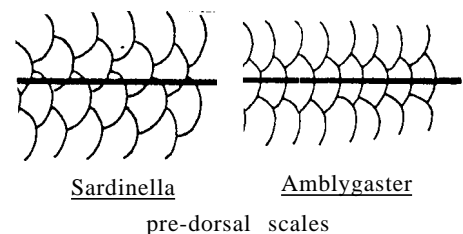
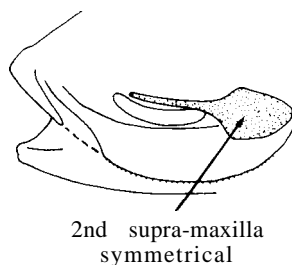
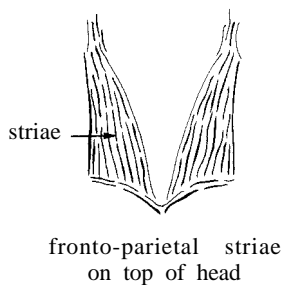
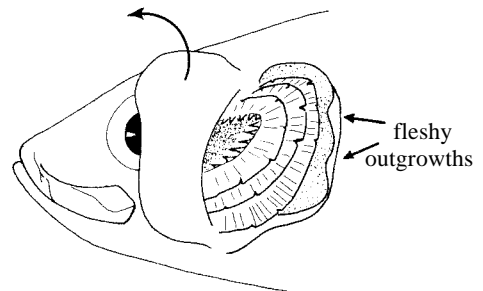


Sardinella Valenciennes, 1847

CLUP Sardal

Sardinella Valenciennes, 1847, Hist.nat.pois., 20:18 (type: Sardinella aurita Valenciennes). Clupeonia Valenciennes, 1847, Hist.nat.pois., 20:345 (type: Clupeonia jussieui Valenciennes). Kowala Valenciennes, 1847, Hist.nat.pois., 20:362 (type: Kowala albella Valenciennes). Clupalosa Bleeker, 1849, Verh.batav.Genoot.Kunst.Wet., 22:12 type: Clupalosa bulan Bleeker = Kowala albella Valenciennes). Sardinia Poey, 1860, Mem.Hist.nat.Cuba, 2:311 (type: Sardinia pseudohispanica Poey = Sardinella aurita Valenciennes). Paralosa Bleeker, 1868, Verst.Meded.K.Akad.wet.Amst., 2(2) :300 type: Harengula (Paralosa) valenciennesi Bleeker = Clupea melanura Cuvier). Wilkesina Fowler & Bean, 1923, Proc.U.S.natn.Mus., 63:3 (type: Harengula fijiense Fowler & Bean). Fimbriclupea Whitley, 1940, Aust.Zool., 9(4):399 (type: Fimbriclupea dactylolepis Whitehead = Clupea gibbosa Bleeker). Fiscina Whitley, 1940, Aust.Zool., 9(4):400 (type: Fiscina posterus Whitley = Sardinella lemuru Bleeker).

Diagnostic Features : The presence of two fleshy outgrowths on the hind margin of the gill opening distinguishes Sardinella from all other clupeoid genera except Harengula (New World; a toothed hypo-maxilla present), Opisthonema (new World; last dorsal finray filamentous), Herklotsichthys (Indo-West Pacific; only 3 to 7 frontoparietal striae on top of head, second supra-maxilla asymmetrical, final two anal finrays not enlarged) and Amblygaster. Sardinella closely resembles Amblygaster (the two were formerly combined) in having 7 to 14 frontoparietal striae, a symmetrical paddle-shaped second supra-maxilla and the last two anal finrays distinctly enlarged, but has more, often many more, lower gillrakers (40 to 100, or up to 200 or more in round-bodied species; cf. 26 to 43 in Amblygaster) also, all round-bodied species of Sardinella have paired predorsal scales (a single median series in Amblygaster). Superficially, the round-bodied Sardinella resemble Clupea and Strangomera, whose ranges they sometimes overlap in the North Atlantic and perhaps also in the North and South Pacific, but the characters listed above distinguish them (gill opening, frontoparietal striae, enlarged anal finrays).



Biology, Habitat and Distribution : Marine, pelagic and schooling; some species enter lagoons and estuaries, usually as juveniles. Species of the subgenus Sardinella occur on both sides of the Atlantic, in the Mediterranean and throughout the tropical and subtropical parts of the Indo-West Pacific; members of the subgenus Clupeonia are found mainly in the Indo-West Pacific, but 2 species are in the eastern Atlantic (of which one extends into the Mediterranean).

Interest to Fisheries : A number of species make a very significant contribution to artisanal and fully mechanized fisheries, while numerous others are collectively important in the Indo-West Pacific region (of much more importance than are species of Herklotsichthys, as can be seen in the fish markets of India and southeast Asia). The total recorded catch for Sardinella in 1983 was 1499 437 tons (about 60% unidentified,; the major species were S. longiceps and S. aurita).

Species : In the last revision of Indo-West Pacific species, Wongratana (1980) recognized 18 species and subsequently described one of these as new and gave a replacement name to another (Wongratana, 1983). To these can be added 4 further species from the Atlantic and Mediterranean. Identification of some species, especially the smaller members of the subgenus Clupeonia, is often extremely difficult and in the case of juveniles sometimes impossible. As an aid to identification, the geographical distribution of the species should serve as a first step once the correct subgenus has been determined:

Subgenus Sardinella (pelvic finrays i 8; mostly rather round-bodied species)

- S. aurita Valenciennes, 1847, Atlantic (both sides and Mediterranean), also Japan
S. brasiliensis (Steindachner, 1879), western Atlantic (? also eastern Atlantic and Mediterranean)
S. lemuru Bleeker, 1853, Indonesia, Western and northern Australia, North China Sea
S. longiceps Valenciennes, 1847, Indian Ocean (northern part)
S. neglecta Wongratana, 1983, Indian Ocean (East African coast)

Subgenus Clupeonia (pelvic finrays i 7; mostly more compressed species)**Widespread**

- S. albella (Valenciennes, 1847)
S. brachysoma (Bleeker, 1852)
S. fimbriata Valenciennes, 1847)
S. gibbosa (Bleeker, 1849)
S. melanura (Cuvier, 1829)

Western Indian Ocean

- S. jussieu (Valenciennes, 1847) (southern India, Madagascar, Mauritius)
S. sindensis (Day, 1878) (northern part only)

Western Pacific, northern part

- S. hualiensis (Chu & Tsai, 1958) (Taiwan Island)
S. richardsoni Wongratana, 1983 (South China Sea)
S. tawilis (Herre, 1927) (South China Sea)
S. zunasi (Bleeker, 1854) (China, Japan)

Western Pacific, southern part

- S. atricauda (Günther, 1868) (Indonesia)
S. fijiense (Fowler & Bean, 1923) (New Guinea, Fiji)
S. marquesensis Berry & Whitehead, 1968 (Marquesas Islands)

Eastern Atlantic

- S. maderensis (Lowe, 1839), eastern Atlantic, Mediterranean
S. rouxi (Poll, 1953), eastern Atlantic (western Africa).

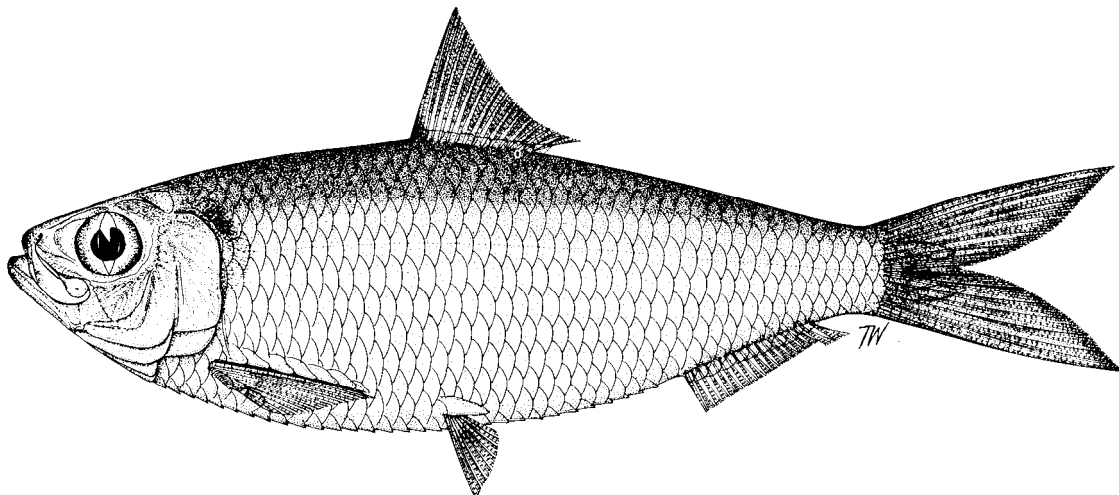
Sardinella albella (Valenciennes, 1847)

CLUP Sardl 6

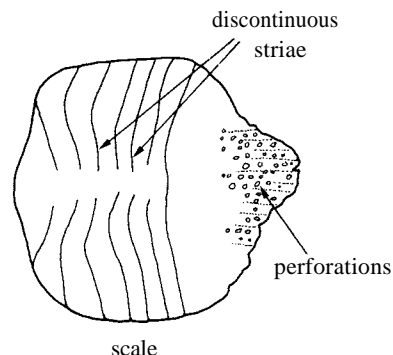
Kowala albella Valenciennes, 1847, Hist.nat.poiss., 20:362 (Pondicherry).

Synonyms : Clupalosa bulan Bleeker, 1849:12 (Indonesia); Kowala lauta Cantor, 1850:297 (Penang); Clupea perforata Cantor, 1850:1276 (Penang to Sumatra and Singapore); Spratella kowala Bleeker, 1851:492 (Rio, Batavia); Clupea (Harengula) sundaica Bleeker, 1872:105 (Batavia, etc.); Harengula dollfusi Chabanaud, 1933:1, figs 1-2 (Gulf of Suez); Sardinella perforata:Fowler, 1941:605 (the Philippines); Chan, 1965:16, fig 7B (Thailand to Taiwan Island); Sardinella bulan:Whitehead, 1963:33-41 (types of bulan, perforata, kowala); Whitehead et al., 1966:53, 55, 61 (types of bulan, kowala, sundaica); Sardinella albella:Losse, 1968:96 (East Africa); Whitehead, 1973b:183, fig. 13; Wongratana, 1980:121, pls 58, 59 (revision); SFSA, in press (southern Africa); Whitehead & Bauchot, in press (types of albella, dollfusi).

FAO Names : En - White sardinella.



Diagnostic Features : Body somewhat compressed but variable, from slender to moderately deep, its depth 25 to 40% of standard length; total number of scutes 29 to 33 (usually 30 to 32). Lower gillrakers 41 to 68 (at 4 to 15 cm standard length, increasing a little with size of fish). Vertical striae on scales not meeting at centre, hind part of scale with a few perforations and somewhat produced posteriorly. A dark spot at dorsal fin origin. Closely resembles *S. fimbriata* and *S. dayi* which have more lower gillrakers (54 to 82, usually more than 55 in *S. fimbriata*; 88 to 126 in *S. dayi*) and can be confused with *S. gibbosa* and *S. sindensis* which have more scutes (31 to 34, usually 32 or 33). Other similar species have more scutes or more gillrakers or overlapping scale striae or no spot at dorsal fin origin or caudal tips black (or a combination of some of these features). See CLUP Sardl 6, Fishing Area 51, also Areas 57, 71.

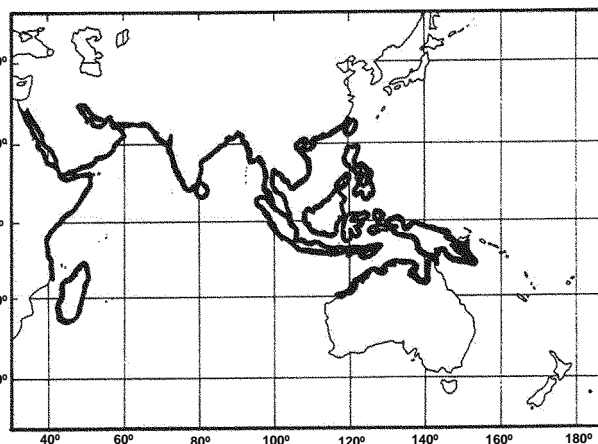


Geographical Distribution : Indo-West Pacific (Red Sea, the "Gulf", East African coasts, Madagascar eastward to Indonesia, north to Taiwan Island, south to Papua New Guinea).

Habitat and Biology : Coastal, pelagic, schooling. Misidentifications make published biological data potentially unreliable. The biology is summarized by Nair (1960, 1973).

Size : To 14 cm standard length, usually to 10 cm.

Interest to Fisheries : Included in the general statistics for *Sardinella*, but of some importance along the western coasts of India (although fishery statistics probably include *S. fimbriata* and *S. gibbosa*).



Local Names : Mostly the same as for *S. gibbosa*.

Literature : Nair (1960, 1973 - India, synopsis of biology and fisheries); Losse (1968 - East Africa).

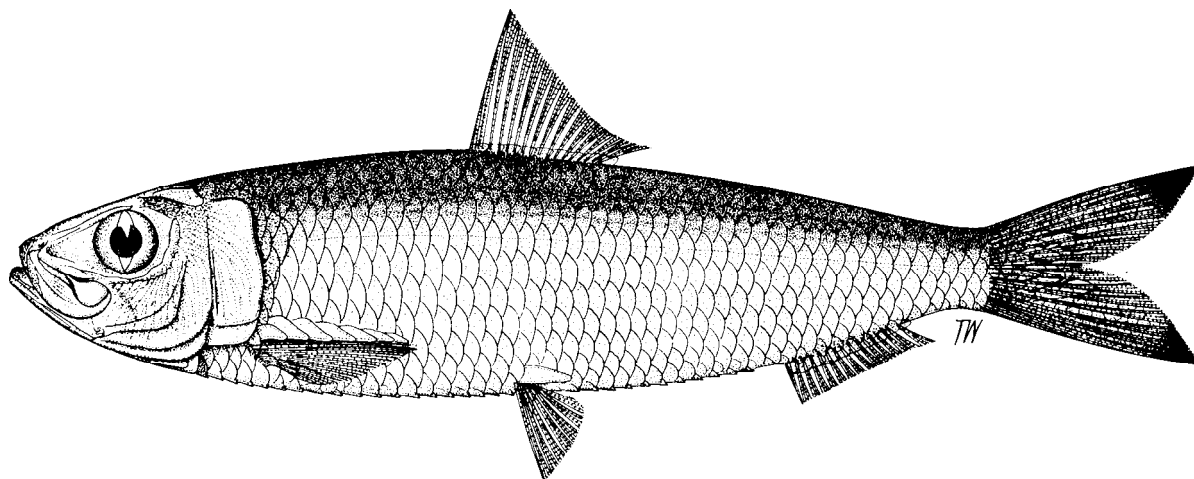
Sardinella atricauda (Günther, 1868)

CLUP Sardl 16

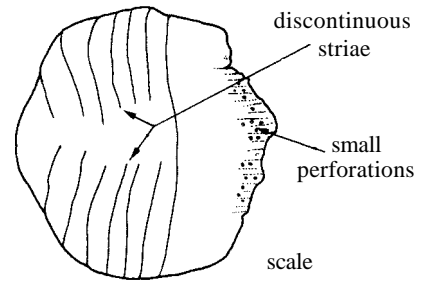
Clupea atricauda Günther, 1868 (14 March), *Cat.Fishes Brit.Mus.*, 7:426 (Ceram; Bleeker's specimen of *Harengula melanurus*).

Synonyms : *Harengula melanurus* Bleeker, 1853:245 (not *Clupea melanurus* Cuvier, 1829); *Harengula (Paralosa) valenciennesi* Bleeker, 1868 (presumed after 14 March): 300 (Waigou; replacement name for his *Harengula melanurus*); Wongratana, 1980:134, pls 77, 78 (revision). Note: included by Fowler (1941:615), Chan (1965:5); Whitehead et al. (1966:63); Whitehead (1973b:180) and others in the synonymy of *S. melanura*.

FAO Names : En - Bleeker's blacktip sardinella.



Diagnostic Features : Body slender, its depth 23 to 27% of standard length; total scutes 32 to 35 (pre-pelvic scutes usually 19). Lower gillrakers 39 to 43, with many asperities on them (probably not increasing in number in larger fishes). Vertical striae on scales not meeting at centre, numerous small perforations on hind part of scale. No dark spot at dorsal fin origin; tips of caudal fin black. Most closely resembles *S. melanura*, which also has black caudal fin tips, but fewer scutes (27 to 31). Other *Sardinella* species lack the black caudal tips or have more gillrakers or fewer scutes or occur outside the area.



Geographical Distribution : Western Pacific (Java Sea from Jakarta to Amboina, but perhaps more widespread in Indonesia).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

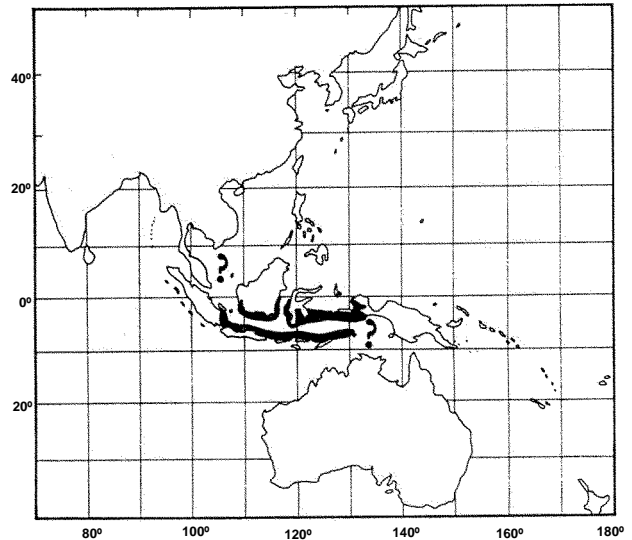
Size : To 12.6 cm standard length, usually to about 10 cm.

Interest to Fisheries : Presumably contributes to local *Sardinella* catches.

Local Names : -

Literature : See under synonyms.

Remarks : Occurs with *S. melanura* in the Java Sea and must have been confused with it frequently.



Sardinella aurita Valenciennes, 1847

CLUP Sardl 1

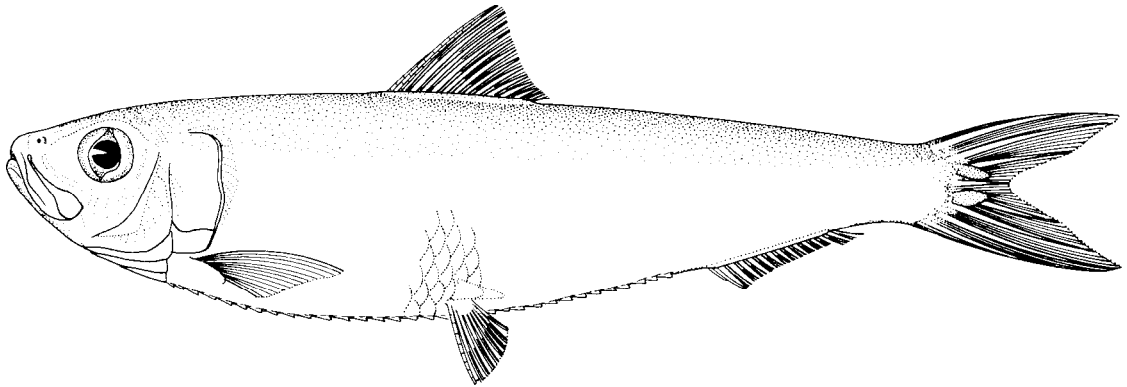
Sardinella aurita Valenciennes, 1847, *Hist.nat.pois.*, 20263 (Messina to Gulf of Morée, Greece).

Synonyms : These are separated for the two major areas of distribution:

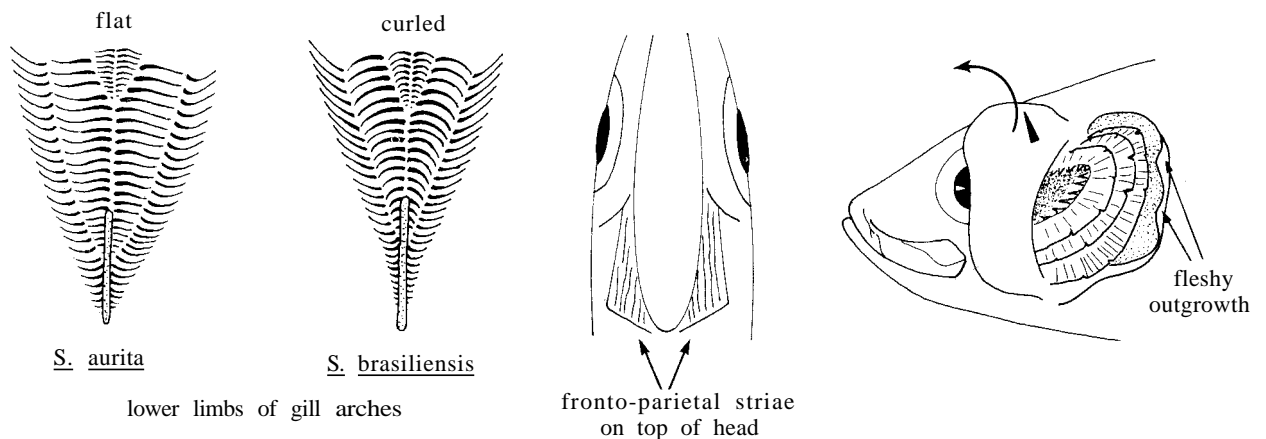
(a) Eastern Atlantic : *Clupea allecia* Rafinesque, 1810:57 (Sicily; potential *nomen oblitum*, but not yet formally suppressed as such); *Alosa senegalensis* Bennett, 1831 (Senegal; overlooked and should be designated a *nomen oblitum*); *Clupea aurovittata* Swainson, 1838 (*nomen nudum*) and 1839:385 (Palermo; overlooked, another potential *nomen oblitum*); *Meletta mediterranea* Valenciennes, 1847:369 (Toulon, Marseille); *Sardinella cuxina* Antipa, 1906:46, pl. 3, figs 12 to 18 (Black Sea); *Clupea venulosa* Steinitz, 1927:3230 (Haifa); *Sardinella aurita terrasae* Lozano y Rey, 1950:14, pl. 3, fig. 2 (Western Sahara, Canaries); *Sardinella aurita* var. *mediterranea*:Rossignol, 1959:215 (Mediterranean). *Sardinella aurita* - Svetovidov, 1952:172, pl. 5, fig. 2 (Russian waters); *Idem*, 1963:189, pl. 5, fig. 2 (same); CLOFNAM, 1973:103 (full synonymy for Mediterranean and eastern Atlantic); FNAM, 1984:222 fig. ; CLOFETA, in press (eastern central Atlantic, full synonymy); SFSA, in press (southern Africa); Whitehead & Bauchot, in press (types of *aurita*, *mediterranea*).

(b) Western Atlantic : *Sardinella anchovia* Valenciennes, 1847:269 (Rio de Janeiro); FWNA, 1963:401, fig. 99 (synopsis of taxonomy and biology); Cervigón, 1966:120, fig. 50 (Venezuela); *Sardinia pseudohispanica* Poey, 1860:311 (Cuba). *Sardinella pinnula* Bean, 1912:122 (Bermuda); FWNA, 1964:400, fig. 98 (synonymy, biol.); *Sardinella aurita*:Whitehead, 1973a:27, fig. 6 (Guianas).

FAO Names : En - Round sardinella.



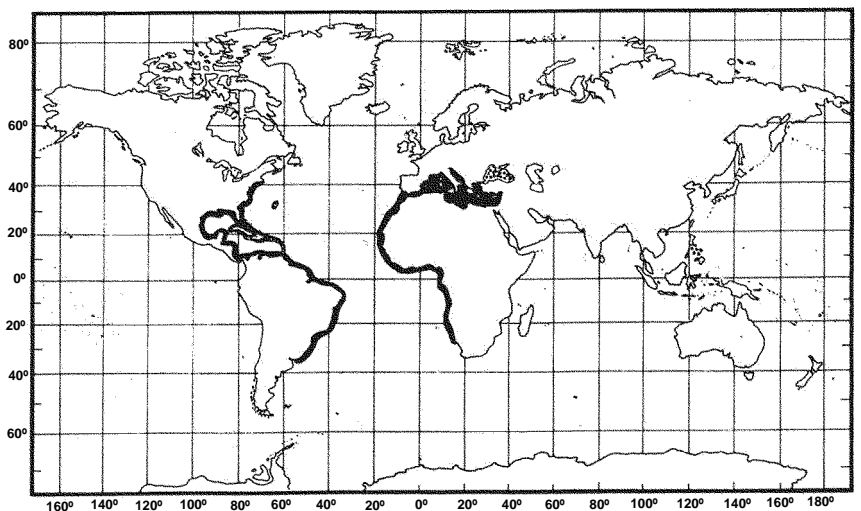
Diagnostic Features : Body elongate, usually subcylindrical, but sometimes a little compressed; belly rather rounded, but scutes apparent. Lower gillrakers fine and numerous, more than 80 (162 to 248 in West African specimens of 23 to 28 cm standard length); anterior gillrakers on lower limbs of second and third gill arches lying more or less flat (strongly curled in *S. brasiliensis*). The pelvic finray count of i 8 distinguishes *S. aurita* from all other species of *Sardinella*, also *Harengula*, *Opisthonema*, *Herklotsichthys* and *Amblygaster* that occur with it. Resembles *Clupea*, but has two fleshy outgrowths along outer margin of gill opening (smooth in *Clupea*) and numerous fine fronto-parietal striae on top of head. Flanks silvery, with a faint golden midlateral line, preceded by a faint golden spot behind gill opening; a distinct black spot at hind border of gill cover (absence of silver pigment). See CLUP Sardi 1, Fishing Areas 37, 34 and 47 (in part), 31.



Geographical Distribution :

Eastern Atlantic (Mediterranean, but rare in Black Sea; African coasts from Gibraltar southward to Saldanha Bay, South Africa (see also under remarks); western Atlantic (Cape Cod to Argentina).

Habitat and Biology : Coastal, pelagic, preferring clear saline water with a minimum temperature below 24°C; from inshore and near surface to edge of shelf and down to 350 m (West Africa), or perhaps even deeper; schooling and strongly migratory, often rising to surface at night and dispersing. Feeds mainly on zooplankton, especially copepods, but some phytoplankton (especially by juveniles). Breeds perhaps at all times of the year (e.g. off West



Africa), but with distinct peaks, e.g. mid-June -end of September, i.e. the summer months, in the Mediterranean and perhaps off North America; from about May off Senegal (but again in October-November) through to July-August off Mauritania; around July or August off Ivory Coast and Ghana; but apparently September to February, i.e. the winter months, in the Gulf of Mexico (Houde & Fore, 1973), January-February off Venezuela (Simpson, 1969), and, if it spawns with S. brasiliensis, then September to March off Brazil. The breeding pattern is extremely complex, with two principal spawning periods in some areas (linked with upwelling regimes off West Africa). The juveniles tend to stay in nursery areas (main nurseries off Mauritania and Senegal/Gambia for the West African region), but on maturity rejoin adult stocks in the colder offshore waters.

Size : To 30 cm standard length, usually to 25 cm.

Interest to Fisheries : Major fisheries off West Africa, in Mediterranean and off Venezuela and Brazil, although catches not always distinguished from those of other Sardinella species (especially of S. brasiliensis in western Atlantic). The total catch for 1983 was 702 775 tons, being 15 209 tons for the Mediterranean (mixed with S. maderensis), 401 039 tons for West Africa (mixed with S. maderensis) and 286 527 tons for the western Atlantic (mixed with S. brasiliensis).

Local Names : USA (Florida): Spanish sardine.

Literature : For eastern Atlantic area, Svetovidov (1952, 1963 - Mediterranean, Black Sea); Ben-Tuvia (1960 - general synopsis); Postel (1960 - synopsis, West Africa); Banarescu (1964 - Black Sea); Fagetti & Marak (1972 - synopsis of spawning off West Africa); Anon. (1979 - same, also growth, fecundity); Boely & Freon (1980 - same); FNAM (1984 - synopsis); CLOFETA (in press - virtually complete bibliography for West Africa). For western Atlantic area, Hildebrand (i.e. FWNA, 1964).

Remarks : The separation of S. aurita from S. brasiliensis by means of gillrakers shape (see diagnostic features) is tentative; it appears to reinforce the difference in gillrakers numbers (more in S. brasiliensis, but in both cases they increase as the fish grows) which workers have hitherto used. The 'brasiliensis' curled form of gillrakers has been found also in both Mediterranean and West African fishes. Possibly this is a racial difference, which might account for the double peaks in spawning in some areas. The species has been best studied off West Africa, where there are three quite distinct 'stocks':

- (i) North Transitional Zone (Mauritania to Guinea; also, off Sierra Leone - perhaps a separate stock)
- (ii) Central Upwelling Zone (Ivory Coast, also Ghana)
- (iii) South Transitional Zone (southern Gabon to southern Angola).

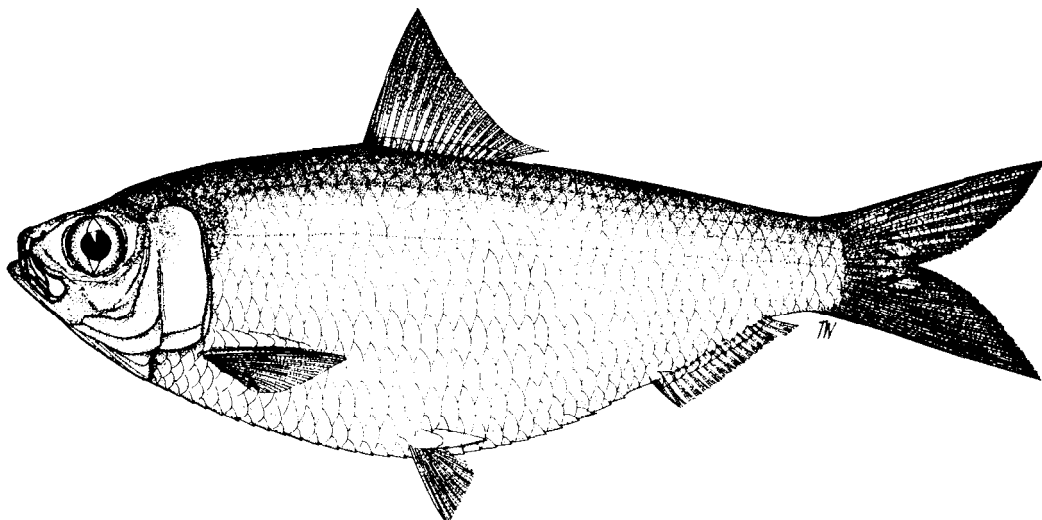
<u>Sardinella brachysoma</u>	Bleeker, 1852
-------------------------------------	---------------

CLUP Sardl 5

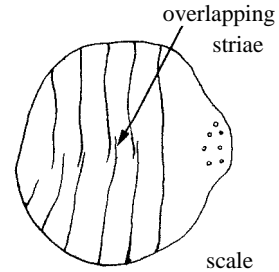
Sardinella brachysoma Bleeker, 1852, Verh.batav.Genoot.Kunst.Wet., 24:19 (Batavia).

Synonyms : Harengula hypselosoma Bleeker, 1855:427 (Amboina); Meletta schlegelii Castelnau, 1873:93 (Darwin); Sardinella albella:Fowler, 1941:605 (incorrect synonymy); Sardinella brachysoma - Chan, 1965:19, fig. 9 (India; but China, Hong Kong specimens probably S. hualiensis); Whitehead et al., 1966:49 (types of brachysoma, hypselosoma); Whitehead, 1973b:182, fig. 12; Wongratana, 1980:127, pls 67, 68 (revision).

FAO Names : En - Deepbody sardinella.



Diagnostic Features : Body deep and compressed, its depth 30 to 39% of standard length; total scutes 29 to 32. Lower gillrakers 48 to 67, hardly increasing with size of fish. Vertical striae on scales overlapping or sometimes continuous at centre of scale, numerous small perforations on hind part of scale. A dark spot at dorsal fin origin. Closely resembles S. hualiensis of China, which has dark dorsal and caudal fin tips. Differs from other deep-bodied species with overlapping or continuous scale striae chiefly in its lower gillraker count (87 to 134 in S. filiense, 88 to 126 in S. dayi) and presence of a dark spot at dorsal fin origin (absent in S. richardsoni and S. zunasi). See CLUP Sardl 5, Fishing Areas 57, 71.



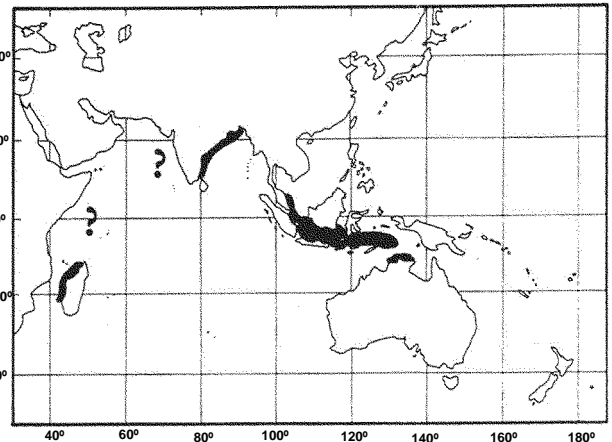
Geographical Distribution : Indo-West Pacific (Madagascar, but apparently not elsewhere in the western Indian Ocean; Madras, Indonesia, northern Australia; Chan's Hong Kong and Taiping specimens were most likely S. hualiensis).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 13 cm standard length, usually to 12 cm.

Interest to Fisheries : Included in the general statistics for Sardinella; probably of some local importance in parts of Indonesia.

Local Names : -



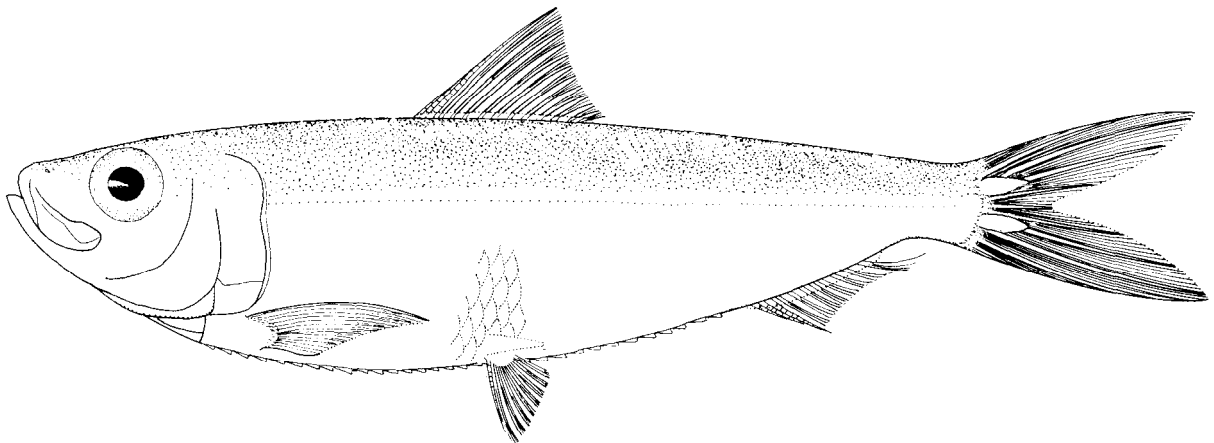
Sardinella brasiliensis (Steindachner, 1879)

CLUP Sardl 11

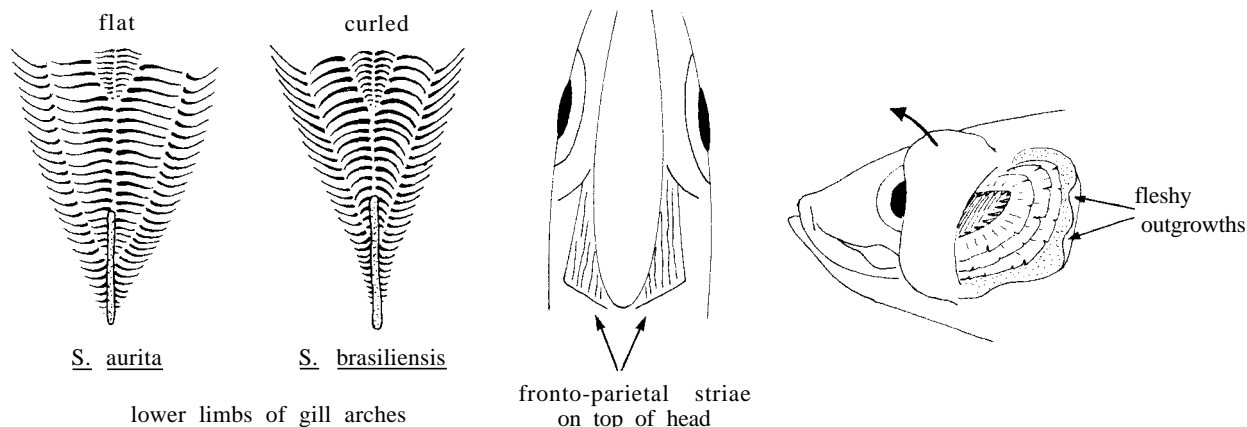
Clupea brasiliensis Steindachner, 1879, Sber.Akad.Wiss.Wien, 80:182 (Rio de Janeiro).

Synonyms : Clupea janeiro Eigenmann & Bray, 1849, Ann.N.Y.Acad.nat.Sci.:626 (replacement name in view of the homonym Clupea brasiliensis Schneider, 1801 = Albula vulpes Linnaeus, 1758; the name janeiro seems never to have been adopted and although correct should be rejected on grounds of - usage); Sardinella brasiliensis - FWNA, 1964:407, fig. 101; Whitehead, 1973a:30 (Guianas).

FAO Names : En - Brazilian sardinella.



Diagnostic Features : See Sardinella aurita, from which it differs in having the anterior gillrakers on the lower limbs of the second and third gill arches distinctly curled downward (more or less flat in S. aurita). The pelvic finray count of i 8 distinguishes S. brasiliensis from all other species of Sardinella, also Harengula and Opisthonema. Resembles Strangomera of Argentina and Chile, but has two fleshy appendages along outer margin of gill opening (smooth in Strangomera) and numerous fine fronto-parietal striae on top of head. See CLUP Sardl 11, Fishing Area 31.



Geographical Distribution : Western Atlantic (Gulf of Mexico, Caribbean, West Indies southward to Brazil and northern Uruguay, but identifications not always reliable). See also remarks.

Habitat and Biology : Coastal, pelagic, schooling. Probably similar to *S. aurita*, but if indeed this species is distinct from *S. aurita* then it may account for one of the apparent double spawning peaks of that species.

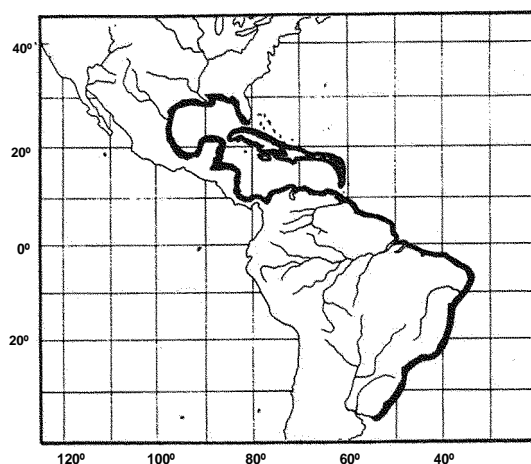
Size : To 25 cm standard length, usually around 20 cm.

Interest to Fisheries : Large fishery in Venezuela, but statistics do not separate if from *S. aurita*.

Local Names : USA: Orangespot sardine (Florida).

Literature : Included in many of the western Atlantic references to *S. aurita* and perhaps mixed with *S. aurita* even in studies purporting to deal only with *S. brasiliensis* (e.g. Matsuura, 1975, 1977 - southern Brazil, spawning, eggs, larvae; Figureido & Menezes, 1978:23, fig. 27).

Remarks : Separation of *S. brasiliensis* from the widespread *S. aurita* on the basis of gillrakers shape and a higher gillraker count is tentative, the more so since fishes with the *brasiliensis* curled form of gillrakers occur off West Africa and in the Mediterranean.



Sardinella fijiense (Fowler & Bean, 1923)

CLUP Sardl 17

Harengula fijiense Fowler & Bean, 1923, *Proc.U.S.natn.Mus.*, 63:63 (Fiji).

Synonyms : *Harengula fijiensis* Fowler, 1928:31 (unjustified emendation of name); *Harengula nymphaea*: Fowler, 1941:599, fig. 15 (his *H. fijiensis* in the synonymy; his Fiji material only); *Sardinella fijiense*: Wongratana, 1980:125, pls 61, 62 (revision).

FAO Names : En - Fiji sardinella.