

A NEW SPECIES OF SARDINE *SARDINELLA* (*AMBLYGASTER*) *JONESI*  
(*CLUPEIDAE*) FROM VIZHINJAM, SOUTHWEST COAST OF INDIA,  
WITH A REVISED KEY TO THE SPECIES OF THE SUBGENUS  
*AMBLYGASTER* BLEEKER, 1849

S. LAZARUS

Central Marine Fisheries Research Institute, Cochin-682 018\*

ABSTRACT

A new species of sardine *Sardinella* (*Amblygaster*) *jonesi* collected from Vizhinjam, southwest coast of India is described. Its affinities with those of the other known species of the subgenus are discussed with a revised key.

INTRODUCTION

SUBGENUS *Amblygaster* Bleeker 1849 of the genus *Sardinella* Valenciennes, 1847 is known only by three species, namely *Sardinella sirm* (Walbaum), *S. leiogaster* (Valenciennes) and *S. clupeioides* (Bleeker) (Chan, 1965 and Whitehead, 1973) and all the species are known to occur along the southwest coast of India (Bennet, 1965; Talwar, 1974). The author, while engaged in the study of the sardines of the southwest coast of India, came across another species which is not referable to any of the known species and the same is described here as new. This species is named *Sardinella* (*Amblygaster*) *jonesi* in respect to Dr. S. Jones, the former Director of the Central Marine Fisheries Research Institute under whom the author started his research career, to honour him at his 70th birth day as the material was collected from the place of his birth.

I wish to express my sincere thanks to Dr. E.G. Silas, Director, Central Marine Fisheries

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*Sardinella jonesi* sp. nov. (Fig. 1)

*Holotype*: CMFRI/T/118/1, S.L 182 mm (T.L 218 mm), Vizhinjam (lat. 8° 22'N and long. 76° 59'E) near Trivandrum, Kerala State, India, April 1978.

\* Present address: Calicut Research Centre of Central Marine Fisheries Research Institute, Calicut, Kerala, S. India.

*Paratypes*: 35 specimens, S.L 39-182 mm given in Table 4. Measurements and counts (T.L 46-218 mm) CMFRI-VZM No. 90/F/30.10, Vizhinjam fish landing centre, Kerala State, India, April 1978—April 1980. were made following Raja and Lazarus (1975) and the body measurements are expressed as percentage of standard length.

For comparison 38 specimens of *S. sirm* (Based on the holotype; variation of paratypes given within brackets) (CMFRI-VZM No. 91/F/30.11) ranging from

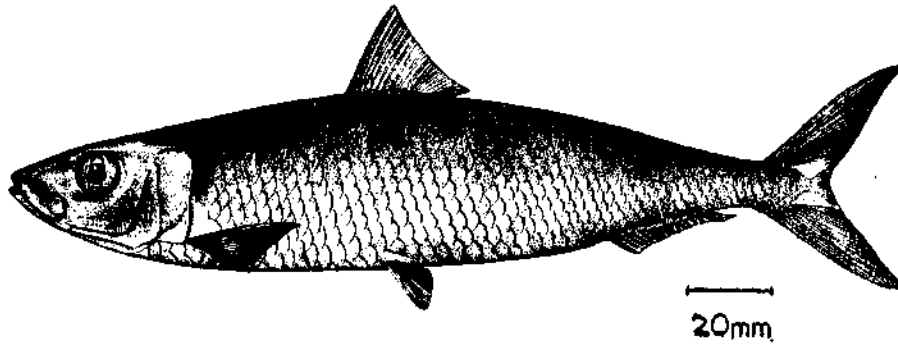


Fig. 1. *Sardnella jonesi* sp. nov.

46-185 mm standard length (55-225 mm total length) and 12 specimens of *S. clupeioides* (CMFRI-VZM No. 92/F/30.12) ranging between 133 and 206 mm standard length (167-257 mm total length) collected from the same place were used and the material is deposited in the museum of the Vizhinjam Research Centre of CMFRI, Vizhinjam. The data related to *S. leiogaster* were taken from published accounts (Menon and Talwar, 1975; Talwar, 1974). A comparison of proportional measurements and meristic characters of *S. jonesi*, *S. sirm*, *S. clupeioides* and *S. leiogaster* is given in Table 1 and 2 respectively. The means of each meristic character for *S. jonesi* and *S. sirm* and the 't' value for testing the significance, if any, between the two means and the inference are given in Table 3. While employing the 't' test for morphometric characters all measurements were converted to the percentages of the standard length. The means of each morphometric character for the above two forms and the 't' value for testing the significance, if any, between the two means and the inference are

#### DESCRIPTION

*Meristic counts (variation of paratypes in parenthesis)*: D 18 (15-21); P 16 (16-17); V 8; A 18 (16-20); C 24 (20-26); Scales in lateral series 44 (41-45); longitudinal scale rows 11; predorsal scales 15 (14-15); pre-ventral scutes 17 (14-17); post-ventral scutes 13 (12-15); gill rakers on the upper arm of first gill arch 16 (13-17); gill rakers on lower arm of first gill arch 41 (37-48); vertebrae 43-45 (holotype and paratypes not included).

*Measurements as percentage of SL*: Head length 23.6 (22.1-28.0), longer than depth at dorsal origin. Maxillary length 8.8 (5.1-10.3) not reaching to the vertical of the anterior margin of the orbit. Eye diameter 6.0 (5.6-10.3), covered by thick adipose tissue with a vertical slit. Snout length 8.2 (7.1-11.3), about as long as eye in juveniles and slightly longer in adults. Inter-orbital width 6.6 (5.7-10.3), as long as eye. Post-orbital length 9.9 (8.5-13.67). Width between upper ends of gill openings 9.9 (8.3-11.4), as long as post-orbital length.

TABLE 1. A comparison of morphometric measurements in mm of *S. jonesi*, *S. sirm*, *S. clupeioides* and *S. leiogaster* from Indian Seas

Characters	<i>S. jonesi</i>		<i>S. sirm</i>		<i>S. clupeioides</i>		<i>S. leiogaster</i> *
	Mean	Range	Mean	Range	Mean	Range	Range
Head length	24.21	(22.1-28.0)	23.77	(22.6-26.1)	24.2	(22.7-27.1)	(23.3-25.9)
Maxillary length	6.99	(5.1-10.3)	7.51	(5.9-10.9)	7.2	(6.3-8.3)	(7.3-7.6)
Orbit diameter	7.26	(5.6-10.3)	6.92	(5.8-8.7)	7.1	(6.3-8.3)	(6.0-6.4)
Snout length	8.11	(7.1-10.3)	8.09	(7.4-9.8)	7.5	(6.8-8.3)	(7.6-8.0)
Upper jaw length	9.45	(7.6-13.0)	9.74	(8.1-13.0)	8.2	(7.5-8.9)	(8.0)
Lower jaw length	10.54	(8.9-13.6)	10.36	(8.8-13.0)	9.7	(9.0-10.3)	(8.8-9.6)
Post-orbital length	10.11	(8.5-13.6)	9.86	(8.8-13.0)	9.4	(8.9-9.8)	—
Inter-orbital length	6.68	(5.7-10.3)	6.79	(5.4-8.3)	7.2	(6.7-8.3)	—
Width between upper ends of gill openings	9.67	(8.3-11.4)	9.46	(8.7-10.9)	11.1	(10.2-11.4)	—
Depth at dorsal origin	21.29	(19.4-23.4)	21.15	(19.5-24.1)	25.1	(24.0-26.7)	(21.0-22.8)
Depth at anal origin	15.69	(11.4-17.9)	14.88	(13.8-17.4)	18.1	(17.2-19.3)	—
Depth at lower jaw base	11.52	(9.4-18.2)	11.36	(9.9-14.1)	11.5	(11.1-12.3)	—
Least depth of caudal peduncle	8.19	(6.7-12.8)	8.00	(6.5-10.2)	7.9	(7.0-8.3)	—
Pre-dorsal length	43.92	(40.0-46.2)	43.57	(40.6-45.3)	49.1	(47.3-50.0)	(51.4-52.2)
Post-dorsal length	59.97	(56.8-62.4)	59.58	(56.5-61.6)	56.1	(53.1-59.4)	—
Dorsal base	12.38	(10.1-15.9)	12.16	(9.2-13.0)	13.4	(12.3-15.0)	—
Length of longest dorsal ray	15.61	(12.6-18.3)	15.11	(11.1-19.6)	13.2	(11.2-15.0)	—
Pre-anal length	77.70	(73.3-83.7)	75.81	(72.6-79.7)	77.7	(71.8-80.5)	(76.7-86.6)
Anal base	14.38	(12.3-19.6)	14.39	(12.3-16.7)	13.0	(12.1-14.1)	(11.1-11.9)
Length of last branch of last anal ray	5.84	(4.4-6.8)	5.17	(3.8-6.5)	4.5	(4.1-5.3)	—
Pre-pectoral length	23.46	(21.6-28.2)	22.99	(21.0-26.0)	24.4	(22.9-25.7)	—
Pectoral length	15.87	(14.6-17.9)	15.28	(14.0-16.4)	14.7	(13.4-16.1)	(15.0-16.0)
Pre-ventral length	48.54	(44.7-51.1)	48.29	(45.9-51.1)	51.2	(49.6-52.4)	(51.4-53.3)
Ventral length	9.39	(7.6-11.8)	9.38	(8.1-10.9)	9.6	(8.9-11.3)	(8.3-8.5)
Length of caudal fin	21.20	(18.1-25.0)	20.61	(18.5-24.2)	24.0	(21.4-29.3)	—

\*As given in Menon and Talwar (1975) and Talwar (1974)

TABLE 2. A comparison of meristic characters of *S. jonesi*, *S. sirm*, *S. clupeioides* and *S. leiogaster* from Indian Seas

Characters	<i>S. jonesi</i>		<i>S. sirm</i>		<i>S. clupeioides</i>		<i>S. leiogaster</i> *
	Mean	Range	Mean	Range	Mean	Range	Range
Lateral scales	42.40	(41-45)	42.50	(42-45)	43.4	(40-45)	(42)
Longitudinal scale rows	11.00	(11)	10.55	(10-11)	12.0	—	(11)
Pre-dorsal scales	14.75	(14-15)	13.65	(12-15)	15.0	(13-17)	(14)
Pre-ventral scutes	15.75	(14-17)	16.10	(14-17)	15.7	(15-17)	(16-17)
Post-ventral scutes	13.80	(12-15)	13.45	(13-14)	13.5	(12-14)	(12-14)
Gill rakers : Upper arm	14.55	(13-17)	15.55	(10-18)	14.6	(13-17)	(17)
Gill rakers : Lower arm	39.90	(37-48)	38.20	(29-42)	27.5	(26-29)	(31-35)
Pectoral rays	16.10	(16-17)	15.90	(14-17)	16.5	(16-17)	(16-17)
Pelvic rays	8.00	—	8.00	—	8.0	—	(8)
Anal rays	17.40	(16-21)	16.45	(14-19)	16.8	(16-18)	(16-18)
Caudal rays	23.60	(20-26)	23.70	(22-24)	24.0	—	—
Dorsal rays	17.25	(15-21)	16.30	(14-17)	17.8	(17-19)	(18)

\* As given in Menon and Talwar (1975) and Talwar (1974)

TABLE 3. Results of 't' test on the mean values of 12 meristic characters for *S. jonesi* and *S. sirm*

Meristic characters	Mean No. of counts of meristic characters		't' Value	Inference	Result
	<i>S. jonesi</i> N = 23	<i>S. sirm</i> N = 23			
Lateral scales	42.4000	42.5000	0.1462	Not significant	No significant difference
Longitudinal scale rows	11.0000	10.5500	3.9427	Significant at 1% level	Number of scale rows more for <i>S. jonesi</i>
Predorsal scales	14.7500	13.6500	3.5590	-do-	Number of scales more for <i>S. jonesi</i>
Pre-ventral scutes	15.7500	16.1000	1.3496	Not significant	No significant difference
Post-ventral scutes	13.8000	13.4500	0.9448	Not significant	-do-
Gill raker : upper arm	14.5500	15.5500	2.2375	Significant at 5% level	No. of rakers more for <i>S. sirm</i>
Gill raker : lower arm	39.9000	38.2000	1.8852	Not significant	No significant difference
Pectoral rays	16.1000	15.9000	1.6464	-do-	-do-
Polvic rays	8.0000	8.0000	0.0000	-do-	-do-
Anal rays	17.4000	16.4500	1.7363	-do-	-do-
Caudal rays	23.6000	23.7000	0.3121	-do-	-do-
Dorsal rays	17.2500	16.3000	1.4323	-do-	-do-

TABLE 4. Results of 't' test on the mean values of 25 morphometric characters for *S. jonesi* and *S. sirm*

Morphometric characters	Mean percentage to the standard length of morphometric characters		't' value	Inference	Results
	<i>S. jonesi</i> N = 23	<i>S. sirm</i> N = 23			
Head length	24.21	23.77	1.06	Not significant	No significant difference
Maxillary length	6.99	7.51	1.08	-do-	-do-
Orbit diameter	7.26	6.92	0.93	-do-	-do-
Snout length	8.11	8.09	0.08	-do-	-do-
Upper jaw length	9.45	9.74	0.49	-do-	-do-
Lower jaw length	10.54	10.36	0.37	-do-	-do-
Post orbital length	10.11	9.86	0.64	-do-	-do-
Inter orbital length	6.68	6.79	0.26	-do-	-do-
Width between upper ends of gill openings	9.67	9.46	0.86	-do-	-do-
Depth at dorsal origin	21.29	21.15	0.50	-do-	-do-
Depth at anal origin	15.69	14.88	1.82	-do-	-do-
Depth at lower jaw base	11.52	11.36	0.24	-do-	-do-
Least depth of caudal peduncle	8.19	8.00	0.42	-do-	-do-
Predorsal length	43.92	43.57	0.87	-do-	-do-
Postdorsal length	59.97	59.58	0.68	-do-	-do-
Dorsal base	12.38	12.16	0.47	-do-	-do-
Length of longest dorsal ray	15.61	15.11	1.00	-do-	-do-
Pre-anal length	77.70	75.81	1.81	-do-	-do-
Anal base	14.38	14.39	0.01	-do-	-do-
Length of last branch of last anal ray	5.84	5.17	2.10	Significant at 5% level	Longer for <i>S. jonesi</i>
Pre-pectoral length	23.46	22.99	1.14	Not significant	No significant difference
Pectoral length	15.87	15.28	2.58	Significant at 5% level	Longer for <i>S. jonesi</i>
Pre-ventral length	48.54	48.29	0.51	Not significant	No significant difference
Ventral length	9.39	9.38	0.03	-do-	-do-
Length of caudal fin	21.20	20.61	1.14	-do-	-do-

Minute feeble teeth present on palatines, pterygoides and tongue. Opercular bones, post-orbitals and sub-orbitals covered by translucent dermal tissue. The cephalic sensory system appears as hollow venules spread downwards in a radiating pattern.

Body oblong and elongated with weakly keeled belly having blunt scutes which are not prominent. Depth at dorsal origin 23.1 (19.4-23.4), almost equal to caudal fin length. Depth at anal origin 15.9 (11.4-17.9), as long as pectoral fin length. Least depth of caudal peduncle 7.1 (6.7-12.8), about  $\frac{1}{2}$  of maximum body depth and  $\frac{1}{2}$  of depth at anal origin. Length of pre-dorsal region 45.6 (40.0-46.2), post-dorsal length 59.3 (56.8-62.4), origin of dorsal fin nearer to snout than to caudal base; dorsal base 11.5 (10.1-15.9), length of longest dorsal ray 12.6 (12.6-18.3). Pre-pectoral 24.2 (21.6-28.2), pectoral length 15.4 (14.6-17.9), the tip not reaching vertical from dorsal origin. Pre-pelvic length 48.4 (44.7-51.1), pelvic fin length 8.2 (7.6-11.8), about as long as upper jaw length or snout length; the pelvic fin origin below first  $\frac{1}{2}$  of dorsal fin base. Pre-anal length 78.0 (73.3-83.7). The distances between anal and caudal bases and that between anal and pelvic bases are almost equal in the smaller fish but in larger fish the latter is considerably longer, so that the anal origin is nearer to caudal base than to the pelvic base. Anal base 12.6 (12.3-19.6), longer than dorsal base. Length of last branch of last anal ray 4.4 (4.4-6.8).

**Scales :** Body scales cycloid, some what deciduous. Pre dorsal median ridge is covered by a single longitudinal row of scales. Anterior portion of scales with one continuous basal transverse groove, preceded by a set of two to five interrupted grooves with a wide distinct interspace between the discontinuous portions (Fig. 2 a). Exposed portion of the scales of the belly region slightly eroded. Scale sheaths cover the base of dorsal and anal fins. Base of caudal rays covered by small scales and there is a longer and more elongated scale on each

caudal lobe near the fork. An axillar scale present at the base of the ventral fin.

**Colour :** In fresh, dark blue on the back with silvery or pale brown on the belly. A dark spot present in the supracleithral region at the level of the upper end of gill opening. The mediolateral part of the body white, mildly yellowish. Snout and tip of lower jaw blackish in the adult and brownish in juveniles. Caudal and tip of dorsal dusky in the adult and pale in the juveniles. The axillar side of the pectoral fin with a dark streak on the anterior  $\frac{2}{3}$  of the first to fourth or fifth ray. Ventral and anal translucent.

**Local name :** Like *Sardinella sirm* it is also known as 'keerichalai' in Tamil and in Malayalam 'keerimeen'.

**Relationship with other species :** A comparison of the external characters of *S. jonesi* with that of *S. sirm* reveals two important differences. They are the absence of lateral dots and a shorter maxillary which does not reach the vertical of the anterior margin of the orbit. Raja and Hiyama (1969 b) have observed such dots in their Okinawan specimens of *S. sirm* (lower gill rakers 33-42) above the dividing line almost merging with the darker background were only faintly discernible or absent in some fishes, suggesting that Kishinouye's *okinawensis* was actually *S. sirm* (no gillraker counts given). In *S. sirm* available in this area, also, the dots are found above the dividing line but they are very prominent even after long preservation. So there is no question of the dots fading away due to preservation or omission due to the darker background. Whitehead (1973) is of the opinion that the green gold spots in fresh *S. sirm* quickly turn black on preservation and frequently disappear. However, the author has not observed the dots disappearing on preservation in *S. sirm* from this area. In *S. jonesi* the lateral dots, even in fresh specimens of a wide size range (39-182 mm SL),

are absent. Apart from this, the other differences observed are as follows :

1. *Gonad* : Virgin gonad (Stage II) of a female fish of *S. jonesi* (Fig. 2 c) differs much from that of *S. sirm* (Fig. 2 b) in its shape and size. The gonad of *S. jonesi* is much longer and bigger in size than that of *S. sirm* in comparable sizes. Moreover, the anterior end of the left lobe of *S. jonesi* is triangular in shape with a distinctly tapering tip and thin edges, more or less similar to that of *S. clupeioides* (Fig. 2 d). Whereas in *S. sirm* the tip is conical with rounded borders giving the gonad a somewhat cylindrical appearance when viewed laterally.

3. *Vertebral count* : Vertebral count made on 15 specimens each of *S. jonesi* (166-172 mm SL) and *S. sirm* (168-176 mm SL) gave a count of 43-45 for the former and 46 for the latter. It is to be noted that the mean value given by Raja and Hiyama (1969 a) for *S. sirm* from Philippines (82-160 mm SL) is 42.93 (range 42-44) and of those from India (125-153 mm SL) is 42.89 (41-44). So the average mean according to them comes to 42.91 and is the lowest count among the sardines they have studied. Further it is also stated that there is no significant difference in the population means and if this being the case the higher

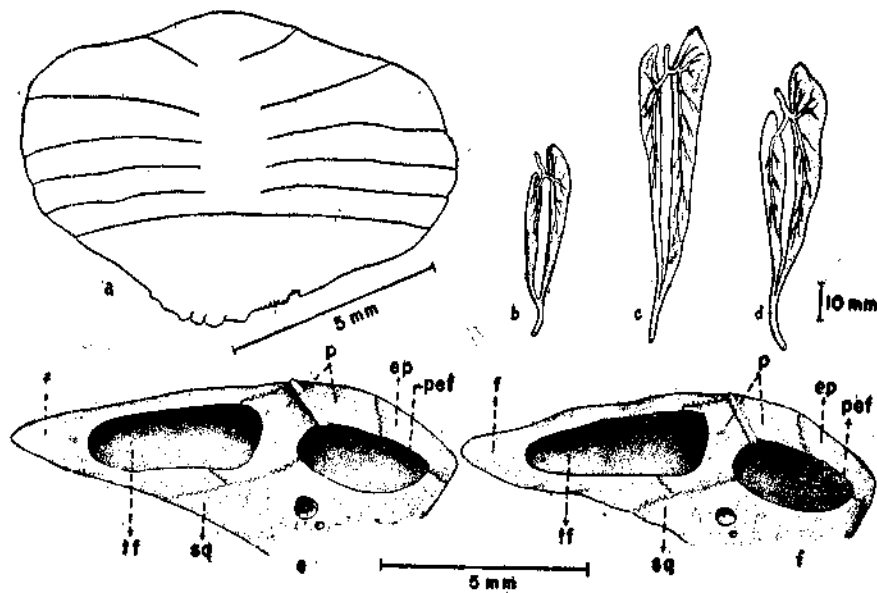


Fig. 2 a. Body scale of *S. jonesi* taken from the midlateral side above the vent, b. Female gonad (Stage II) of *S. sirm* (130 mm SL), c. Female gonad (Stage II) of *S. jonesi* (130 mm SL), d. Female gonad (Stage II) of *S. clupeioides* (134 mm SL), e. Lateral view of a part of the skull of *S. jonesi* showing the temporal and foramen and f. Lateral view of a part of the skull of *S. sirm* showing the temporal foramen. ep = epiotic, f = frontal, p = parietal, pef = pre-epiotic fossa, sq = squamosal and tf = temporal foramen.

2. *Temporal foramen* : The temporal foramen leading into the upper part of the cranial cavity is broad and almost rectangular in shape in *S. jonesi* (Fig. 2 e), but in *S. sirm* (Fig. 2 f) it is comparatively narrow and almost conical in shape.

vertebral count range (43-45) found in *S. jonesi* appears to be a specific character.

4. *Results of the 't' test* : Results of the 't' test also reveal variation in the meristic and morphometric characters between *S. sirm*

and *S. jonesi* in at least five characters (Table 3, 4). The characters which showed significant variation were: number of longitudinal scale rows, predorsal scales, gill rakers of the upper arm, length of pectoral fin and length of the last branch of the last anal ray. Among these characters, only in the case of gill raker (upper arm) count *S. sirm* showed a greater number, whereas for the other characters *S. jonesi* exhibited higher values.

Like *S. clupeioides* and *S. leiogaster*, *S. jonesi* also has a short maxillary which does not reach to the vertical of the anterior margin of orbit in addition to the absence of lateral dots. But it differs from the above two species in having a slender body and also in having a higher number (37-48) of gillrakers on the lower lobe as in *S. sirm*. However in the position of dorsal fin it comes closer to *S. clupeioides* and *S. sirm*.

The points in favour of considering *S. jonesi* as a new species and as different from *S. sirm* are: 1. absence of lateral dots, 2. a short maxillary which does not reach the vertical of the anterior margin of the orbit, 3. size and shape of the female gonad, 4. broad and rectangular temporal foramen, 5. more number of vertebrae, 6. more number of predorsal scales and longitudinal scale rows, 7. longer pectorals and anal rays and 8. less number of gill rakers on the upper arm. Similarly *S. jonesi* differs from *S. clupeioides* in having 1. a higher number of gill rakers on the lower lobe, 2. a narrow body, 3. less number of longitudinal scale rows and 4. a shorter predorsal distance. It also distinguishes itself from *S. leiogaster*

in having 1. more number of gill rakers on the lower lobe, 2. a slender body, 3. a longer anal base, 4. a shorter pre-ventral length and 5. an anteriorly placed dorsal fin.

In view of the above differences constantly found in the present form it is described here as a new species.

#### REVISED KEY TO THE SPECIES OF THE SUBGENUS

##### AMBLYGASTER

- I. A row of 10-20 dark blue, rounded spots along flanks; maxilla reaching to the vertical of the anterior margin of orbit; gill rakers on lower branch of first arch 29-42.....*S. sirm* (Plate I A)

No dark blue spots along flanks; maxilla not reaching to the vertical through the anterior margin of orbit; gill rakers on lower branch of first arch 26-48:

- A. Body moderately heavy, depth 24-27% in SL; lower gill rakers 26-30; origin of the dorsal fin slightly nearer to snout than to caudal base.....  
.....*S. clupeioides* (Plate I B)

- B. Body elongated, depth 22-24% of SL; lower gill rakers 31-36; origin of the dorsal fin equidistant between snout and caudal base.....  
.....*S. leiogaster* (Plate I C)

- C. Body slender, depth 19-23% in SL; lower gill rakers 37-48; origin of the dorsal fin nearer to snout than to caudal base.....*S. jonesi* (Plate I D)

#### REFERENCES

- BENNET, P. S. 1965. On *Sardinella clupeioides* (Bleeker) from the coasts of India. *J. mar. biol. Ass. India*, 7 (1): 208-210.
- BLEEKER, P. 1849. Bijdrage tot de kennis der ichthyologische fauna van het eiland Madura. *Verh. Batav. Genoots.*, 22: 1-16.
- CHAN, W. L. 1965. A systematic revision of the Indo-Pacific clupeoid fishes of the genus *Sardinella* (Family: Clupeidae). *Jap. J. Ichthyol.*, 12 (3-6): 104-118.
- MENON, A. G. K. AND P. K. TALWAR 1975. Taxonomy and distribution of *Sardinella leiogaster* Valen-

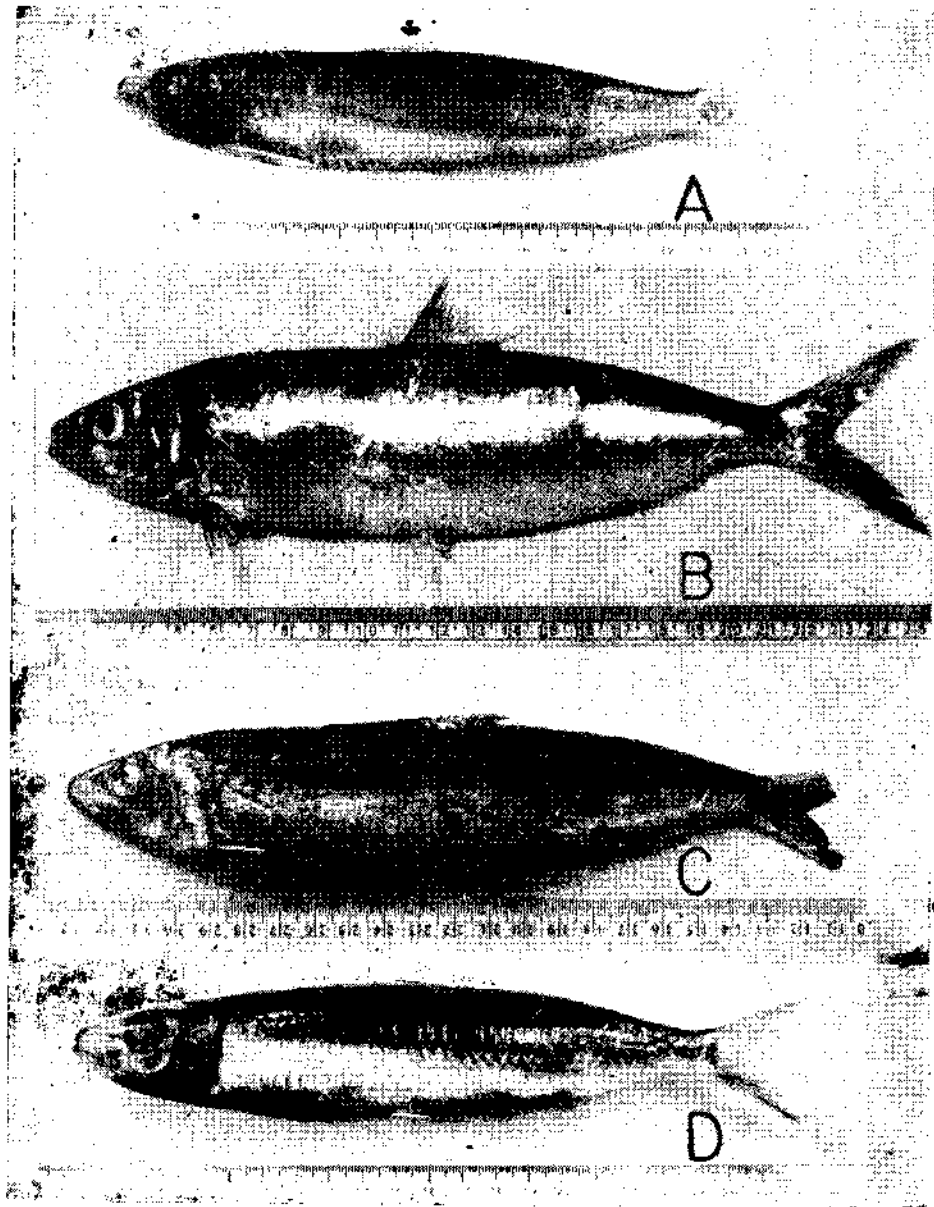


PLATE I. A. *Sardinella sirm*, 165 mm SL, Vizhinjam, Southwest Coast of India, B. *S. chupeoides*, 208 mm S,L, Vizhinjam Southwest Coast of India, C. *S. leiogaster*, 202 mm SL Shangumugam, Southwest Coast of India ZSI F 7034/2 (Collected by Dr. P.K. Talwar) and D. *S. jonesi*, 192 mm SL, Vizhinjam, Southwest Coast of India.