Diagnostic Features: First dorsal fin with X to XII spines and second dorsal fin with I spine and 19 to 22 soft rays; anal fin with II spines and 17 to 20 soft rays. Lateral-line scales 66 to 76. Vertebrae: 16 or 17 abdominal + 8 to 11 modified + 10 to 13 caudal, total of 37. Swimbladder without a median anterior extension.

Geographical Distribution: Western Australia from Shark Bay southward along the southern coast of Australia to eastern South Australia. One unconfirmed report of this species from Exmouth Gulf, Western Australia (Fig. 129).

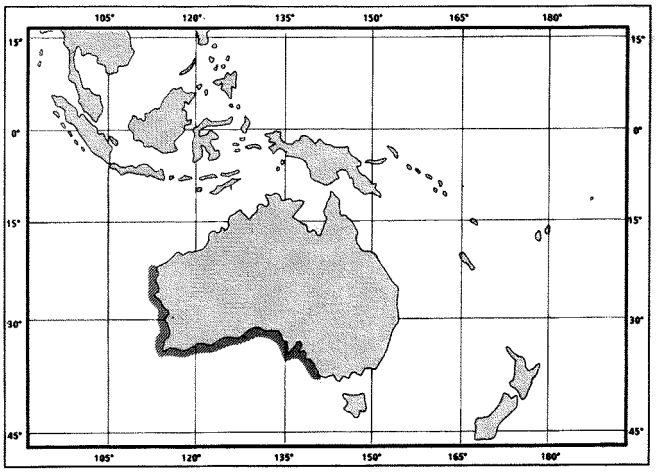


Fig. 129

Habitat and Biology: ***Sillago schomburgkii*** frequents inshore sand banks, bars and spits, and congregates in sandy hollows. It occurs in depths of 0 to 30 m. At high tide this species moves in schools across the sand flats and retreats to the slopes of the banks when the tide falls. It enters sandy estuaries in large schools, and may penetrate to the limit of the brackish water. At Mandurah and Leschenault Inlet, Western Australia, large schools appear during the summer months. The spawning season commences in September and is completed by January in Shark Bay (Lenanton 1969a). The juveniles frequent the shallows of protected bays and inlets and move into deeper water at maturity.

Size: To 41 cm total length.

Interest to Fisheries: Taken by seine in open bays and near estuaries. This species forms the basis for small fisheries. It has potential as an aquaculture species.

Local Names: AUSTRALIA: Yellowfin whiting.

Literature: Scott (1962:187-188, fig.); Whitley (1964:43); Lenanton (1969a:4-11, 1969b:5); Jones (1981:20-23); Hutchins and Swainston (1966:col. pl. 269).

Sillago sihama (Forsskål, 1775)

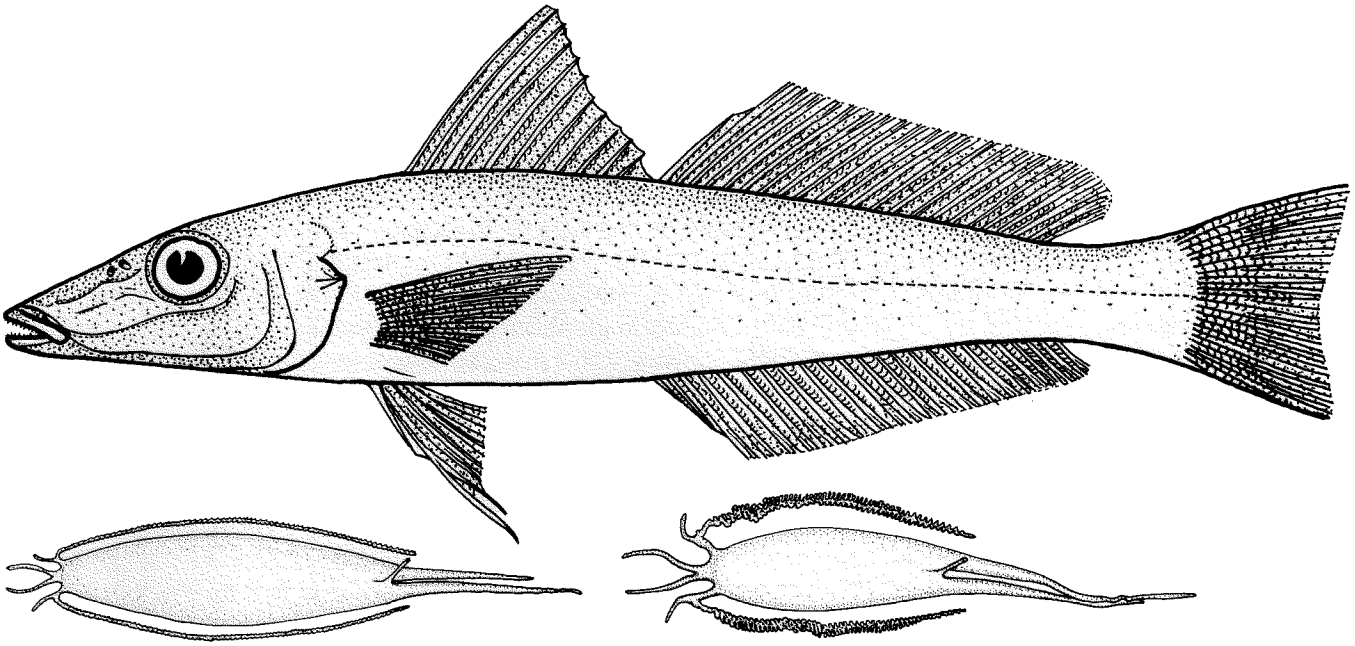
Fig. 130

SILL Sill 2

Atherina sihama Forsskål, 1775:70 (Lohaja, Red Sea).

Synonyms: ***Platycephalus sihamus*:** Bloch and Schneider, 1801:60. ***Sciaena malabarica*** Bloch and Schneider, 1801:81, pl. 19 (Tranquebar). ***Sillago acuta*** Cuvier, 1817:258 (Sea of the Indies). ***Sillago erythraea*** Cuvier, 1829:409 (Suez, Red Sea). ***Sillago malabarica*:** Cantor, 1849:1003. ***Sillago ihama*** (misprint) Fowler, 1928b:16.

FAO Names: En - Silver sillago; **Fr** - Pêche-madame argenté; **Sp** - Silago plateado.



SWIMBLADDER (Red Sea)

SWIMBLADDER (Queensland)

Fig. 130 ***Sillago sihama***

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 20 to 23 soft rays; anal fin with II spines and 21 or 23 soft rays. Lateral-line scales 66 to 72. Vertebrae: 14 abdominal + 2 to 8 modified + 12 to 18 caudal, total of 34. Two posterior extensions to the swimbladder, two anterior extensions extend forward and diverge to terminate on each side of the basioccipital above the auditory capsule; two lateral extensions commence anteriorly, each sending a blind tubule anterolaterally and then extending along the abdominal wall below the investing peritoneum to just posterior of the duct-like process; two posterior tapering extensions of the swimbladder project into the caudal region, one usually longer than the other; the lateral extensions are normally convoluted and have blind tubules arising along their length. **Colour:** Body light tan, silvery yellow-brown, sandy brown, or honey coloured; paler brown to silvery white below; a midlateral, silvery, longitudinal stripe normally present; dorsal fins dusky terminally with or without rows of dark brown spots on the second dorsal-fin membrane; caudal fin dusky terminally; no dark blotch at the base of the pectoral fin; other fins hyaline, the anal fin frequently with a whitish margin. After long preservation the coloration may become a uniform light brown.

Geographical Distribution: A wide ranging species throughout the Indo-West Pacific region from Knysna, South Africa to Japan. Although ***Sillago sihama*** has been recorded from Japan by numerous authors (see ***S. japonica)*** it appears that many records refer to ***Sillago japonica.*** The two species can be positively identified by reference to the swimbladder morphology, and the total vertebrae counts (33 in ***S. sihama***, 34 in ***S. japonica).*** In Australia from Broome in the west to Townsville, Queensland (Fig. 131).

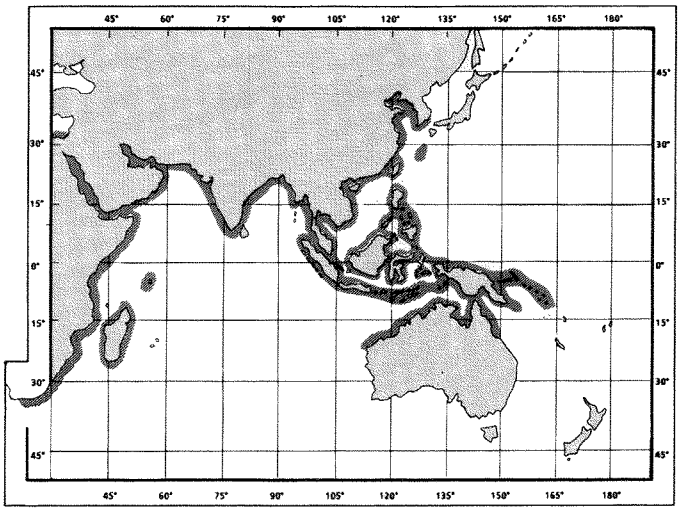


Fig. 131

Habitat and Biology: A nearshore species that frequently penetrates estuaries for considerable distances. The species has been recorded from freshwater by Günther (1861, p. 221) and Macleay (1883, p. 360), despite the absence of renal corpuscles or tubules in the kidney. It is common along the beaches, sandbars, mangrove creeks and estuaries; but very rarely captured by prawn trawling vessels. In depths ranging from 0 to 20 m (seldom 60 m). Like most members of the family, ***S. sihama*** may bury itself in the sand when danger approaches (Maxwell, 1921) and commonly avoids seine-nets by employing this behaviour. The principal items of diet are polychaete worms (*Marphysa, Perinereis, Nereis*), small prawns (*Penaeus*), other Crustacea (*Ocypoda, Alpheusand Gonodactylus),* shrimps and amphipods (Chacko, 1949a, 1949b). Small fish are often taken and filamentous algae is consumed. Australian specimens frequently contain polychaete worms and small Crustacea. The spawning season in India is November to March (Chacko, 1950) with advanced post-larvae appearing from December to February, reaching 25 mm by April (Gopinath, 1946). The growth is rapid, attaining sexual maturity at a length of 13 to 14 cm at about 1 year, 16 to 20 cm at 2 years, 20 to 24 cm at 3 years and 24 to 28 cm by 4 years of age. Growth rings on the otolith are clearly defined and it is possible to discern rings with the naked eye (Radhakrishnan, 1954). The egg is spherical, colourless and buoyant, 0.5 to 0.6 mm in diameter, and without a large oil globule. Palekar and Bal (1961) found numerous small oil globules that fused into a large single oil globule in the fully ripe ovum which measured from 0.57 to 0.80 mm. The presence of a single shining, translucent oil globule is characteristic of the mature ovum. Spawning takes place in the Kali river estuary during August to October and occurs only once during the season. Fecundity varied between 16 682 and 166 130. The size at first maturity is much larger (235 mm for females and 224 mm for males) than that reported by Radhakrishnan (1954) and the time of spawning is at variance with that reported by Chacko (1950). Accurate identification of ***S. sihama*** is of crucial importance in such studies. It has been shown that misidentification of this species, especially with ***S. japonica***, ***S. lutea*** and ***S. vincenti***, is widespread.

Size: To 30 cm standard length.

Interest to Fisheries: An important foodfish throughout its range. Taken by seine net and cast net in the mouths of estuaries and along coastal beaches in bays. Large schools are common in estuaries and fleets of canoes with cast net fishermen encircle the school and cast together or in rapid succession. As the fish burrow into the sand to escape the seine net children and women follow the hauled net and feel for the fish with the feet; the buried fish is captured by hand and dispatched by biting the fish behind the head or threaded by the gills on cord and toggle. Considerable catches are made but generally not reflected in the fishery statistics. In Pakistan the main fishery takes place in June to July. The catches reported range from 102 t (1980) to 859 t

(1982) with an average of 404 t (Bianchi, 1985). The species is recognised as a superior fish for invalids and children. For this reason it does not always appear in small markets and is rarely salted or dried. Recipes for cooking frequently include milk or coconut juice, the flesh being simmered or steamed rather than deep fried. When steamed the flesh is of delicate texture, flavour and of clean white appearance. It is a potential candidate for aquaculture.

Local Names: AUSTRALIA: Northern whiting, Sand smelt; JAPAN: Moto-gisu; MADAGASCAR: Amboso, Ambotso, Amborody, Ambotsoka, Toholava; PAKISTAN: Bhambor, Hashoor, Silver whiting; TANZANIA: Mtambaanchi, Tambanji, Sondo.

Literature: Rüppell (1828:9, pl. 3, fig. 1); Günther (1860:243, 1861:221, 1880:56); Gill (1861:504); Bleeker (1865:56, 1865:56, 1874:67, 1876:332, 1878:46); Day (1865a:18, 1865b:47-48, 1869:299, 1870:686, 1878:265, pl. 57, fig. 3); Schmeltz (1866:8, 1869:16, 1879:44); Playfair (1867:861); Klunzinger (1870:818, 1879:369, 1884:123); Peters (1877:836); Macleay (1883:360); Steindachner (1893:237); Rutter (1897:87); Jordan and Snyder (1901:109, 1902:486-487); Jordan and Evermann (1902:360); Johnstone (1903:295); Fowler (1904:549, 1925:248, 1927:286, 1928a:235, 1928b:709, 1930a:611, 1930b:654, 1931a:377, 1931b:302, 1933:417-421, 1934a:422, 1934b:422, 1935:150, 1937:238, 1939:50, 1949:50); Pellegrin (1905:83, 1907:203, 1914:225); Jordan and Seale (1905:782, 1907a:12, 1907b:25); Jordan and Starks (1905:205, 1917:455); Gilchrist and Thompson (1908:192, 1916:275, 1917:348); Regan (1908:245); Jordan and Richardson (1909:192); Jenkins (1910:132, 136); Seale (1910:281, 1914:69); Weber (1913:267); De Beaufort (1913:119); Jordan et al. (1913:187); Jordan and Metz (1913:41); Jordan and Thompson (1914:259); Maxwell (1921:33); Fowler and Bean (1922:68, 1927:8); Chaudhuri (1923:721); Hora (1924:489); Vinciguerra (1926:583); (?) Paradice and Whitley (1927:89); Barnard (1927:507-508); Reeves (1927:10); Whitley (1928:12, 1964:43); Mori (1928:6); Gudger (1929:528); Duncker and Mohr (1929:70); Weber and de Beaufort (1931:172-173, description, references, localities); Borodin (1932:85); Herre (1933:4,1939:112,1953:479-480); Martin and Montalban (1935:222-224); Umali (1934:371); Hardenberg (1936:246, 1941:227); Villadolid (1937:192); Blanco (1938:507); Domantay (1940:98); Gopinath (1942:337,1946:13,19); Chako (1949a:33, 1949b:95, 1950:171); Smith (1949:203, fig. 467, 1955:44); Suvatti (1950:395); Tripathy (1952:80, 84); Radhakrishnan (1954:196, 1957:254-283); Palekar and Bal (1955:128, 1961:76-93); Munro (1955:121, 1958:178, 1967:347); Tomiyamaand Abe (1958:1176); Scott (1959:56); Menon (1961:387); Khalaf (1961:80); Smith and Bailey (1961:359); Misra (1962:232-233); Nadkarni (1963:164-166, kidneys); Smith and Smith (1963:18); Marshall (1964:170); Grant (1965:88, 1972:243); Alfred (1966:100); Arnoult and Fourmanoir (1967:137); Macnae and Kalk (1969:132); (?) Kakuda (1970:1-55, fishery); Kawamura et al. (1975:797, burrowing); Hiramoto (1976:14-20, aquarium spawning); Lee (1976:31-37, diet, Taiwan, 1981:361-363, eggs, Taiwan); Ramamurthy and Dhulkhed (1977:283-284); Mouneimne (1977, Sicily, Crete, first record); Kumai and Nakamura (1978:1055, spawning); James et al. (1978:212-220); Shao and Chang (1978:9, pl. 1, fig. 3, pl. 2, fig. 3, 1979:695-705); Dutt and Sujatha (1980:371-375); McKay (1980:381-382, fig. 1D, 1985:6-11, figs 2B, 6AB, 14A, 15); Krishnamurthy and Kaliyamurthy (1981:84-97, age and growth, Pulicat Lake, India); Lee, Huand Hirano (1981:169-174, salinity, eggs and larval survival); Masuda et al. (1984:151, pl. 134-D); Sano and Mochizuki (1984:136-149, figs 1C, 5); James et al. (1984:313-324, larval resource, India); Lee and Hirano (1985:225-230, temp., photoperiod, spawning); Shao et al. (1986:147, distribution, swimbladder, Taiwan); Arshad (1986:238-239, distribution); Chervinski (1986:30-32, salinity tolerance); Yu and Chang (1986:127-130, spawning, 1987:227-229, culture); Allen and Swainston (1988:col. pl. 357); McKay and McCarthy (1989:551-553, fig. 3E-J, vertebrae, otoliths, Red Sea).

Remarks: Commonly confused with a number of uniform-coloured whiting species. All identifications must involve an examination of the swimbladder after careful removal of the dark brown or black peritoneum in addition to lateral-line scale and fin-ray counts. McKay and McCarthy (1989) describe the otoliths of two specimens from the Arabian Gulf and recognise this population to be genetically isolated from the Indo-West Pacific population. The swimbladder shape is slightly different in specimens taken from Queensland and the Red Sea (Fig. 130).

Sillago soringa Dutt and Sujatha, 1983 | Fig. 132 | **SILL Sill 28**

Sillago soringa Dutt and Sujatha, 1983:611-614, fig. 1.

Synonyms: None.

FAO Names: En - Soringa sillago; **Fr** - Pêche-madame soringa; **Sp** - Silago de Soringa.

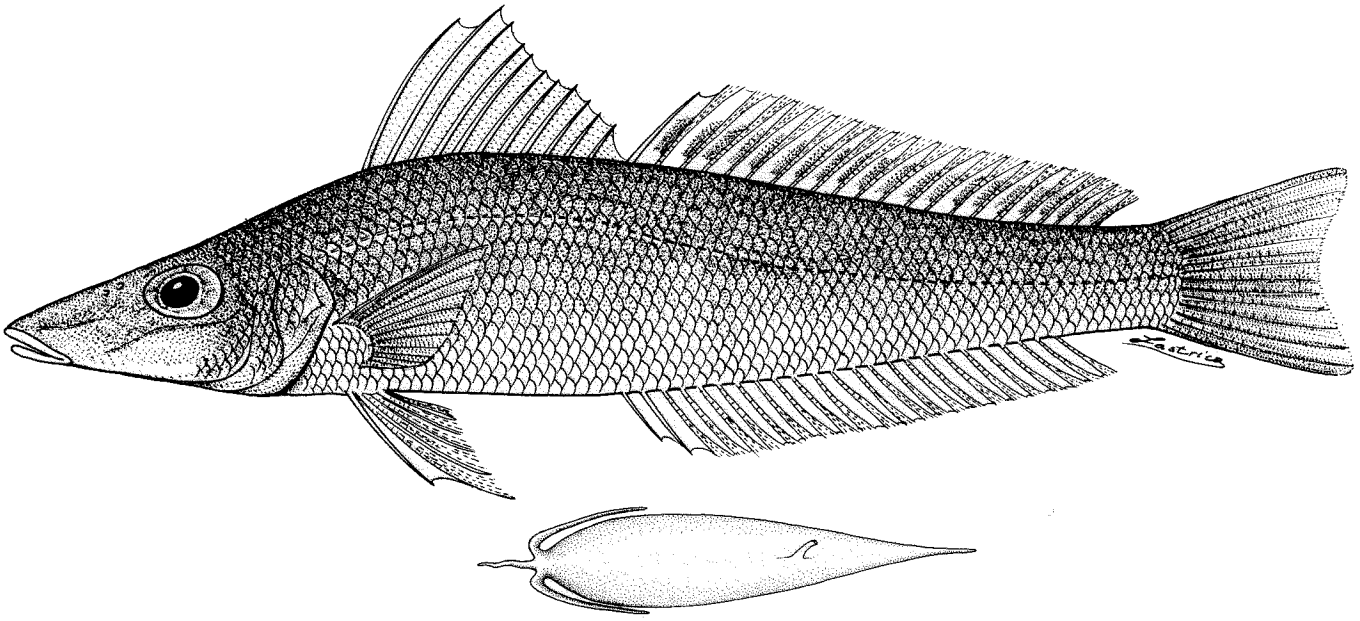


Fig. 132 ***Sillago soringa***
(adapted from Dutt and Sujatha, 1982)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 soft rays; anal fin with II spines and 22 soft rays. Lateral-line scales 64 to 68. Vertebrae: total of 34. Swimbladder with three anterior extensions, the middle one projecting forward and the anterolateral ones recurved backward for a short distance along the sides; a single short posterior extension. **Colour:** Dorsal side and upper flanks grey brown, becoming paler laterally; lower flanks and ventral side milky white; spinous dorsal fin with minute discrete black dots on membrane; they are more numerous toward the distal half especially in the anterior half of the fin; in the soft dorsal fin is a more or less continuous grey band, running parallel to and close to the anterior edge of each ray; the membrane of the anal fin is also provided with minute black dots, but to a lesser extent than the spinous dorsal; pectoral fin and ventral fin hyaline with golden tinge; caudal fin hyaline, with fine black dots.

Geographical Distribution: East coast of India (Fig. 133).

Habitat and Biology: An inshore species related to sandy bottoms at 5 to 30 m depths.

Size: To 15 cm standard length.

Interest to Fisheries: Unknown.

Local Names: INDIA: Soringa.

Literature:

Remarks: Although Dutt and Sujatha (1983) regard their ***S. soringa*** as a distinct species, the close similarity to ***S. asiatica*** indicates that the latter species is a junior synonym of ***S. soringa***. retain both species pending a full study of the Indian material.

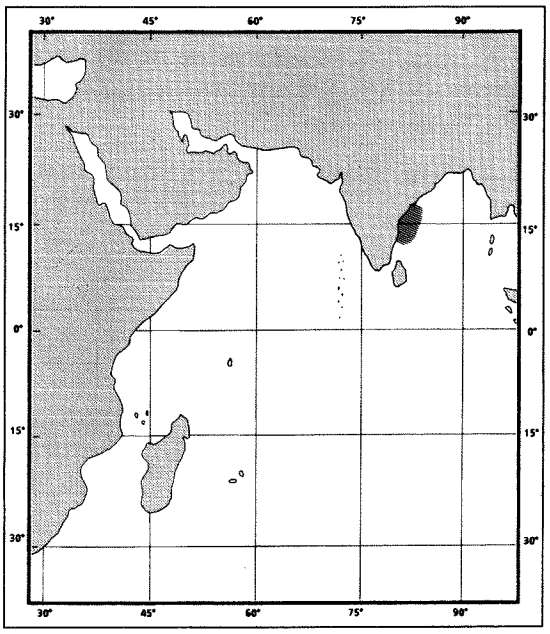


Fig. 133

Sillago vincenti McKay, 1980 | Fig. 134 | **SILL Sill 4**

Sillago vincenti McKay, 1980:378-381, fig. 1A-C (Kavanad near Neendakara, Kerala State, India).

Synonyms: None.

FAO Names: En - Vincent's sillago; **Fr** - Pêche-madame truité; **Sp** - Silago de Vincent.

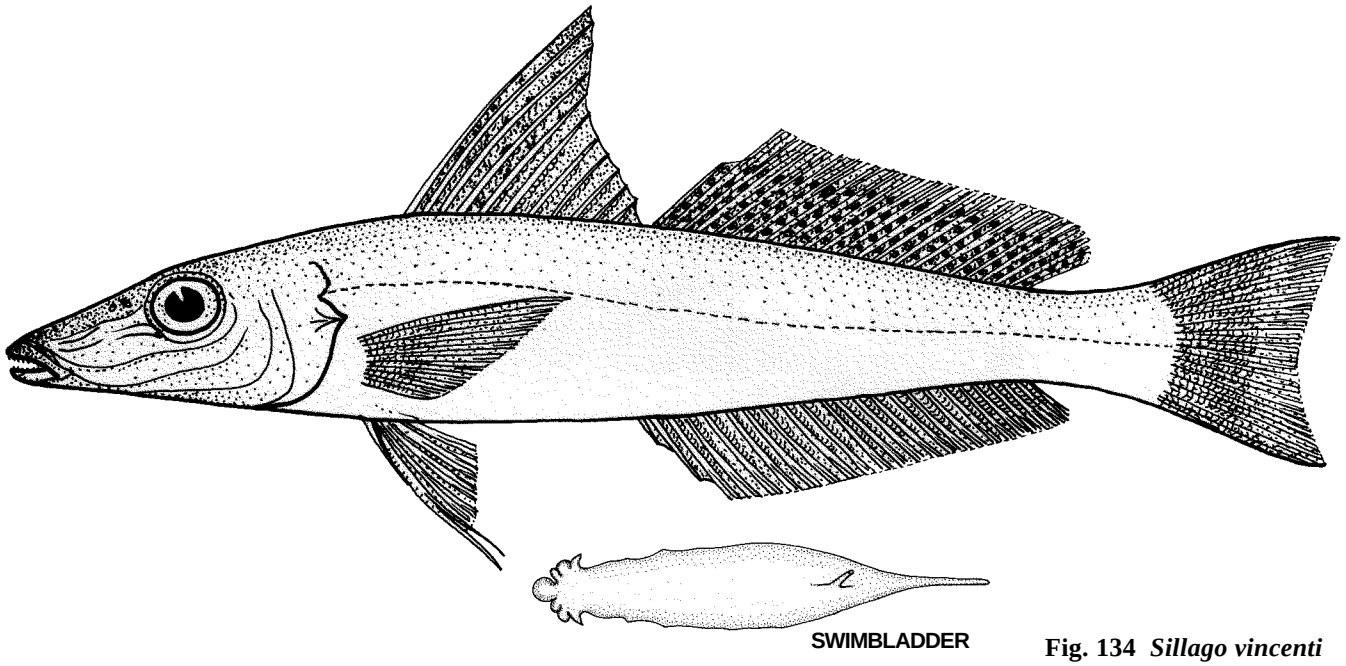


Fig. 134 ***Sillago vincenti***

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 to 23 soft rays; anal fin with II spines and 22 or 24 soft rays. Lateral-line scales 70 to 74. Vertebrae: 14 abdominal + 4 to 6 modified + 14 to 20 caudal, total of 34. Swimbladder with a single posterior extension, a short bulbous projection anteriorly with one to three anterolateral lobate or recurved projections; no tubular extensions anteriorly. **Colour:** Body uniform pale tan coloured, with the second dorsal fin spotted.

Geographical Distribution: East and west coast of India (Fig. 135).

Habitat and Biology: McKay (1980) reported females of 25 to 28 cm running ripe in late January to early February. It is caught in depths of 0 to 10 m and occurs with ***Sillago sihama*** apparently in mixed schools on muddy substrates.

Size: To 30 cm standard length.

Interest to Fisheries: Indian fishermen catch this species well into the estuaries. The species is recognised as having considerable potential for aquaculture in impoundments and tidal ponds. Growth is reported to be rapid.

Local Names: INDIA: Kalimeen.

Remarks: This species is very similar in external morphology to ***Sillago sihama***. A dissection of the posterior part of the swimbladder is required for field identification.

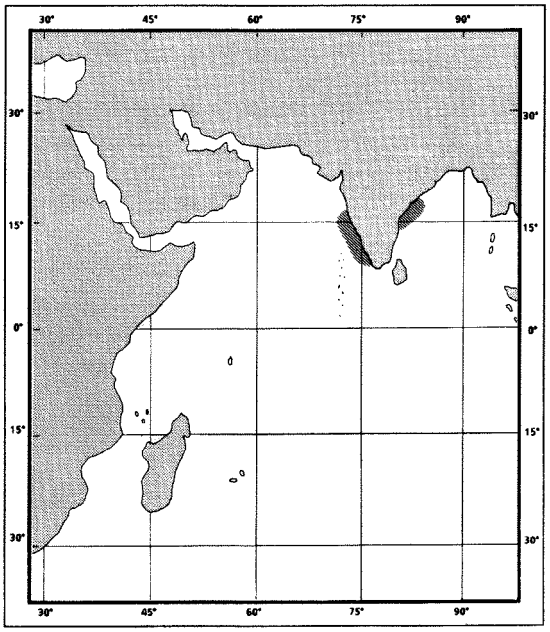


Fig. 135

Sillago vittata McKay,1985 | Fig. 136 | **SILL Sill 29**

Sillago vittata McKay, 1985:20-22, figs 4B, 12B, 13E, 14C (Western Australia).

Synonyms: None.

FAO Names: En - Banded Sillago; **Fr** - Pêche-madame rubonné; **Sp** - Silago bandeado.

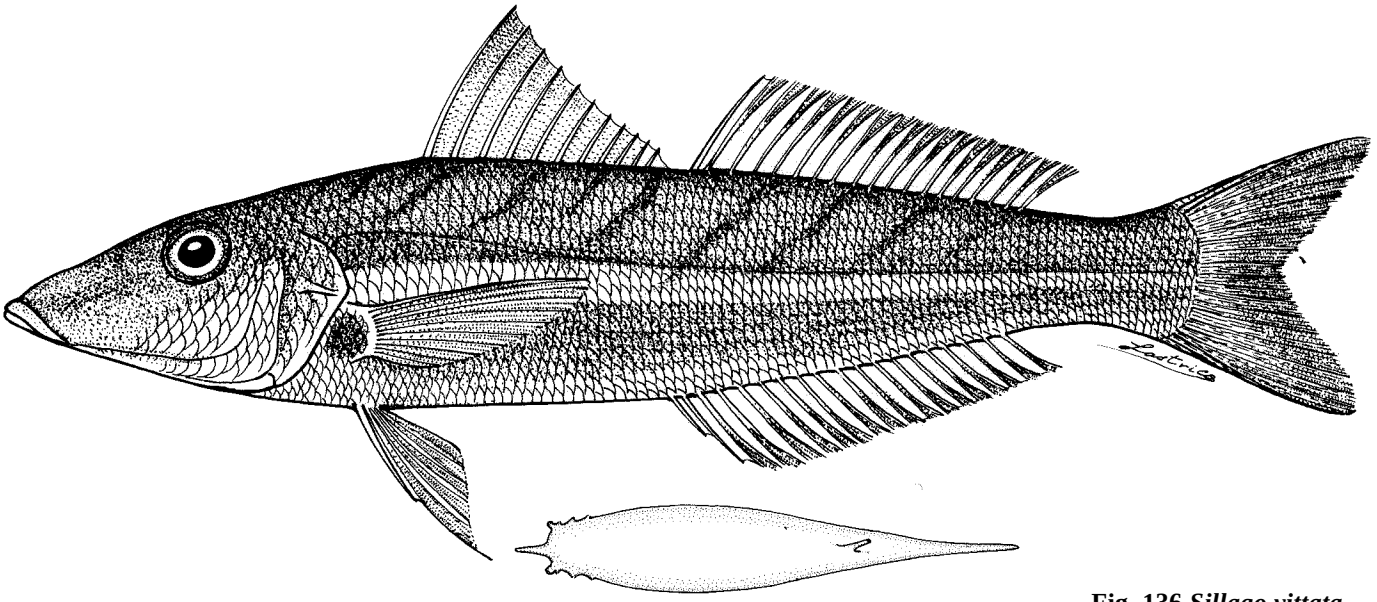


Fig. 136 ***Sillago vittata***

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 17 to 19 soft rays; anal fin with II spines and 16 or 18 soft rays. Lateral-line scales 65 to 70. Vertebrae: 13 or 14 abdominal + 8 to 12 modified + 7 to 10 caudal, total of 32 to 34. Swimbladder with a median anterior extension and very rudimentary anterolateral projections. **Colour:** Pectoral-fin base with a dusky spot, and body with 8 to 11, light brown to rusty brown very narrow bars extending from the back obliquely forward to touch or almost touch a conspicuous silvery midlateral longitudinal stripe.

Geographical Distribution: Maud Landing southward to Rottnest Island, Western Australia (Fig. 137).

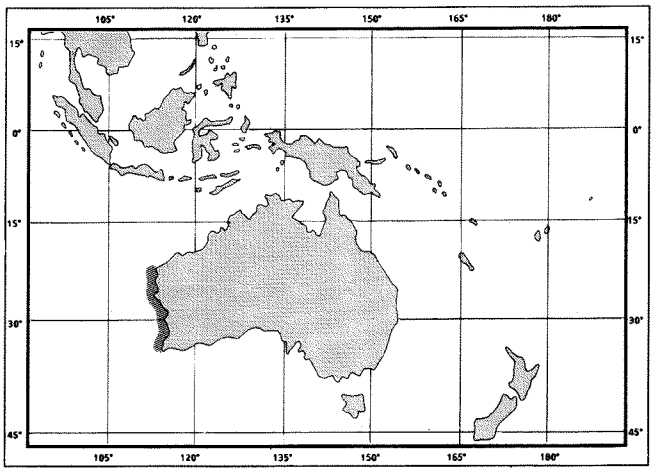


Fig. 137

Habitat and Biology: This species is most common near weed banks and coral reefs in shallow-water and it is associated with ***S. burrus, S. schomburgkii*** and **S. *analis.*** It is known from depths between 20 and 55 m. At Maud Landing ***S. vittata*** may be taken by hook and line from the beach, but off Rottnest Island large catches may be taken by trawl net in 31 to 36 m where the species is in association with ***S. robusta, S. bassensis,*** and ***S. burrus.*** In southern waters ***S. vittata*** is not captured in shallow water.

Size: To 30 cm standard length.

Interest to Fisheries: A small fishery has developed on this species inside Shark Bay and off Rottnest Island, Western Australia. The flesh is of excellent quality.

Local Names: AUSTRALIA: Banded whiting, Bastard whiting, Golden whiting, Western school whiting.

Literature: Gloerfelt-Tarp and Kailola (1984:150, ***Sillago*** sp. 1); Hutchins and Swainston (1986:col. pl. 266); Allen and Swainston (1988: col. pl. 358).

Remarks: ***Sillago vittata*** may be separated from ***Sillago burrus*** by coloration, the morphology of the swimbladder, in having mostly ctenoid cheek scales, and by vertebrae counts.

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