Sp. br. 17—21; L.lat. $89 \frac{17-19}{4-6}$ 107.

This species, apparently the most frequent of all, is characterized, besides the number of scales and rays, by the lateral line only slightly de-curved, long and pointed snout, a strong symphyseal hook on the lower jaw. It is restricted to North India (Indus and Ganges-Brahmaputra drainages) and to Mahannadi drainage in Orissa.

2. *Salmostoma clupeoides* (Bloch, 1782). Fig. 2.

Specimens examined :

B.M.N.H. 1938. 2. 22. 52—56, Nasik, Deolali, upper Godavari dr., 5 spec., 83.0—116.0 mm.

B.M.N.H. 1889. 2.1.1419—23, Jubbulore, Narbada dr., 4 sp., 60.5—81 mm.

R.M.N.H. 8746, Madras, 2 spec., 77.2—90.2 mm.

H.Z.S. 2113, 2 spec., 74.0—75.0 mm.

M.N.H.N. B 2, "India", 1 spec., 89.0 mm.

M.N.H.N. B 93, "India", 8 spec., 72.1—82.8 mm.

D 3/7; A 3/11—14; Sp. br. 24—29; L. lat. $79 \frac{12-15}{3-4}$ 93.

This species closely resembles *S. bacaila* in general shape, body proportions, shape of mouth, etc., differing from it only in having fewer scales; the extreme values of the number of scales in lateral line and between this and ventrals overlap in both species, whilst the number of scales between lateral line and dorsal is quite distinct.

The main range of *clupeoides* lies in South India and in the Western Ghats; according to Day, it lives also in Burma; no Burma specimens were available to me. *S. bacaila* and *S. clupeoides* may prove to be subspecies of a single species; special investigations, in the region of contact of their ranges are necessary, in order to find if they intergrade, or if their ranges overlap without hybridization.

3 a. *Salmostoma phulo phulo* (Hamilton-Buchanan, 1822). Fig. 3

Synonyms : *Cyprinus ph.* Hamilton, 1822 (lower Ganges); *Opsarius albulus* Mc Clelland, 1839; *Chela ph.* Day, 1878 (partim : Assam, Bengal).

Specimens examined :

B.M.N.H. 1889. 2.1. 1406, Assam, Brahmaputra dr., 1 spec., 65.5 mm.

I.B.T.S. 1134, Barackpore, W. Bengal. lower Ganges-Brahmaputra dr., 4 spec., 39.8—47.2 mm, received from Z.S.I.

I.B.T.S. 2004, Ditto, Bengal, 2 spec., 50.8 & 54.2 mm (received from Z.S.I., labelled *Chela untrahi*).

D 3/7; A 3/17—19; L.lat. 99—112; Sp. br. 13—16.

The body proportions are indicated in Table 1. The symphyseal hook is rudimentary.

This species was described from the lower Ganges. Day records it also from Orissa and South India; he gives 80—87 scales in lateral and says the specimens from Assam belong to a "variety" characterized by 100—110 scales. But I found the same high number also in specimens from Bengal, e.g. from lower Ganges (type locality). Day Assamese "variety" corresponds thus to the nominal subspecies, whilst the specimens from Orissa belong to a distinct subspecies, and those from South India and Western Ghats recorded in the literature as *phulo* belong to a quite different species, *S. novacula*, with 76—96 gill rakers.

3 b. *Salmostoma phulo orissaensis* nova subsp. Fig. 4.

Synonyms : *Chela phulo* (not exactly of Hamilton), Day, 1878 (partim : Orissa).

Table 1

Number of gill-rakers and body proportions in *S. phulo*, *S. punjabensis* and *S. novacula*

Species	<i>S. ph. phulo</i>		<i>S. ph. orris-saensis</i>		<i>S. punjabensis</i>		<i>S. novacula</i>			
	Bengal, Assam	Orissa	Indus dr.	Madras	Poona	Deolali	"Deccan"			
Sp. br.	13-16	13	17-18	76-85	83-87	76-94(83.7)	80-87			
st. length	39.8-56.5	47.0-56.5	35.0-51.2	83.5-106.0	95.0-100.0	62.0-90.0	94.0-99.0			
depth	19.5-23.3	19.2-23.4	21.4-23.4	23.1-25.4 (24.2)	20.0-24.2	17.7-22.2 (20.4)	24.2-25.3			
caud. ped.	16.3-19.4	17.7-17.8	14.7-20.0	17.2-18.6 (18.02)	16.7-18.2	17.1-20.0 (18.68)	17.9-18.4			
least depth	8.5-10.4	8.5-9.4	8.2-10.0	8.15-8.8 (8.4)	7.3-8.1	6.8-7.7 (7.30)	8.5-9.6			
predorsal	60.8-64.5	61.7-63.5	61.5-67.0	64.0-68.2 (67.05)	65.5-66.8	63.0-67.5 (65.48)	66.5-67.0			
preanal	61.0-64.5	61.7-64.5	64.0-67.0	66.6-69.3 (67.9)	67.0-68.5	64.5-68.2 (66.81)	67.0-68.0			
preventral	45.6-49.7	46.2-46.4	45.0-49.2	50.0-52.1 (51.4)	65.5-66.8	48.0-53.0 (51.0)	49.6-50.5			
P-V distance	24.1-27.2	25.1-26.6	25.6-29.3	26.6-29.8 (28.4)	27.6-28.6	25.0-28.5 (27.26)	26.8-28.8			
V-A distance	14.2-16.9	14.9-19.6	17.3-21.5	15.7-19.5 (17.4)	16.8-20.2	14.3-18.7 (16.93)	18.2-18.9			
head	19.7-21.4	20.4-21.2	20.0-22.2	22.6-24.4 (23.4)	22.8-23.8	23.3-26.0 (24.51)	22.4-23.2			
snout	4.2-5.7	5.3	3.8-5.1	5.6-6.1 (5.89)	5.0-5.5	5.28-6.12 (5.87)	5.2-5.6			
eye	6.1-6.8	6.6-7.0	5.8-7.8	5.9-6.6 (6.28)	5.8-6.5	6.6-7.7 (7.26)	6.0-6.7			
eye % of interrob.	97-130	92.5-95.0	100-133	86.0-100.0	89.0-108	92.5-122 (111.0)	97.0-103			

% of standard length

Holotype : B.M.N.H. 1889. 2.1. 1403. Orissa, 1 spec., 56.2 mm.

Paratype : B.M.N.H. 1889. 2. 1. 1404. Orissa, 1 spec., 47.0 mm.

D 3/7 ; A 3/18—19 ; Sp. br. 13 ; L. lat. 76—86 ; D. phar. 5.4.2—2.4.4.

The body proportions are indicated in Table 1.

This subspecies is characterized by fewer scales in lateral line. Its range is apparently restricted to Orissa province (lower Mahannadi).

4. *Salmostoma punjabensis* (Day, 1872). Fig. 5.

Specimens examined :

B.M.N.H. 1889. 2.1. 1393—97, Sind, Indus dr., 5 spec., 35.2—51.2 mm.

R.M.N.H. 8749, Sind, leg. et don. Day, 1 spec., 43.0 mm.

N.M.W. 52141, Lahore, Indus dr., 1 spec., 44.2 mm.

D 2/7 ; A 3/14—16 ; Sp. br. 17—18 ; E. lat. 82—92.

The body proportions are indicated in Table 1.

This species is close to *S. phulo*, differing from it by the number of gill rakers and anal rays and its much shorter snout. It may prove to be only a subspecies of *S. phulo*. Its range is restricted to Indus drainage.

5. *Salmostoma novacula* (Valenciennes, 1842) Figs. 6 and 7.

Synonyms : *Leuciscus novacula* Valenc., 1842 (Madras) ; *Chela phulo* (non Hamilton), Day, 1878 (partim : Central India ; Deccan) and other authors. *Oxygaster phulo*, Tonapi & Mulherkar, 1963 (Poona).

Specimens examined :

M.N.H.N. 3895, Madras, 9 syntypes ; one of them (Fig. 6), 98.5 mm, is here designed as lectotype ; it retained the Nr. 3895 ; the other 8 paratypes received the number B 2535.

B.M.N.H. 1938. 2.22. 56—59, Deolali, Nasik, upper Godavari dr., 3 spec., 68.8—85.3 mm (labelled *Ch. S. clupeioides*).

B.M.N.H. 1938. 2.22.12—17, below L. Beale Dam, Deolali, 6 sp., 52.5—77.0 mm (labelled *Ch. phulo*).

S.U. 34561, Deolali, 2 spec., 90.0—84.8, (labelled *Ch. clupeioides*).

B.M.N.H. 1889. 2.1. 1407, Poona, upper Kistna dr., don. Day, 1 spec., 100.0 mm (labelled *Ch. phulo*).

S.U. 41120, Poona, 2 spec., 95.0—98.8 mm (labelled *Ch. phulo*).

B.M.N.H. 1889. 2.1.1408—10, Deccan, don. Day, 2 spec., 94.0—99.1 mm (labelled *Ch. phulo*).

R.M.N.H. 8748, Deccan, don. Day, 1 spec., 95.0 mm (labelled *Ch. phulo*).

D 3/7 ; A 3/14—17 ; Sp. br. 76—94 ; L. lat. 79—95.

The body proportions are indicated in Table 1.

This species was confounded till now with *S. phulo* ; it really resembles this last-named species in general habitus, body proportions number of scales (the same as in *S. ph. orissaensis*) but differs sharply from it in its very high number of gill rakers: 76—94 as against 13—16. Day was wrong in assuming that Valenciennes' *Leuciscus novacula* may be a synonym of *S. clupeioides*.

It is quite probable that all specimens of *Ch. phulo* recorded from Western Ghats, Godavari and Kistna drainage were *S. novacula*.

6. *Salmostoma horai* (Silas, 1951)

Synonym : *Chela horai* Silas, 1951 (Kaveri R., Coorg, Mysore)

D 3/7 ; A 2—3/16 ; L. lat. 76—85.

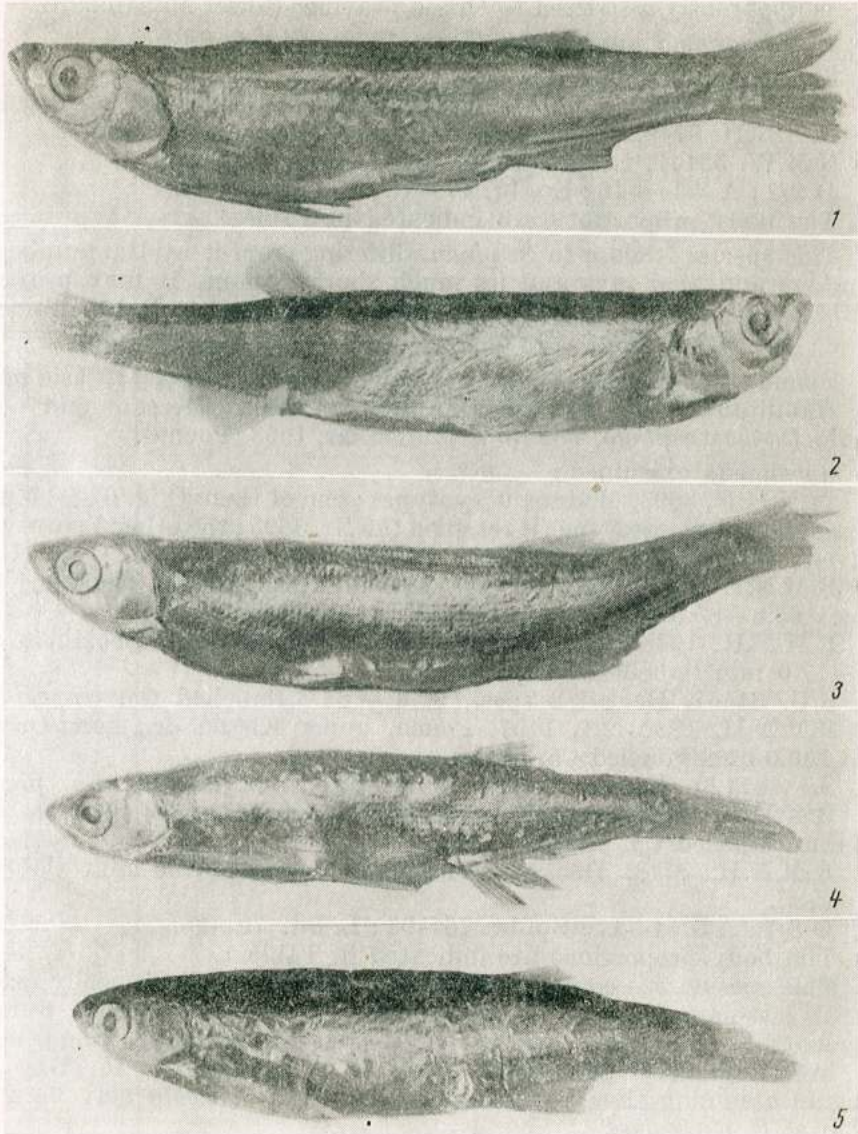


Fig. 1. — *Salmostoma bacaila* (Ham.-Buch.). I.B.T.S. 1136, Barakur R., Bihar.
 Fig. 2. — *Salmostoma clupeoides* (Bloch). B.M.N.H. 1938 2.22. 52, Deolali.
 Fig. 3. — *Salmostoma phulo phulo* (Ham.-Buch.). R.M.N.H. 8746, Madras.
 Fig. 4. — *Salmostoma phulo orissaensis* nova subsp. Holotype, B.M.N.H. 1889.
 2.1. 1403, Orissa.
 Fig. 5. — *Salmostoma punjabensis* (Day).R.M.N.H. 8749, Sind.

No specimen available. According to the original description, this species resembles *S. novacula* and *S. ph. orissaensis* in general shape, body proportions, shape of mouth, number of rays and scales, but differs from them and from all other species within the genus in having vertical dark stripes on sides. Because Silas does not mention the number of gill-rakers, I cannot say if it is closer to *S. phulo* and *S. punjabensis* or to *S. novacula*.

7. *Salmostoma acinaces*, Valenciennes, 1842. Figs. 8 and 9.

Synonyms: *Leuciscus ac.*, Val.; *Chela argentea* Day, 1867 and others.

Specimens examined:

M.N.H.N. 3952, type of *L. acinaces*, Mysore (Kaveri dr.), 69.5 mm.

B.M.N.H. 1889. 2.1. 1387—92, Madras, don. Day, 6 sp., 83.9—106.0 mm.

B.M.N.H. 1889. 2. 1. 1377—78, Bowany (Bhavani) R., Kaveri dr., don. Day, 3 spec., 77.1—83.2 mm.

R.M.N.H. 8750, same locality, don. Day, 1 spec., 88.0 mm.

B.M.N.H. 1889. 2.1. 1382—86, Wynaad, Kaveri dr., 3 spec., 79.5—93.0 mm.

I.B.T.S. 1137, received from Z.S.I. with mention "Bhavani R., Madras" (yet Bhavani R. is far from Madras!), 10 spec., 43.1—75.0 mm.

S.U. 3450, Hooghly R., 1 spec., 96.8 mm.

D 3/7; A 3/(13) 14—15 (17); L.lat. 42—52; Sp. br. 12—22.

The comparison of the type of *L. acinaces* with many *Ch. argentea* (most determined by Day himself) proved their conspecificity.

This species is characterized by its big scales, provided with quite evident longitudinal striae, by its rudimentary symphyseal hook and by the anal inserted in front of the dorsal origin.

There are rather big differences between the specimens examined. The type has 13 divided anal rays, the single Hooghly river specimen has 17, most specimens from other populations 14 or 15; the mean values range between 14.2 (I.B.T.S. 1137) and 15.0 (Madras).

In most populations there are 42—46 scales in lateral line (means: Madras, 44.1; Bhavani 43.2; Wynaad 45.2); the specimens I.B.T.S. 1137 have 43—49 scales ($M = 45.53$) and the unique Hooghly specimen about 48—52 (Day gives 43—45 scales for *Ch. argentea*).

In most populations there are 14—18 gill rakers (means: Madras 15.65; Bhavani 15.75; Wynaad 14.7; I.B.T.S. 1137 14.1), in the Hooghly river specimen 22.

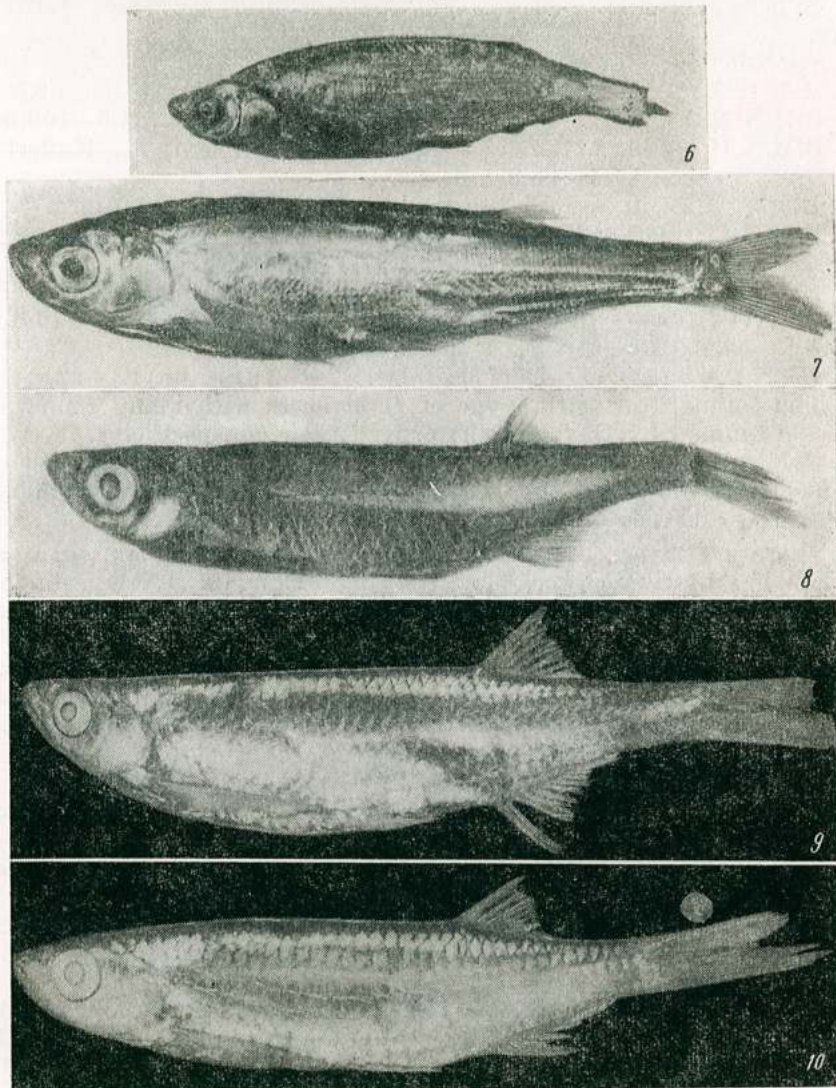
Some body proportions are practically the same in all populations: for ex. caudal peduncle length (16.7—20.2% of st. length, $M = 18.4 - 18.5$), predorsal distance (62—67%, $M\% = 63.7 - 66$), preanal distance (64.8—66.7%, $M = 65.6 - 67.2$), but other values differ rather much, for ex.:

Body depth: 21.6% of st. length in the type; 21.2—23.2% (21.96) in Madras specimens; 23.4—24.8 (24.15) in Bhavani; 22.5—23.2% (21.96) in Wynaad specimens; only 18.6—20.4% (19.54) in I.B.T.S. 1137; 21.3% in Hooghly river specimen.

Least depth: 7.9%; 8.3—9.2% (8.67); 7.9—9.1% (8.68); 8.2—8.8% (8.53); 6.2—7.9% (7.2); 8.05%.

Preventral distance: 52.3%; 46.5—49.5% (48.06); 46.0—49.5% (47.83); 47.3—49.0% (48.23); 48.4—51.1% (50.19); 47.0%.

PLATE II



- Fig. 6. — *Salmostoma novacula* (Valenc.). Lectotype, M.N.H.N., 3895, Madras.
 Fig. 7. — *Salmostoma novacula* (Valenc.). S.U. 34561, Deolali.
 Fig. 8. — *Salmostoma acinaces* (Valenc.). Holotype, M.N.H.N. 3952, Mysore.
 Fig. 9. — *Salmostoma acinaces* (Valenc.). B.M.N.H. 1889. 2.1.1387, Madras.
 Fig. 10. — *Salmostoma boopis* (Day). B.M.N.H. 1889. 2.1.1411, Canara.

Head : 25.2% ; 19.6—22.8% (21.1) ; 21.7—22.3% (21.9) ; 20.8 — 24.0% (22.1) ; 23.4—27.2% (24.9) ; 19.6% of st. length ; these differences may be essentially due to the negative allometry of head length.

Through its high number of anal rays, gill rakers and scales, the only available specimen from Hooghly river may represent a distinct sub-species.

8. *Salmostoma boopis* Day, 186. Fig. 10.

Specimens examined :

B.M.N.H. 1889. 2. 1. 1411, Canara (small tributary of the Arabian Sea), don. Day, 1 spec., 77.8 mm.

R.M.N.H. 8747, South Canara (probably Sharvati R., a tributary of the Arabian Sea), don. Day, 1 spec., 85.0 mm.

N.M.W. 52124, same locality, don. Day, 1 spec., 93.0 mm.

S.U. 41116, Poona district, upper Kistna dr., 1 spec., 88.0 mm.

H.Z.S. 3165, Motha Moola R., Poona, upper Kistna dr., leg Maydell det. Meinken, 1 spec., 77.5 mm.

D 3/7 ; A 3/12—14 ; Sp. br. 15—20 ; L. lat. 39—42.

This species is close to *S. acinaces*, differing from it in number of scales, rays and gill rakers (but with overlap of extreme values !), then in having the dorsal origin well in front of anal origin. Because of these differences, in position of both fins, some body proportions differ from those in *S. acinaces* : preanal distance 67.8—69.7% ; predorsal 62.5—64.5% of st. length, then depth 19.1—24.8% ; caudal peduncle 16.7—18.4% ; least depth 7.8—8.8% ; head 20.2—25.4%.

9. *Salmostoma untrahi* Day, 186. Figs. 11 and 12.

Specimens examined :

B.M.N.H. 1889. 2.1.1746, Mahannadi R., don. Day, 1 spec., 96.0 mm.

N.M.W. 52154, Mahannadi R., don. Day, 1 spec., 110.0 mm.

D 3/7 ; A 3/14—15 ; Sp. br. 15—16 ; L. lat. $59 \frac{10}{1-2}$ 63.

S. untrahi is characterized, besides the number of rays and scales, by an almost vertical mouth, a rather strong symphyseal hook of lower jaw and a corresponding incision of the upper one. The dorsal profile is less convex than the ventral, the head somewhat oblique (especially in the second specimens, Fig. 12), the lateral line more strongly bent than in other species within the genus ; *S. untrahi* bears thus some resemblance with the genus *Oxygaster*.

Range : Mahannadi River drainage in Orissa.

10. *Salmostoma sardinella* (Valenciennes, 184), Figs. 13 and 14.

Synonyms : *Leuciscus sardinella* Val. ; *Chela s.* Günther, 1868 ; Day, 1878 ; Vinciguerra, 1890 ; ? *Ch. untrahi* (partim) Day, 1878.

Specimens examined :

M.N.H.N. 3879, type of *L. sardinella*, Rangoon, Burma, 134.0 mm.

B.M.N.H. 1889. 2.1. 1374—76, Vrome, Burma, 3 spec., 54.1—98.5 mm.

R.M.N.H. 8752, Moulmein, Burma, 1 spec., 113.0 mm.

N.M.W. 52149, same locality, 1 spec., 128.0 mm.

N.M.W. 52150 "Pagu" (probably Pegu, Burma), 1 spec., 89.1 mm.

N.M.W. 52153, Orissa, don. Day, labelled "type of *Ch. untrahi*", 1 spec., 59.5 mm.

B.M.N.H. 1889. 2.2. 1747 — 51, Orissa, don. Day, 2 spec., 78.3 — 94.0 mm (labelled *Ch. untrahi*).

B.M.N.H. 1889. 2.1. 1466, Orissa, don. Day, 1 spec., 62.7 mm (labelled *Ch. phulo*).

I.B.T.S. 1135, Ditto, Bengal (Ganges-Brahmaputra dr.), 8 spec., 44.8—60.3 mm (received from Z.S.I., originally labelled *Ch. untrahi*).

I.B.T.S. 2003, Brackpore, W. Bengal (same drainage), 7 spec., 41.5—58.3 mm (received from Z.S.I., originally determ. *Ch. phulo*).

D 3/7; A 3/16—19; Sp. br. 15—22; L. lat. (47) $48 \frac{7-8}{1-2}$ 52 (53).

This species was hitherto recorded only from Burma (Irawadi and Salwin drainages); I identified it also in Bengal and Orissa; most of the Orissa specimens, labelled as *Ch. untrahi* and apparently determined by Day himself (including N.M.W. 52153, labelled as one syntype of *untrahi*!) proved to be *S. sardinella*; they are in all respects identical with Burmese and Bengalese specimens of *sardinella*.

S. sardinella differs sharply from *S. untrahi* in number of rays and scales, in having both profiles equally arched, the head in the body axis, the mouth less vertical and the symphyseal hook on the lower jaw quite rudimentary.

11. *Salmostoma sladdoni* (Day, 186). Fig. 15.

Specimens examined:

R.M.N.H. 8751, Burma, don. Day, 1 spec., 84.3 mm.

N.M.W. 52152, Bhamo, Burma, leg. Fea, 1 spec., 105.0 mm.

D 3/7; A 3/18—19; Sp. br. 15—17; L. lat. $61 \frac{8}{1-2}$ 64.

This species approaches *S. sardinella* on general habitus, shape of mouth and anal rays and *S. untrahi* in number of scales. Its range is restricted to Irrawadi drainage in Burma.

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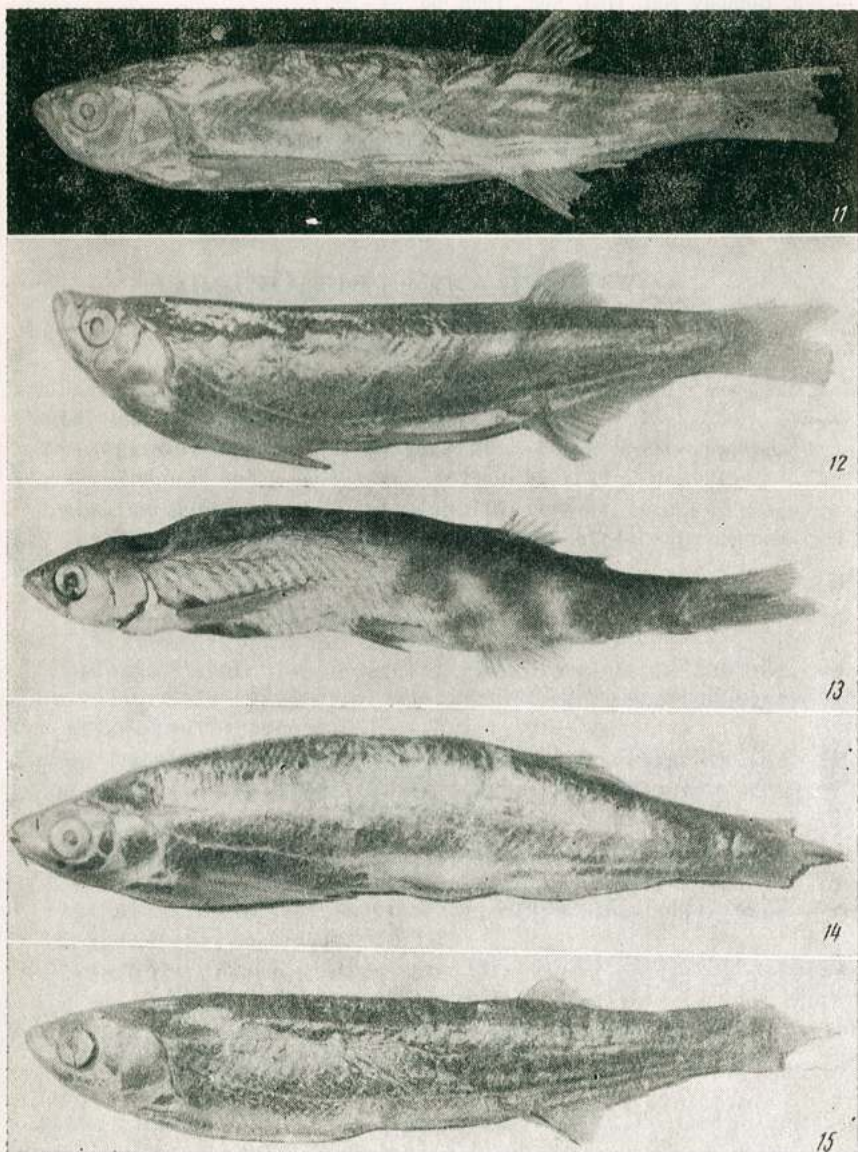
The species of *Salmostoma* belong to four phylletical series. The first three series consist of species totally or partially representative:

- 1) *bacaila* (Ganges-Brahmaputra, Indus and Mahannadi drainages) — *clupeoides* (Nardaba and Godavari to Kaveri drainage, then Burma);
- 2) *phulo* (Ganges — Brahmaputra and Mahannadi) — *punjabensis* (Indus) — *novacula* (Godavari, Kistna, Penner and adjacent drainages in South India, but apparently not Kaveri) — *horai* (Kaveri drainage);
- 3) *boopis* (upper Kistna and Arabian Sea drainage in Canara) — *acina-ces* (Kaveri drainage, Hooghly River, Madras, probably Penner).

The remaining three species are not so evidently related. *S. untrahi* is restricted to Mahannadi, *S. sladdoni* to Irrawadi, whilst the range of the intermediate *S. sardinella* includes that of both other species.

This distribution pattern indicates that the speciation within the genus was mainly geographic. *S. boopis*, perhaps also *S. clupeoides* and *S. novacula* probably dispersed along the Western Ghats, *S. bacaila*, *S. phulo* and *S. sardinella* dispersed probably through lowlands.

PLATE III



- Fig. 11. — *Salmostoma untrahi* (Day). B.M.N.H. 1889.2.1.1746, Mahannadi.
 Fig. 12. — *Salmostoma untrahi* (Day). N.M.W. 52154, Mahannadi R.
 Fig. 13. — *Salmostoma sardinella* (Valenc.). Holotype, M.N.H.N. 3879, Rangoon.
 Fig. 14. — *Salmostoma sardinella* (Valenc.). N.M.W. 52149, Moulmein.
 Fig. 15. — *Salmostoma sladdoni* (Day). N.M.W. 52152, Bhamo, Burma.

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